THE UNIVERSITY OF MELBOURNE

Faculty of Science

School of BioSciences

Research Prospectus

Contents

About the School

Our planet inspires us to understand how animals, plants, fungi, bacteria, and viruses work, how they evolve and how they interact. We are fascinated by the breadth and diversity of life and living systems from DNA to entire ecosystems, from a single molecule to the Amazon rainforest. We nurture the next generation of bioscientists and love sharing our passion for biology with young people and the community.

The School of BioSciences is a vibrant collective of academic and professional staff, as well as undergraduate and postgraduate students, and valued funders, collaborators, and alumni.

Our scholars and students explore questions of conservation and climate change, evolution and behaviour, genetics and development, marine biology, or plant biodiversity.

The School of BioSciences is a leader and participant in various collaborative centres, including the Australian government's Cooperative Research Centres (CRC) program which encourages collaboration between research institutions and industry, and Australian Research Council (ARC) Centres of Excellence.

The University of Melbourne's Faculty of Science acknowledges the Traditional Owners of the lands on which we work: the Wurundjeri Woi-Wurrung and Bunurong peoples (Burnley, Fishermans Bend, Parkville, Southbank and Werribee campuses), the Yorta Yorta Nation (Dookie and Shepparton campuses), and the Dja Dja Wurrung people (Creswick campus). We pay respect to their Elders, past and present. We also acknowledge and respect that Aboriginal and Torres Strait Islander people are this country's first scientists, with deep and enduring knowledge of the land, waters and skies.

Professor Margaret Mayfield

Head of the School of BioSciences

Professor Margaret Mayfield

- Community ecology
- Pollination
- Biodiversity conservation
- Plant functional ecology
- Restoration

margie.mayfield@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/945097-margie-mayfield

I am a plant community ecologist interested in how changes to the environment impacts plant and insect community structure and function. My work spans theoretical and applied questions about how biological diversity is maintained in general and in response to local to large scale environmental changes resulting from climate change, invasive species, urbanisation, agricultural intensification and restoration.

I am fundamentally interested in protecting biodiversity in a world dominated by human-caused environmental change. Much of our understanding of ecological systems is based on the study of "pristine" natural communities, not impacted by human activities. Over the last century the number of such "pristine" systems have declined dramatically and the modern state of most natural systems is one of constant disruption and change. Because the history of ecology focused on systems not impacted by human activities, we have a very limited understanding of natural communities, how they form, are maintained and change. I aim to improve this understanding through the development of new theory, and the study of specific environmental changes. Though my work focuses on plant and insect communities, the work I do is designed to expand our understanding of the mechanisms by which all natural communities change and are maintained in the modern world.

Most of my research falls into four related themes:
1) coexistence theory and diversity maintenance;
2) plant pollinator interactions;
3) functional ecology; and
4) ecological restoration.

I have worked in a wide range of natural systems during my career from rainforests in Costa Rica to crop fields in South Africa and India but my current research involves developing statistical tools in order to test ecological theory using the wildflower communities of SW Western Australia and Eucalyptus forests of Tasmania and Australia's east and south coasts.

I have several active research projects:

1. My ARC funded work currently aims to understand how facilitation - positive interactions (among plants and among plants and insects) alters coexistence of plant species and plant community diversity maintenance.
2. I am working with a Europe based global collaboration "Bug-net" assessing the impacts of invertebrate herbivores and pathogenic fungi on plant communities and ecosystems.
3. I am also working on understanding the responses of Australian Eucalyptus species to drought at different life stages, and how important community diversity is to drought responses.
4. Finally, I am involved in the development and assessment of forest restoration experiments, one in SE Queensland and the other in South Australia

Professor Mayfield in Perenjori Reserve Western Australia.

Professor Alex Andrianopoulos

Professor Alex Andrianopoulos

- Gene regulation
- Development and differentiation
- Human pathogen
- Fungal genetics
- Host-pathogen genomics

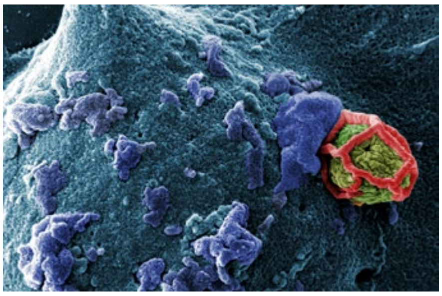
alex.a@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/397-alex-andrianopoulos

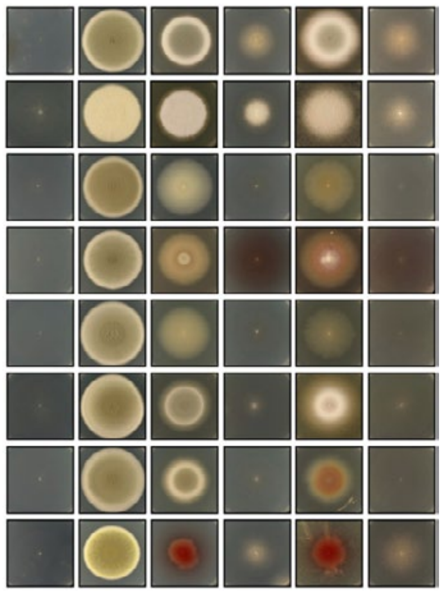
My research is focused on understanding fundamental molecular mechanisms of how genes are controlled and applying that understanding to controlling and combatting fungal diseases, as well as developing new or improved applications for the use of fungi in biotechnology.

Fungi are everywhere. They are the major recyclers of waste — from the backyard compost bin to the forest floor — are in the air and are both on and in our bodies. They are important for food, chemical and pharmaceutical production and are being developed as building products. However, some fungi are also pathogens that infect and kill many plants and animals, including humans. Infectious diseases are a major health burden in society leading to morbidity, mortality and immense health care costs. Amongst all the infectious diseases, fungi are the hidden killers. Fungal infections affect about 25 per cent of the world's population, with mortality rates often higher than 50 per cent and death rates over 1.5 million people a year. The increasing incidence of invasive fungal infections over the last few decades has followed the increasing population of immunocompromised individuals due to AIDS, immunosuppressive drug treatments for transplant recipients, anti-cancer chemotherapy treatments, prolonged antibiotic therapy, and other factors such as steroid use in COVID-19 recovery. The high mortality rate is a consequence of many factors, including our poor understanding of these pathogens, the lack of rapid and reliable diagnostics and a very limited arsenal of effective antifungal drugs. Using an array of genetic and genomic approaches, the research in the lab aims to understand how fungi infect humans, get around the immune defence systems and cause disease.

Both pathogenic and non-pathogenic fungi, like all organisms, respond to their environment. These responses can be transient, allowing for rapid adaptation to changing conditions, or permanent, as in the case of development. Responding to external and internal signals, which is fundamental to all life, involves detecting these signals and responding with changes in gene expression. Understanding how cells and organisms control their responses to these signals is another key area of research in the lab. Using fungi as the model organism, the work is focused on how genes control these responses and how these controlling genes are themselves controlled. The research is of basic biological importance but also has implications in understanding and treating disease, and improving biotechnological processes that use fungi that are important in industry and have direct economic impacts as pathogens.



Macrophage engulfing a fungal spore.



Growth of various mutants under different conditions.

Dr Simon Baxter

Dr Simon Baxter

- Genetics
- Biosecurity
- Entomology
- Evolutionary biology

✉ **simon.baxter@unimelb.edu.au**

findanexpert.unimelb.edu.au/profile/23340-simon-baxter

I aim to develop sustainable solutions for pest management using genetic approaches.

Controlling invasive fruit fly in Australia

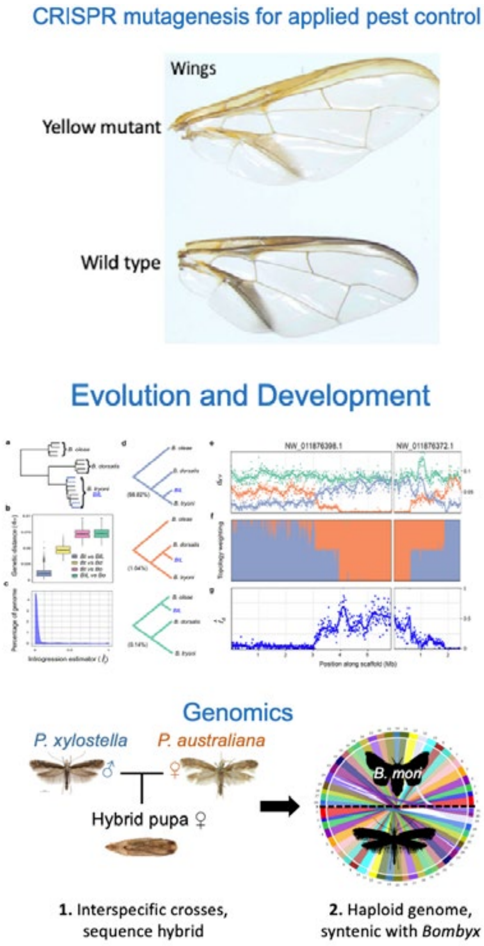
Releasing sterile male insects into the environment on a massive scale can reduce and eradicate insect pests through an approach called the sterile insect technique (SIT). Sterile males seek out and mate with wild females, who can't lay fertile eggs, causing the population to rapidly decline. We're actively working with research partners (University of Adelaide, Macquarie University) to develop improved SIT factory strains of Queensland Fruit Fly, which is an oppressive and persistent burden to the horticultural industry. Separating males from females in the factories is an ongoing challenge we're trying to solve by making genetic sexing strains that enable males to be mechanically sorted from females based on pupae colour, or through heat sensitivity genes that conditionally kill females. We're also introducing visible markers to flies in the laboratory to make it simple to distinguish our sterile flies from wild ones.

Insecticide resistance

Insecticides are the frontline defence many farmers use to control crop pests, yet the way in which they kill is often poorly understood. We're working with natural bacterial toxins produced by Bacillus bacteria (Bt) that target and kill specific pests (including the diamondback moth), to understand how they work and why they are harmless to so many beneficial insects. This work has led us to focus on insect ion transporters, aquaporin water channels, and cellular pathways involving cell death. Sometimes mutations can arise in the insect genomes, causing insects to become resistant to toxins or chemicals. Genetic and genomic approaches have enabled us to understand how resistance to Bt toxins and diamide insecticides in particular can evolve in the field, and we're trying to develop kits for early detection of resistance.

Gene drives and genomics

Gene drives are selfish genetic elements passed on to offspring at rates much higher than expected by chance. We're collaborating with other research groups to overcome some major challenges associated with developing synthetic gene drives. This laboratory-based research has the potential to impose a fitness cost or benefit to a population and therefore may have applied outcomes in the future.



Research projects.

Plutella xylostella, the diamondback moth, is the most destructive pest of brassica crops (cabbage, canola) worldwide.

Dr Michael Bayly

Dr Michael Bayly

- Genetics
- Biosecurity
- Entomology
- Evolutionary biology

mbayly@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/88987-mike-bayly

My mission is to improve understanding of the diversity of the Australasian flora so that this knowledge can underpin its conservation, management and utilisation.

I work on the diversity, evolution, classification and biogeography of Australasian flora, with particular emphasis on flowering plants and ferns. This research relies heavily on genetic markers and generally involves field work, molecular lab work, comparisons of plant morphology and use of herbarium specimens. It provides fundamental data on genetic variation in native plants to test and refine their naming and classification.

This knowledge of plant taxonomy and relationships underpins the management and conservation of biodiversity because it defines the units (species, subspecies, areas of genetic diversity) that are the objects of management.

Flowers of Philotheca pungens.

The SABRE experiment and its component.
Sabre is 4 m high and 4 m wide.

Dr Joanne Birch

Dr Joanne Birch

- Tree of life
- Evolution of the Australian biota
- Southern hemisphere biogeography
- Plant taxonomy

joanne.birch@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/718286-jo-birch

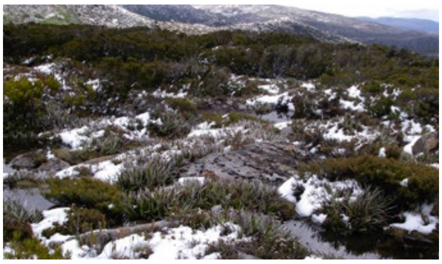
In the Plant Systematics Research Group we aim to describe and understand large scale patterns of evolution within the Australasian flora (plants) and fauna (fungi). Our research investigates possible explanations for patterns in the distributions of diversity. Our research informs descriptions and distribution mapping of the plants and fungi for the flora of Australia.

Plant evolution

We reconstruct the tree of life for native Australasian lineages using genetic and genomic data, estimating the timing of plant diversifications using molecular dating techniques. We use morphological and genetic data to distinguish species so that they can be accurately identified in the field.

Plant biogeography

Our research investigates how distributions of extant taxa have been shaped by evolutionary processes over time, particularly focusing on lineages with distributions in the Southern Hemisphere. We are interested in identifying traits that have enabled Australian taxa to adapt to changing climatic conditions and habitat availability during the Tertiary Period.



Alpine herbland dominated by Astelia alpina (Asteliaceae) in Mount Field National Park, Tasmania.

Caesia parviflora (Asphodelaceae) flowers. Image credit: A.Webb.

Associate Professor Anthony Boxshall

Associate Professor Anthony Boxshall

- Marine ecology
- Environmental impacts

boxshall.a@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/14197-anthony-boxshall

I focus on enabling and enhancing transfer of environmental science knowledge to decision-makers, environmental monitoring, pollution detection, and community involvement in marine and coastal adaptation to climate change.

I am a Melbourne Enterprise Fellow. Among other initiatives, I am involved in the Centre for Anthropogenic Pollution Impact and Management and the National Centre for Coasts and Climate Change.

Associate Professor Richard Bradhurst

Associate Professor Richard Bradhurst
Centre of Excellence for Biosecurity Risk Analysis (CEBRA)

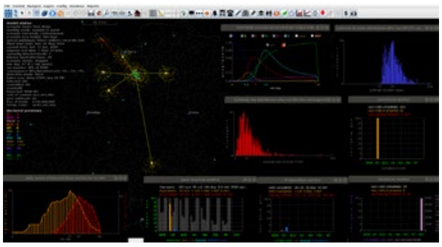
- Computational epidemiology
- Emergency animal diseases
- Priority plant pests
- One Health
- Biosecurity

richard.bradhurst@unimelb.edu.au
findanexpert.unimelb.edu.au/profile/788489-richard-bradhurst

I lead the development of complex simulation models in the emergency animal disease and priority plant pest space. These models provide critical insights for Government decision-makers on how to prepare for and respond to animal and plant health emergencies.

Australian Animal Disease Spread Model (AADIS)

The backbone of my research is a computational modelling framework that I wrote called AADIS (**www.aadis.org**). This groundbreaking model simulates outbreaks of emergency animal disease, enabling decision makers to thoroughly explore various incursion scenarios and evaluate the cost-effectiveness of potential control strategies. AADIS has been customised for over 20 countries and I work closely with animal health authorities in Australia, New Zealand, Canada, the USA, and Europe, as well as the Food and Agricultural Organization of the United Nations.



The AADIS model simulating an outbreak of foot-and-mouth disease in Australia.

AADIS
AUSTRALIAN ANIMAL DISEASE SPREAD MODEL

Preparedness for emergency outbreaks

Australia is currently at risk from highly contagious exotic diseases like foot-and-mouth, African swine fever, lumpy skin disease, and highly pathogenic avian influenza. These diseases are significant threats to the country's livestock industries and export markets, potentially leading to billions of dollars in losses. Decision-makers use the AADIS model to assess strategies for surveillance, biosecurity, and control.

Invasive species

The AADIS model simulates contagious and vector-borne animal diseases, plant and environmental pests, and human diseases. It assesses surveillance strategies for high-priority plant pests, such as khapra beetles, which threaten grain industries with multi-billion-dollar losses.

Transmission of disease between feral animals and livestock

I am interested in the complex epidemiological connections between livestock, insect vectors and feral animals. The transmission of diseases between domestic and wild populations is not well understood. This issue is further complicated by Australia's diverse climate, wildlife habitats, and livestock production systems. It is rewarding collaborating with industry, Government, veterinary researchers, and postgraduates around the world in this ever-changing environment.

A group of feral pigs in the western Riverina region of NSW (photo credit: NSW Govt. Local Land Services).

Dr Elizabeth Bromfield

Dr Elizabeth Bromfield

- Reproductive health
- Cellular homeostasis
- Ageing

liz.bromfield@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1027130-liz-bromfield

I am a reproductive biologist interested in cellular homeostasis and redox biology. My expertise includes germ cell biology, fertilisation, reproductive health, contraceptive development, medically assisted reproduction, and ageing. I use lipidomic and proteomic strategies to better understand germ cell development and responses to environmental oxidative stress.

My research group examines connections between reproductive health and body-wide health to improve early detection of diseases, and to design strategies that enhance cellular defences against oxidative stress to prevent infertility. We use mouse transgenic models and human clinical samples to study lipid and protein biochemistry, protein-protein interactions, the formation of cytotoxic protein aggregates, and reactive oxygen species.

Dr Keely Brown

Dr Keely Brown

- Plant evolution
- Macroalgae
- Genetics and genomics
- High-throughput phenotyping
- Environmental effects

My research focuses on how the environment impacts the genetics of natural and agricultural plant and macroalgae populations. By understanding this connection, we can predict and mitigate the effects of climate change on agriculture and ecosystems.

Improvement of barley breeding through field phenotyping

Breeding for better crop growth in new or changing environments requires being able to measure traits related to yield and relate them to the genome. Measuring enough plants in a field context by hand with enough time resolution to be useful is challenging. We have developed an open-source software package called PlantCV-Geospatial for extracting agronomically-relevant traits from drone images of fields. My lab will use high-throughput phenotyping to connect traits to genetic and genomic variation across environments and stresses in cultivated barley, Australia's second most important grain crop.

Population genetics of sea lettuce

Macroalgae species, such as sea lettuce, often provide many ecosystem functions like carbon capture and food and habitat for herbivores. They also experience highly variable environmental gradients on small geographic scales, as the intertidal zone changes through each day. My lab will investigate how these changes in the environment influence the genetics of populations of sea lettuce living in different coastal areas.

Genetically variable barley plots in a field.

Sea lettuce growing in a controlled environment for experimentation.

Dr Hayley Bugeja

Dr Hayley Bugeja

- Science education
- Program-level assessment
- Student agency

h.bugeja@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/11935-hayley-bugeja

I seek ways to improve assessment in STEM to increase student engagement, agency, and life-long learning skills.

Assessment is a strong driver of student engagement. It can direct student learning towards the most valued skills and attributes of STEM graduates, including understanding science, inquiry and problem solving, personal and professional responsibility and communication. But instead, many assessments focus on content knowledge and short-term, subject-specific learning goals.

Program-level assessment

Program-level approaches link assessment longitudinally across subjects. This provides ongoing feedback to students (and staff) on their progress toward longer-term learning goals. My research considers the options for program-level approaches, common in medical training, to be used in STEM degrees.

STEM academics' assessment beliefs and practices

Changing entrenched assessment cultures is not quick or easy. To effect meaningful change in assessment approaches, I aim to 'meet people where they are at'. I explore factors that influence assessment practices, including STEM academics' beliefs about assessment.

Dr James Camac

Dr James Camac

- Biosecurity
- Data science
- Quantitative ecology

james.camac@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/224904-james-camac

I aim to (i) understand and forecast impacts of climate change and changing fire regimes on biodiversity, and (ii) enhance post-border surveillance networks to protect Australia's environmental, social, and economic capital from exotic pests and diseases.

As a trained quantitative and applied ecologist, I have extensive experience in field ecology, long-term ecological monitoring, experimental design, ecological statistics, reproducible data science, biosecurity risk analysis and project management.

I am a Senior Research Fellow and Chief Investigator within the Centre of Excellence for Biosecurity Risk Analysis, and Associate Editor for The Australian Journal of Botany.

Dr Rory Craig

Dr Rory Craig

- Genome evolution
- Transposable elements
- Epigenetics
- Genetic conflict
- Algae and protists

rory.craig@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1106859-rory-craig

I aim to understand the extreme variation in eukaryotic genomes and specifically the evolution and evolutionary impacts of genetic parasites such as transposable elements.

Jumping genes in the laboratory

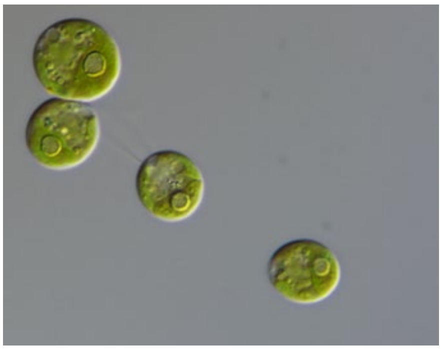
Transposons are mobile genetic units that are ubiquitous across the tree of life and play fundamental roles in evolution and disease. Although these elements dominate many eukaryotic genomes, studying their active replication has been a long-standing challenge.

I use microbial models like the green alga *Chlamydomonas* and the latest sequencing technologies to study active transposition in the laboratory. My questions include: What controls transposon activity? How do host genomes supress transposons, and can transposons fight back? What molecular mechanisms enable transposons to spread throughout genomes?

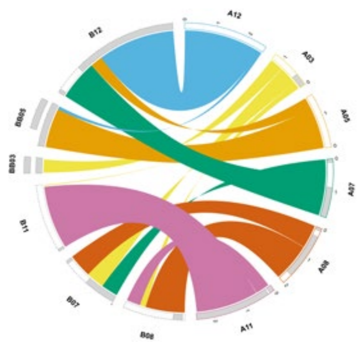
Genome evolution within and between species

Comparative genomics has traditionally been performed between related species, but we now have access to an increasing number of "pan-genomes" that enable comparison of multiple genomes from individuals of the same species.

Focusing on algae and other understudied eukaryotic groups, I use intra- and inter-specific analyses to study genome evolution at multiple evolutionary timescales, from the fastest evolving regions (transposons, centromeres and immunity genes) to deeply conserved genes and genomic features.



The model green alga *Chlamydomonas*.
Image credit: Thomas Pröschold.



Chromosomal rearrangements between the sub-genomes of a hybrid species from the algal genus *Auxenochlorella*.

Dr Shannon Currie

Dr Shannon Currie

- Ecophysiology
- Biologging
- Comparative physiology
- Cardiorespiratory physiology
- Movement ecology

shannon.currie@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1040605-shannon-currie

I aim to increase understanding of how physiological capacity drives individual behaviour, time and energy budgets, and survival.

Physiological biologging

Biologging uses devices attached to animals to collect data on their behavior, physiology, and environmental interactions. I integrate multiple biologging technologies for more comprehensive assessment of the physiology and energy budgets of animals in their natural habitats, including for extremely energy demanding activities such as migration.

I have focused on bats, which can exhibit dramatic fluctuations in physiology over short time frames. Bats transition between low heart rates in torpor (5bpm) and high heart rates during flight (>1000bpm) state, which they alternate between daily during their migration.

Comparative ecophysiology

I examine how physiological flexibility drives species population distribution, particularly for *heterothermic* species that enter torpor or hibernate in response to inclement environmental conditions. As the climate is changing, winters are becoming shorter and warmer, potentially becoming suboptimal for adequate hibernation, or preventing hibernation altogether. How this will impact species is yet unknown.

The heart rate of a bat can reach over 1000bpm in flight.

Hedgehogs hibernate in unbuffered nests and require cool temperatures for optimal hibernation. Warmer winters may mean they cannot conserve enough energy to survive.

Dr Daniel Czech

Dr Daniel Czech

- Biotechnology
- Education
- Graduate employability
- Work-integrated learning
- Industry

daniel.czech@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/940030-daniel-czech

I investigate the impact of work-integrated learning (WIL) and teaching innovation on science students' employability, identity development, and transition into the workforce.

A common challenge faced by science graduates is the gap between what they learn at university and the expectations of employers. Despite years of theoretical and technical training, many feel uncertain about their career direction and unprepared for professional roles.

I collaborate with industry partners, educators, and students to investigate how WIL experiences, such as industry-linked projects, internships, and capstone subjects, can address this disconnect. These experiences can give students opportunities to apply disciplinary knowledge to real-world problems, build networks, and reflect on their development in a supported environment. They also engage employers more closely with universities to engage more closely in preparing the future STEM workforce.

I evaluate WIL programs through interviews, surveys, and case studies, and investigate approaches that can scale work-based learning opportunities to all students. I am also examining the effectiveness of simulated biomanufacturing experiences for improving the employability of science graduates. My research informs the design and delivery of science education programs aligned with student and industry needs. The goal is to create meaningful learning opportunities that not only strengthen technical competence, but also foster adaptability, communication, and workplace readiness.

Biotechnology industry project students working with Merck Life Sciences.

Master of Biotechnology graduates now working with industry partner Commercial Eyes.

Biotechnology industry project students working with Trajan Scientific and Medical.

Associate Professor Andrew Drinnan

Associate Professor Andrew Drinnan

- Plant evolution
- Palaeobotany
- Plant morphology

a.drinnan@unimelb.edu.au

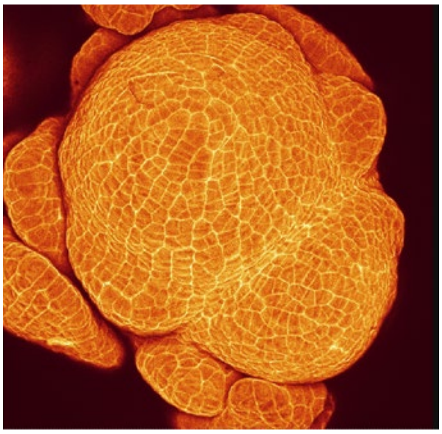
findanexpert.unimelb.edu.au/profile/16521-andrew-drinnan

I investigate the fundamental bases of the evolution of plant structure and form.

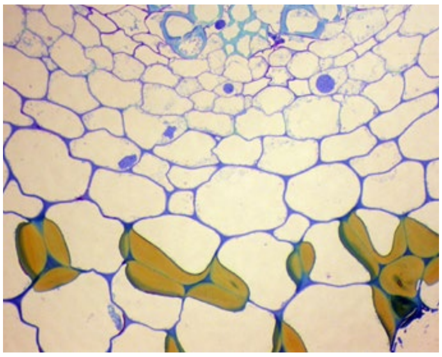
My research group investigates the embryology and development of all land plants – from liverworts to flowering plants – to build a consistent model of plant architecture and evolution that enables more meaningful comparison of morphologically diverse plants.

We test phylogenetic hypotheses by using light microscopy, scanning electron microscopy, and laser scanning confocal microscopy to study vegetative and reproductive morphology. This includes the cellular configuration of shoot apices, cell divisions leading to stem segments and leaf initiation, and branch, flower and root development.

The lycopod Huperzia squarrosa.



Confocal microscope image of lycopod apical meristem.



Cells of a fork-fern stem with distinctive cell wall thickenings.

Dr Ashley Dungan

Dr Ashley Dungan

- Microbial ecology
- Metagenomics
- Conservation
- Microbial engineering
- Probiotics for wildlife

ashley.dungan@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/802619-ashley-dungan

I integrate microbiome science with wildlife management to enable non-invasive assessment of at-risk populations and improve wildlife health.

Microbiome engineering

Translocating captive-bred animals into the wild is a key conservation strategy for threatened species, yet up to 50 per cent of translocated individuals die within the first month. Due to artificial diets and controlled environments, captive animals experience gut microbiota shifts that can compromise nutrition, immune function, and ecological fitness essential for survival post-release. Using a threatened marsupial, the fat-tailed dunnart, as a model system, I am tailoring diets to restore beneficial gut microbes, enhancing nutritional uptake, energy reserves, and immunity.

Sampling of the oral microbiome of the fat-tailed dunnart. Photo credit: Dr Millie Scicluna.

Bacterial biomarkers

Monitoring threatened species across large landscapes is resource-intensive and often involves capture and handling that stresses animals. I aim to enable rapid, non-invasive health assessments of koala populations by integrating comprehensive health datasets with microbiome profiles derived from faecal samples. By applying machine learning, we identify bacterial biomarkers linked to disease and poor health, providing wildlife managers with a powerful tool for early detection and targeted conservation action.

Dr Jessica Dunleavy

Dr Jessica Dunleavy

- Reproductive biology
- Germ cell biology
- Cytoskeletal biology
- Male infertility
- Contraception

jessica.dunleavy@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/880911-jessica-dunleavy

I aim to advance understanding of sperm production and function to help generate contraceptive and pro-fertility/infertility treatments, and provide more accurate, evidence-based predictions for male infertile patients and their offspring.

Building sperm: novel mechanisms of cytoskeletal regulation

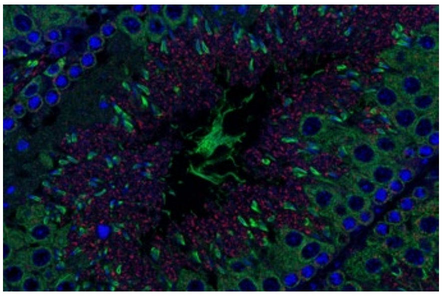
Sperm are highly specialised cells. Their development involves a series of dramatic remodelling events, which transform non-descript, round, precursor cells, into streamlined 'rockets' with a motile tail and a condensed, species-specific head shape.

I study how unique structures and mechanisms of the sperm cell skeleton – the cytoskeleton – control and drive this transformation. I am focussed on microtubule severing, non-canonical tubulins, tubulin post-translational modifications, and mitochondrial transport.

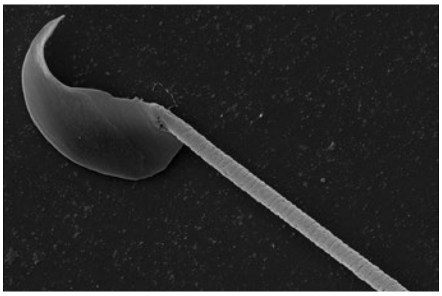
Sperm osmoregulation: a new contraceptive target

To fertilise an egg, a human sperm cell must ascend the female reproductive tract using its powerful tail while rapidly adapting to the conditions in the tract, including a dramatic decrease in the concentration of the surrounding solution.

In partnership with the Male Contraceptive Initiative, I aim to identify the key mechanisms by which sperm rapidly respond to osmotic stress, and to investigate the potential for this process to be targeted by non-hormonal contraceptives.



Mouse testis sections labelled for microtubules (green), mitochondria (red) and DNA (blue).



Scanning electron micrograph of a mouse sperm, with the membrane removed.

Dr Nancy Margaret Endersby-Harshman

Dr Nancy Margaret Endersby-Harshman

- Insecticide resistance in dengue vector mosquitoes
- Management of dengue using Wolbachia mosquitoes
- Mosquito population structure

nancye@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/146011-nancy-endersby

I aim to understand dengue vector mosquitoes' distribution, population structure, invasion history and insecticide resistance to inform dengue control programs. I also train international collaborators in monitoring techniques for control programs.

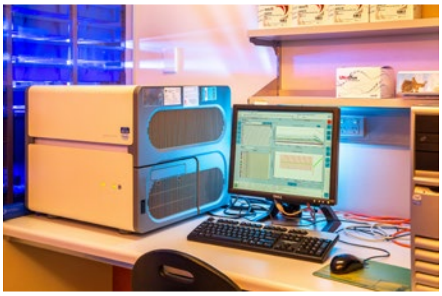
Managing dengue with *Wolbachia* mosquitoes

Dengue is a viral disease endemic in more than 100 countries. With collaborators in the UK, Malaysia and Burkina Faso, I am working on a project funded by the Wellcome Trust to facilitate affordable, sustainable, customised, and locally managed dengue control programs in a range of environments around the world.

Wolbachia bacteria naturally infect many species of insects, but not the dengue-spreading mosquito species. If we introduce an infection artificially, some strains of *Wolbachia* will prevent mosquitoes from transmitting the dengue virus. To control dengue, we replace local mosquitoes with *Wolbachia*-infected mosquitoes.

Insecticide resistance in dengue vector mosquitoes

To replace the local dengue-transmitting population, *Wolbachia*-infected mosquitoes released from the lab must tolerate insecticide exposure at least as well as wild mosquitoes do. Focusing on two dengue vector mosquito species, *Aedes aegypti* and *Aedes albopictus*, I compare the insecticide resistance of wild mosquitoes with *Wolbachia*-infected laboratory colonies destined for release in dengue control programs.



Laboratory equipment for molecular analyses of mosquito DNA.

Mosquito larvae sorting in the laboratory.

Associate Professor Alexandre Fournier-Level

Associate Professor Alexandre Fournier-Level

- Genomics
- Quantitative genetics
- Adaptation
- Weed
- Biosecurity

alexandre.fournier@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/555559-alexandre-fournier-level

Natural ecosystems are degrading at a dramatic pace, and this is primarily due to the consequence of anthropogenic climate change and widespread land degradation. Our research focuses on finding the DNA markers of ecosystems' vulnerability or resilience across multiple plant species.

We combine experimental and computational approaches to study the effect of environmental variation and stress on natural population. We use a range experimental models (Arabidopsis, Drosophila, ryegrass) to test hypotheses related to climate change and pesticide exposure.

Climate change-proof population management

Active population management will be increasingly indispensable to mitigate the effect of human perturbation. However, the perfect management scheme, either to restore or suppress a species, is yet to be designed. In particular, we are interested in using genomics tools to make sure the restoration will be successful, retains a maximum of genetic diversity and is climate change-proof.

Controlling pests and weeds

The emergence of pesticide resistance is evolution in action. Weed populations in Australia have been particularly good at emerging resistance to all the chemicals they have been exposed to, providing a fascinating model for the study of evolution to a well-defined selective agent.

Genomics of native Australian fruits

Australia is a megadiverse country and hosts a large amount of plants with immense potential benefits for medicine and agriculture. Unfortunately, native fruits have rarely been considered crops and their potential remains largely untapped. With emerging genome technology, we aim to fill the gap so that native fruits can represent a sustainable alternative to conventional crops.

Experimental evolution in response to high temperature.

Ryegrass infestation is the major cause of yield loss in Australian cropping systems.

Dr Jennifer Fox

Dr Jennifer Fox

- Education research
- Scientific and academic skills
- Assessment literacy
- Student engagement

jennifer.fox@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1667-jennifer-fox

I aim to enhance university students' learning experiences and prepare them for successful careers in the biological sciences. I investigate how we can best foster scientific and academic skill development, and increase student engagement with online learning activities.

Academic judgement and assessment literacy

Student success at university and beyond depends on developing (i) their academic judgement, which is their ability to assess the quality of their own work as well as that of others, and (ii) their assessment literacy, i.e., understanding the purpose of assessment, marking guides, and their own learning processes.

I work in an interdisciplinary team to evaluate teaching approaches that foster students' development of academic judgement and assessment literacy in various contexts. These approaches include dialogue, increasing student engagement with rubrics, and reviewing student work examples. Evaluation measures include student attitudes and confidence as well as academic outcomes.

Improving student engagement with online learning materials

Today's university students undertake much of their learning online. I evaluate student engagement with different types of online activities and platforms to inform curriculum design that improves student experience and academic outcomes.

Presenting at the Higher Education Research and Development South Australia conference with Clare Wilson.

Dr Nigel Francis

Dr Nigel Francis

- Generative AI in teaching and learning
- Team-based learning
- Technology enhanced learning

nigel.francis@unimelb.edu.au

I investigate novel approaches to teaching and learning, particularly around the integration of technology, including Generative Artificial Intelligence (GenAI). This leads to enhanced student outcomes and engagement in STEM education.

GenAI in teaching and learning

I am exploring the impact of GenAI on assessment validity and investigating ways to encourage students to use the technology ethically to ensure learning outcomes are met. This work is being carried out in conjunction with researchers at Cardiff and Sheffield Hallam Universities in the United Kingdom.

Team-based learning

In collaboration with researchers at the University of Waikato in New Zealand, I am investigating the impact and students' perceptions of teamwork in higher education. The aim is to enhance student satisfaction through a pedagogical approach that is often challenging to implement but enables the development of key graduate outcomes.

Associate Professor Lisa Godinho

Associate Professor Lisa Godinho

- Science education
- Student success
- Equity and inclusion
- Indigenous education
- Field-based learning

lisa.godinho@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/19876-lisa-godinho

If those who push the boundaries of knowledge and apply STEM to solve problems represent society's diversity, then we can be confident that we are asking questions and finding solutions that will benefit everyone. To this end, I aim to support the success of increasingly diverse cohorts of students in their tertiary STEM studies, particularly First Nations students.

Providing access to field trips or similar experiential learning experiences has become challenging as the number of tertiary students has increased. Colleagues and I are developing technology-supported learning experiences that enable students to engage in field-based learning at scale.

I am also interested in the role of *living labs* in Indigenous student success in science. Living labs are collaborative, real-world environments where diverse stakeholders—including researchers, communities, industry, and policymakers—co-create, test, and implement innovative solutions to community-defined challenges. This work is supported by Australian Centre for Student Equity and Success and led by the University of Newcastle.

I also seek to understand how a sense of belonging and disciplinary identity can impact student success. This includes work to understand academics' and students' perspectives on student success, as well as designing and evaluating curricula that support Indigenous student success with a focus on the effectiveness of the Extended Degree model.

BRITE
Innovation and Impact in BioSciences Education

The School of BioSciences education-focused research group.

First-year students engaged in independent field-based learning supported by technology.

Bachelor of Science (Extended) students engaged in On Country learning with Wurundjeri.

Dr John Golz

Dr John Golz

- Seed development
- Seed size control
- Plant development
- Plant genetics

jgolz@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/32493-john-golz

Seeds are a major source of food for a large portion of the planet's inhabitants — hence understanding how seeds develop, particularly the factors that influence the size and shape of seeds, is of fundamental importance. My research addresses a fundamental question in seed biology: how does an embryo within the seed develop and what are the genetic factors that govern final seed size? We aim to use knowledge gained from our studies to improve crop yields by altering the size and shape of seeds.

Embryo formation during seed development

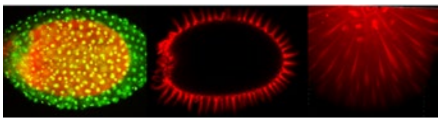
The formation of specific cell types during plant embryogenesis depends on the generation of precise spatial patterns of gene expression. How these gene expression patterns are established remains poorly understood and hence is of major biological interest. My research group aims to identify new pathways involved in gene regulation and show how these are involved in establishing cell identity during the early stages of embryogenesis. Our work involves using a range of genetic, genomic, molecular and cell biological approaches.

Seed size control

Seed size is a major driver of plant yield, and yet the genetic pathways regulating seed size are poorly described. In partnership with international colleagues, my group is investigating the mechanisms that control seed size by focusing on the role played by the seed coat in regulating seed growth. Achieving a better understanding of seed size control will enable us to use this knowledge to potentially improve crop yields.

Plant transformation technologies

In collaboration with colleagues in the School of BioSciences, my research group is looking at developing or improving genetic transformation technologies for crops such as canola and chia. Being able to quickly and cheaply generate transgenic plants will enable the agricultural industry to use gene-editing technologies to develop crops that have superior nutritional qualities, as well as be better able to withstand changing climate and the emergence of new pathogens.



Images of seeds from the model plant Arabidopsis. Left image: activity of a gene in the seed coat of the developing seed. Middle image: staining of the mature seed following exposure to water revealing structures of the seed coat. Right image: close-up of cellular structures that arise when Arabidopsis seeds are placed in water.

Image of an embryo arising in seeds of the model plant Arabidopsis showing activity of a gene in the developing embryonic leaves.

Associate Professor Mark Green

Associate Professor Mark Green

- Reproductive biology
- Fertility
- Sex ratio

mark.green@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/438686-mark-green

I focus on how environmental factors – endocrine disruptors (PFAS and atrazine), light pollution and heat stress – and reproductive technologies affect fertility. Specifically, I focus on how these factors affect eggs, sperm and the development and metabolism of the early embryo, as well as the long-term health of subsequent generations.

My research involves humans, cattle, pigs, birds, rodents, and invertebrates. I am currently working on establishment and validation of the 'exposome' (the environmental exposures that an individual encounters throughout life) as a prognostic predictor of female fertility, as well as using male fertility as a biomarker of health to understand the biological effects of PFAS.

Dr Lara Grollo

Dr Lara Grollo

- Biotechnology
- STEM education
- Higher education
- Student engagement
- Meaningful learning

lara.grollo@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/134509-lara-grollo

My research focuses on applying educational approaches in tertiary biosciences to improve student progression, engagement and academic success. I'm particularly interested in how making learning relevant and enjoyable can support retention and better student outcomes.

Meaningful learning and student engagement

Improving student engagement is key to success in higher education. This can be achieved by focusing on meaningful learning – the interaction between a student's existing knowledge and new information. This process supports the development of enduring knowledge, built on or extending what a student already knows. Importantly, meaningful learning enables students to make inferences and apply their knowledge in new contexts.

Applying meaningful learning in bioscience education

My research focuses on applying meaningful learning in undergraduate and postgraduate bioscience education. I investigate how learning by doing and the use of real-world contexts can support students' understanding of complex ideas in biology and biotechnology. I am currently working on several projects within the School of Biosciences, and in collaboration with the Melbourne School of Graduate Education, to explore meaningful learning across different student cohorts at the University of Melbourne. These projects examine whether students perceive meaningful learning as beneficial, and whether integrating these approaches can improve academic success and employability.

STEM education research.

Medical microbiology.

Associate Professor Anca M. Hanea

Associate Professor Anca M. Hanea

- Decision making under uncertainty
- Probabilistic risk analysis
- Structured expert judgement
- Biosecurity, ecology, environmental modelling

anca.hanea@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/697859-anca-hanea

I combine mathematics, applied probabilities, decision science, and a strong appreciation for methodological foundations to propose rigorous yet practical modelling tools for biosecurity, environmental, and ecological risk assessment.

I focus on integrating uncertainty analysis into decision-making, especially in data-scarce or high-uncertainty contexts. I co-developed the IDEA protocol (Investigate, Discuss, Estimate, and Aggregate) – a structured method that improves the transparency and reliability of expert judgment, now widely used in environmental and biosecurity risk assessments.

I develop and apply probabilistic models, particularly Bayesian Networks (BNs), and contribute to advancing BN methodology and reporting standards. I apply BNs to challenges such as modelling pest and disease spread, assessing climate change impacts on Pacific Islands, and forecasting volcanic eruptions.

My primary focus is on biosecurity issues. For example, I evaluate the effectiveness of pre-border and border interventions to safeguard Australia's ecosystems and agriculture from emerging regional threats.

Pre-border capacity building. I evaluate investment in biosecurity measures in the Asia-Pacific region to better protect against growing risks in Australia's neighbourhood.

Associate Professor Mike Haydon

Associate Professor Mike Haydon

- Circadian rhythms
- Metabolism
- Nutrition
- Signalling
- Plant science

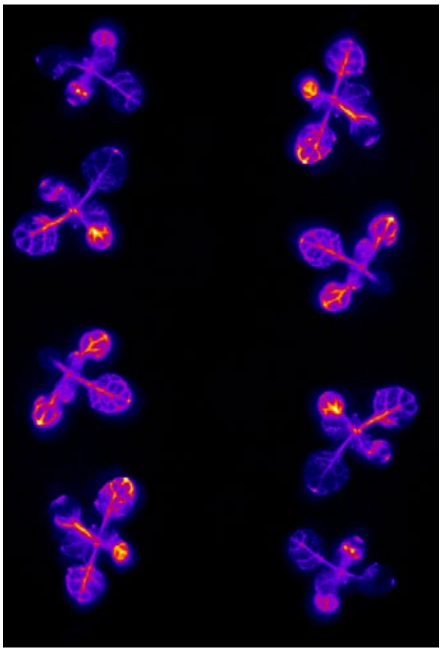
m.haydon@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/12319-mike-haydon

Plants rely on circadian clocks to integrate daily and seasonal environmental cues to coordinate growth, physiology and metabolism. A mismatch between the circadian clock and the local environment is detrimental to growth and fitness. Optimisation of circadian clocks in crops for new environments can contribute to enhanced food production.

Plant circadian rhythms

The circadian system is a biological time-keeper comprised of inputs (light, temperature, stress), an oscillator (a gene regulatory network) and outputs (physiology, metabolism, development). It influences almost all aspects of the plant and allows them to anticipate daily changes in the environment and adapt to seasonal conditions. Our main interest is to define the roles of metabolism and nutrition within the plant circadian system. We consider mechanisms of gene transcription, translation and post-translational control that influence circadian rhythms. Our research aims to make advances to understand fundamental aspects of plant cell biology, and also generate opportunities to develop crops or agricultural practices that match specific growth environments.



Watching the clock. A circadian clock gene driving a firefly luciferase reporter in Arabidopsis seedlings.

Metabolic signals in the circadian system

Sugars, which are the major product of photosynthesis, adjust circadian rhythms by modifying clock gene expression and protein levels. We use the regulation of the circadian system by sugars to define mechanisms of dynamic metabolic signalling in plant cells, and transcriptomics and chemical biology to reveal these metabolic signals. We are currently investigating how sugars generate these signals, and how they control gene expression.

Circadian control of leaf senescence and seed nutrition

Leaf senescence is a controlled developmental process which drives nutrient remobilisation in ageing leaves according to seasonal cues. Ethylene is a plant hormone that controls plant development, promotes leaf senescence and can adjust circadian rhythms in plants. We are investigating the mechanism by which ethylene affects circadian rhythms and the impact on leaf senescence and seed nutrition.

Professor Ary Hoffmann

Professor Ary Hoffmann

- Microbes in insects
- Mosquitoes
- Invertebrate pest control
- Climate change adaptation
- Biodiversity under stress

ary@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/17129-ary-hoffmann

Using microbes and ecological genetics tools, my research group develop solutions for invertebrate pest control in cropping systems and sustainable control of disease vectors. We also develop ways to facilitate the adaptation of threatened organisms to climate change and other threats.

Australian Grains and Horticulture Pest Innovation Program

To protect grain and vegetable crops from invertebrate pests, we target microbial *symbionts* (hosted organisms) in insects and mites to develop novel pest control options, and ways of detecting the evolution of pesticide resistance. Microbial targets include symbionts in pests (to decrease their populations and ability to transmit plant viruses) and in beneficial insects (to make them more efficient).

Mosquito disease transmission

We collaborate with overseas groups to suppress the ability of Aedes mosquitoes to transmit dengue, and with local groups to reduce the incidence of Buruli ulcer.

Insect climate change adaptation and conservation

We use genetic and genomic tools to identify limits to adaptation in insects and to reconstruct the evolutionary history of threatened species like morabine grasshoppers.

Professor Alice C. Hughes

Professor Alice C. Hughes

- Conservation biology
- Biodiversity indicators
- Ecological models
- Bat ecology
- OneHealth

alice.c.hughes@unimelb.edu.au
findanexpert.unimelb.edu.au/profile/1118519-alice-hughes

My work has two major streams: (i) understanding drivers of biodiversity change to inform effective conservation policy, and (ii) bat ecology, evolution and OneHealth.

Understanding biodiversity patterns

I focus on understanding patterns of biodiversity, the gaps and biases in different types of biodiversity data, and methods of data analysis to overcome these biases. My aim is to develop more effective indicators and approaches for monitoring trends in biodiversity over time and to support development of effective conservation policy.

Understanding drivers of biodiversity change

Understanding why the populations of many species, are declining is critical to develop counteractive strategies. I examine a range of major drivers of decline, including loss and degradation of habitats and wildlife trade, to inform recommendations for improved monitoring and actions to reduce unsustainable trade.

Bats and OneHealth

Bats are one of the largest mammal groups with over 1400 known species. Furthermore, bats have incredible immune systems, allowing them to host various pathogens while showing no symptoms. I explore bat ecology and its intersection with OneHealth – how the health of people, animals, and ecosystems is interconnected and interdependent.

Professor Willa Huston

Professor Wilhelmina (Willa) Huston

- Infectious diseases
- Microbiology
- Chlamydia
- Microbiome

willa.huston@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1116313-willa-huston

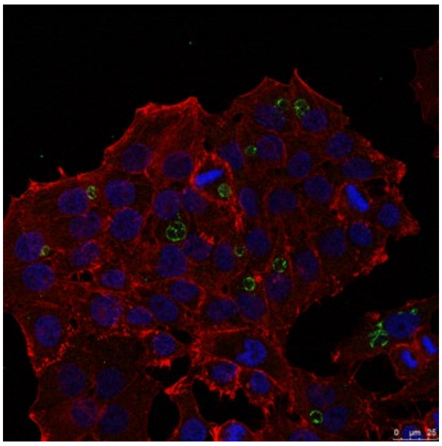
My research group aims to inform improved diagnosis, treatment and management of Chlamydial infections and their consequences in humans and animals.

Chlamydia and infertility

Sexually transmitted infection with the bacterium *Chlamydia trachomatis* can cause infertility in women. To understand why some women with chlamydial infections develop serious damage to the reproductive tract and others do not, we use cell culture models to reconstruct the *in vivo* disease process. We also explore additional therapies that may prevent serious outcomes from an infection.

Treating Chlamydia in koalas

Treating koalas with antibiotics can damage essential gut microflora, sometimes lethally. We explore re-purposed and novel compounds to find new treatment options for koala with chlamydial infections.



A microscopy image of host cells (red), infected with Chlamydia in a persistent form (green).

Associate Professor Alexander Idnurm

Associate Professor Alexander Idnurm

- Mycology
- Genetics
- Diseases
- Biodiversity

alexander.idnurm@unimelb.edu.au

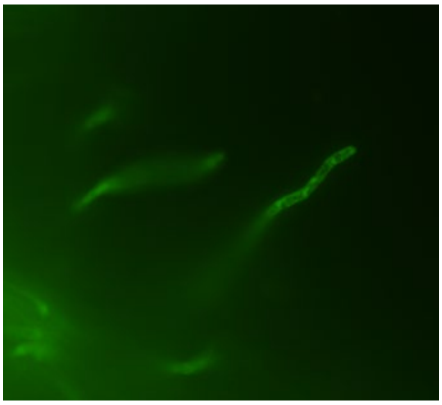
findanexpert.unimelb.edu.au/profile/2799-alexander-idnurm

We are doing research to provide a more secure planet for all people and the environment. A better understanding of how organisms can attack other organisms should provide new strategies for protection, which has wide implications for the deleterious impacts that fungi can have in plant disease, human health and degradation of products.

Our research focuses on the biology of fungi and aims to discover the genes found in these diverse organisms that enable them to cause diseases in plants and animals. The fungi are one of the most diverse groups of organisms on the planet, and while our focus is primarily on those that cause problems, other fungi are highly beneficial to humans as sources of food or pharmaceuticals. Research in the Parkville campus laboratory uses a full spectrum of approaches, from classical genetics and mapping through to genomics, gene editing and other molecular biology approaches.

Our strong partnerships with others, particularly at Grains Innovation Park in Horsham, complement the plant pathology aspects with field studies. Specific aspects of the research in cases are orientated around specific fungi or problems (eg blackleg disease of canola, cryptococcosis in humans) but often intersect through comparative approaches to explore fundamental aspects or emerging concepts in biology.

Blackleg lesions on canola caused by Leptosphaeria maculans.



Neopseudocercosporella capsellae, agent of white leaf spot of canola, expressing green fluorescent protein.

Professor Alex Johnson

Professor Alex Johnson

- Nutrition
- Biotechnology
- Food security
- Biofortification
- Functional food

johnsa@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/242977-alex-johnson

I develop new types of "biofortified" rice, wheat and other food crops that contain high levels of iron and zinc and could eventually give millions of people access to more nutritious food.

Nutrient uptake and transport

Plants use a range of molecules to mobilise iron (Fe) and zinc (Zn) in their tissues and absorb these nutrients from soil. A key molecule underpinning Fe and Zn movement in all higher plants is nicotianamine, a non-protein amino acid that chelates and solubilises transition metals. We have produced Fe- and Zn-biofortified rice and wheat through constitutive expression of nicotianamine synthase (NAS) genes.

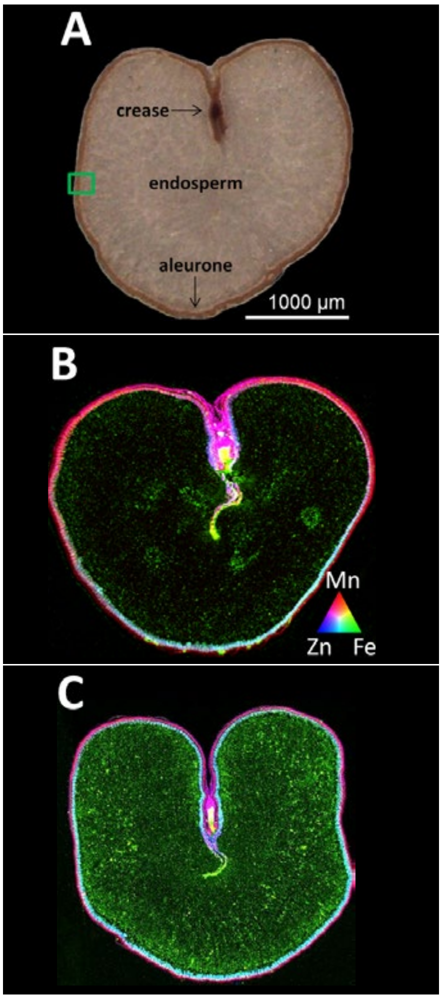
Nutrient bioavailability

Our research indicates that nicotianamine, rather than phytic acid, preferentially binds the increased Fe in our NAS-biofortified rice and wheat, and that these nicotianamine–Fe complexes are highly bioavailable in human diets. We are also exploring the role of ascorbic acid (vitamin C), a powerful antioxidant and enhancer of Fe bioavailability, in our biofortification research.

Nutrition and climate change

Many studies show that Fe and Zn concentrations will significantly decrease in cereals and grain legumes under the atmospheric carbon dioxide levels predicted for 2050. We are analysing Fe and Zn dynamics in rice, wheat and chickpea grown under ambient and elevated CO_2 to understand why these declines occur and to identify strategies to counteract them.

Biofortified rice grows as well as conventional rice in the field.



A biofortified wheat grain, pictured in panel C, has two-fold more iron (Fe) and zinc (Zn) than a conventional wheat grain (panel B).

Professor Theresa Jones

Professor Theresa Jones

- Urban light pollution
- Behaviour
- Life histories
- Evolution

theresa@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/7996-theresa-jones

My work is cross-disciplinary and will aid our understanding of the long-term evolutionary impact of artificial light at night. The data will be of significance and provide much-needed data for a wide range of stakeholders involved in the areas of urban planning and biodiversity monitoring, including government agencies, the lighting industry and the wider public. It will increase the profile of Australia in the burgeoning field of ecological light pollution and create an outstanding international networking and research platform.

My main area of research is in the field of behavioural ecology, with a particular focus on the impact of artificial night lighting on individual fitness and community structure. Since the introduction of electrical street lighting, many species live in environments with no period of 'true darkness'. Scattered light from urban areas may extend beyond city boundaries, resulting in regions that have no street lighting but that are still exposed to unnaturally long periods of light. Accumulating evidence suggests that such 'urban light pollution' has catastrophic health implications for all species (including humans) and puts ecosystem function at risk. To date, the mechanism underlying this remains unconfirmed.

One of our current aims is to investigate whether artificial light at night drives evolutionary change using a combination of field observations, laboratory experiments and advanced genetic techniques. This is a multi-disciplinary study involving several masters and PhD students that will provide a significant advancement in the understanding of the impact of light at night for animals and will enhance our capacity to predict the outcome of future urban expansions for all species. The outcomes will have broad implications for estimating the future biodiversity and health of our urban areas and will benefit both globally and within Australia by providing much-needed data regarding the likely resilience of species currently residing in our major cities.

The lights from Melbourne as seen from 60km away at Serendip Sanctuary. Image: Joanna Durrant.

Dr Patricia Jusuf

Dr Patricia Jusuf

- Developmental neuroscience
- Regenerative neuroscience
- Visual disease modelling
- Zebrafish phenotype pipeline

patricia.jusuf@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/20317-patricia-jusuf

The brain is one of the most complex organs in the human body, composed of over 80 billion nerve cells that need to be made, specialised, and connected correctly for the brain and associated central nervous system organs to function properly. In the Neural Development and Regeneration lab, we study how the nerve cells in the central nervous system are normally correctly generated, what exactly goes wrong when specific genes are not functioning correctly, and what can be learnt from related, highly regenerative animals that might help us to allow missing, damaged or lost human nerve cells to regenerate.

Development of the central nervous system

As an extension of the central nervous system, the retinal nerve cell sheet in the eye of all vertebrates contains the same types of nerve cells as, for example, the brain and spinal cord. By taking advantage of the rapid development of the genetic zebrafish vertebrate animal model, we can easily combine functional gene manipulation with phenotypic analysis using live imaging and fixed tissue to understand how individual genes affect the development of nerve cells, their gene expression, their anatomical connections and, ultimately, their function.

By combining gene function with live imaging of the temporal sequence of genes expressed within each of the distinct nerve cells, we can start building a network map that explains how the development and proper specialisation of vastly different types of nerve cells is coordinated.

Regenerating adult nerve cells

Humans have very limited capacity to repair damaged nerve cells caused by trauma or neurodegenerative disease. In our lab, we aim to decipher how highly regenerative related animals are able to regenerate damaged nerve cells.

The zebrafish vertebrate shares most of the same genes as humans, yet zebrafish are able to activate a distinct set of genes to coordinate highly efficient regeneration of nerve cells from stem cell types that also exist in humans.

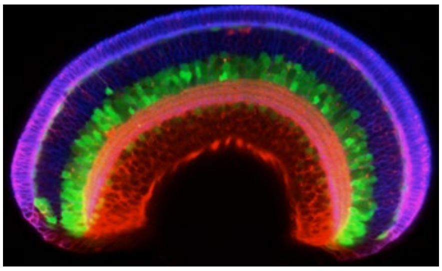
If we can understand and re-activate these genes in humans, we may be able to teach the brain and related organs to self-regenerate.

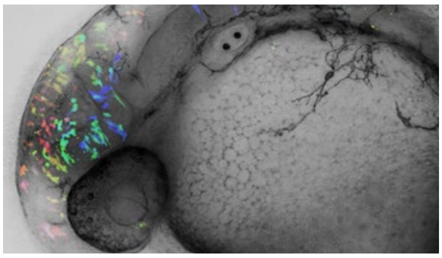
Visual disease modelling and treatment screening

To our knowledge, we have developed the only interdisciplinary visual zebrafish phenotyping pipeline that allows us to assess anatomical, electrophysiological and behavioral phenotypes of hundreds of zebrafish larvae each week.

We are using our pipeline to screen through the hundreds of novel human genes implicated in childhood myopia to identify the few important causative gene candidates that will need to be targeted for focused prevention and treatment strategies.

We are also using established zebrafish glaucoma models to screen for the potential of novel Australian plant-derived antioxidants in preventing or treating the visual nerve cell loss that ultimately leads to blindness in glaucoma patients. We work with clinicians and neuroscientists to take forward our findings towards clinical translation.





Dr Marianthi (Marianna) Karageorgi

Dr Marianthi (Marianna) Karageorgi

- Evolutionary and functional genomics
- Insecticide resistance
- Insect-plant interactions
- Experimental evolution
- Adaptation to changing environments

I investigate how insects adapt to natural plant toxins and synthetic insecticides to predict resistance evolution and support sustainable pest management in changing climates.

Molecular evolution of toxin resistance

Can we predict the genetic paths insects take to adapt to toxic plants and synthetic insecticides? These toxins often target essential proteins, so resistance can improve survival but also carry fitness costs. We combine evolutionary and population genomics to identify adaptive mutations across specialized insect lineages and natural Drosophila populations, then use genome editing to reconstruct these changes and test their effects. This work will help reveal whether simple rules govern toxin resistance evolution.

Genome-wide responses to toxin selection

What happens across the genome when populations adapt to toxins? We use experimental evolution with controlled toxin treatments to track insect populations in real time under semi-natural conditions. By following genome-wide changes and key traits through time, we ask which genetic architectures underlie toxin adaptation and whether evolving resistance affects other traits important for survival and reproduction.

Predicting resistance evolution in changing environments

How do fluctuating environments alter the evolution of resistance? We combine experimental evolution with controlled toxin exposure and climate-relevant temperature fluctuations to test how changing thermal conditions alter the costs and benefits of resistance mutations. This work will help forecast insecticide resistance in changing climates.

The “monarch fly”: a genome-edited fruit fly on a monarch butterfly wing. My research uses Drosophila to reconstruct how insects evolved resistance to plant toxins and to test whether adaptation follows predictable genetic paths. Image credit: Julianne Pelaez.

Field sampling fruit flies. My research connects natural populations with genomics and laboratory experiments to understand how insects adapt to host plant toxins and insecticides in changing environments.

Dr Bhawana Bhatta Kaudal

Dr Bhawana Bhatta Kaudal

- Inclusive education
- Student experience
- Soil science
- Nutrient cycling
- Biochar

bbhatta@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/357434-bhawana-bhatta-kaudal

I advance sustainable land management through soil nutrient cycling research and biochar applications. I also create inclusive learning environments in higher education, to foster student engagement and lifelong learning in biological sciences.

Sustainable soil management

My team's research focuses on enhancing soil fertility and crop productivity through sustainable practices. Biochar – sometimes called horticultural charcoal – is a complex, stable form of carbon produced by heating plant and/or animal material (biomass) to high temperatures in a low-oxygen environment. We investigate the impact of biochar on the physio-chemical properties of soil and explore efficient nutrient recovery from organic additives such as biosolids and agricultural waste.

Inclusive higher education

We create inclusive learning environments, on campus and online, by applying Universal Design for Learning principles. We develop and evaluate innovative teaching strategies that cater to diverse learning needs, incorporating multiple means of representation, engagement, action and expression. By fostering a sense of belonging and support for all students across varied educational settings, we aim to enhance their learning experiences and academic outcomes.

Glasshouse experiment to understand effects of biochar and compost on soil properties and plant growth.

Interactive laboratory-based teaching.

Professor Michael Kearney

Professor Michael Kearney

- Biophysical ecology
- Ecophysiology
- Species distribution modelling
- Metabolic theory
- Climate change

m.kearney@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/100029-michael-kearney

My research aims to develop and apply mechanistic models of how species respond to environmental change based on how individuals experience and respond to their environments across their whole life cycles. Compared to the more traditional statistical modelling methods, mechanistic models can make reliable and robust predictions under complex and novel environmental settings. They can also reveal 'management levers' that can be used to improve or hamper species of applied interest.

Ecological forecasting

I have pioneered the field of 'mechanistic niche modelling' for forecasting species responses to environmental change. This involves the development of modelling tools that apply first-principles models of energy and mass exchange between organisms and their environments to predict their behaviour, life cycles, life histories and, ultimately, distribution and abundance.

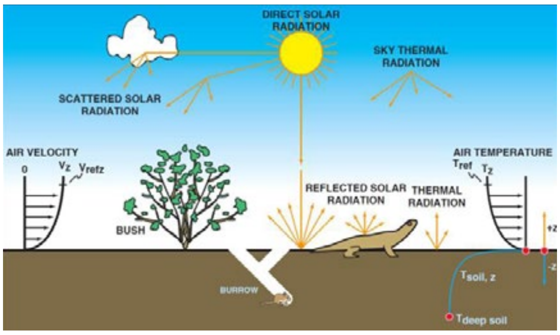
My research in this area involves laboratory work to measure functional traits required by the models and field work to test the models. A large part of this work has involved the development and testing of microclimate models. The approach is highly general, and we apply it to animals (including humans) and plants in both terrestrial and aquatic environments. It is powerful because it can infer species' responses to novel environmental change as occurs during species invasions and under climate change.

Metabolic ecology

One of the most fundamental characteristics of living things is the way they take up resources from their environment and use them to grow, maintain, develop, and reproduce. Metabolic theory aims to characterise this process from first principles, and I work with one particular theory, the Dynamic Energy Budget theory, to study the life cycles and life histories of organisms.

Conservation biology

Our research on ecological forecasting is applied to conservation in many organisms to predict suitable habitat (western swamp turtle, greater glider, koalas, great desert skink) or forecast stress events (flying foxes). But we also have a research program to recover native grasshoppers, including the nationally listed Key's matchstick grasshopper. We integrate field ecology with genetic approaches and captive studies to develop conservation strategies for these species.



Our theoretical work involves modelling how organisms respond to their physical environment.

The best part of research — being in the field (grasshopper resurvey with Hojun Song, Anwar Hossain and Steve Sinclair).

Associate Professor Grzegorz Kubik

Associate Professor Grzegorz Kubik

- Industrial biotechnology
- Biocatalysis
- Precision fermentation

greg.kubik@unimelb.edu.au

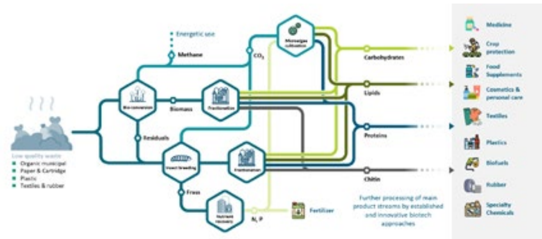
findanexpert.unimelb.edu.au/profile/1090177-greg-kubik

I use biological tools and systems to convert renewable resources from agricultural and industrial waste streams into value-added products efficiently and sustainably.

I develop comprehensive biorefinery concepts to convert carbon dioxide and biomass from agricultural residues into value-added products efficiently and sustainably. I focus on:

- cultivating and processing microorganisms, including algae, bacteria and yeasts
- developing enzymes and biocatalytic processes
- integrating biotechnological approaches into the value chains of the chemical industry.

I would like to expand my research to develop biological processes for waste management and recycling, for example using insects and fungi. This will help us to close the loop to achieve a circular economy and could also aid the remediation of landfills.



A potential concept for a waste refinery, using insects and fungi.

Dr Tyrone Lavery

Dr Tyrone Lavery
Melbourne Biodiversity Institute; Oceania Institute

- Mammalogy
- Ecology
- Evolution
- Biogeography
- Conservation biology

tyrone.lavery@unimelb.edu.au
findanexpert.unimelb.edu.au/profile/1040408-tyrone-lavery

My research spans the field, museums and the laboratory, using diverse tools to understand how mammals are related, how geography shapes their distributions, and how best to conserve them. I am particularly drawn to tracing the stories of rare species – those that are lost, missing, extinct, or still waiting to be discovered by science.

Taxonomy and biogeography

Even in Australia, new mammal species are still being discovered, particularly in remote or poorly studied areas. My research focuses on identifying and classifying these species to better understand where they live and how they evolved.

To fully understand Australia's unique fauna, I also study nearby regions such as New Guinea – one of the least-studied places on Earth for mammals. Filling these knowledge gaps is vital for conservation and for revealing the deep evolutionary links across our region.

Threatened species monitoring

Endangered animals are difficult to protect if we do not know where they occur, how their populations are changing, or what threats they face. Many threatened species lack any monitoring, and existing programs are often inconsistent or poorly targeted.

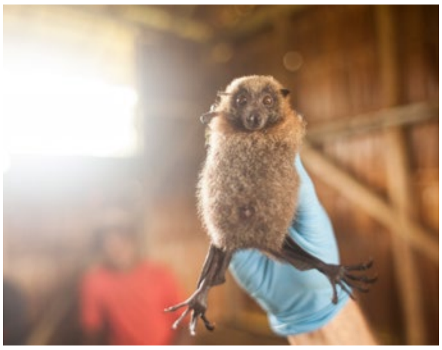
I design tailored monitoring programs using both traditional field methods and new technologies, such as camera traps and acoustic recorders, to track rare species and provide decision-makers with the information needed for timely and effective action.

Using science to support people and wildlife

Lasting conservation depends on strong relationships with the people who live closest to nature. I use my science to support community-led conservation, particularly where cultural and ecological knowledge are closely connected.

Much of my work takes place on Indigenous land, where it is essential that research is useful, respectful and relevant to local communities.

Surveying the high elevation peaks of Guadalcanal Island.



The world's smallest species of flying-fox–dwarf flying-fox (Pteropus woodford).

Villages of East Kwaio, Solomon Islands.

Dr Anna Lister

Dr Anna Lister

- Collaborative skills
- Factors affecting student attentiveness/inattentiveness
- Transition to university and student engagement
- Relational teaching
- Population and ecological genetics

anna.lister@unimelb.edu.au

I aim to design effective learning experiences that help increase student engagement and knowledge retention, aid students in developing transferable skills and graduate-ready capabilities, and foster inclusive communities that support a smooth transition and strong sense of belonging.

Collaborative skills

Collaborative skills are a group of skills widely recognised as required for all graduates in their future profession. We explore the specific collaborative skills students need to develop, and how we can support students in that development. This is then implemented into subject design and scaffolded across subjects, to provide a more valuable learning experience to students.

Attentive and inattentive behaviours

Attention is both limited and selective, and therefore to increase student engagement, we need to understand the factors that influence attentive and inattentiveness. These could include physical learning space attributes, learning task design and may affect students differently depending on their propensity for attentive or inattentive behaviours. By improving the factors teaching teams can control, we can improve attentiveness and therefore students' ability to engage with and retain knowledge.

Students engaging in a discussion in a group.

Student attention or inattention in a classroom.

Dr Lynette H. L. Loke

Dr Lynette H. L. Loke

- Community ecology
- Marine ecology
- Spatial ecology
- Ecological engineering

lynette.loke@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1065653-lynette-loke

I investigate the forces that drive and maintain biodiversity, using intertidal marine systems as model ecosystems to answer fundamental questions in ecology and develop nature-based solutions. My work connects theoretical, empirical, and applied ecology to understand how biodiversity persists in dynamic environments and how we can design better strategies to conserve and restore it.

Community assembly and biodiversity maintenance

What determines the number and composition of species in a community? I examine how ecological processes shape local biodiversity and how communities maintain diversity in the face of environmental change.

Spatial complexity across scales

I study how habitat space, structure and configuration influence species dispersal and biodiversity patterns across spatial scales. This includes examining how patchy and fragmented environments modulate ecological processes. My work develops new metrics and frameworks to understand how spatial habitat patterns affect ecological communities and inform biodiversity solutions.

Global change and biodiversity solutions

Coastal ecosystems face increasing pressures from sea-level rise and rapid urbanisation. I develop nature-based solutions and coastal eco-engineering approaches grounded in an understanding of the drivers of biodiversity and persistence. By linking human-driven change and environmental variability to ecological processes, I aim to reveal how biodiversity, habitat structure and human activities interact across scales.

Rocky intertidal shore.

Professor Geoffrey Ian McFadden

Professor Geoffrey Ian McFadden

- Malaria drugs and vector control
- Coral-algae symbiosis
- Coral bleaching

gim@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/244-geoffrey-mcfadden

To fight malaria, I lead my team to develop new drugs, investigate malaria parasite drug resistance, and build genetic tools with potential for disease control. We also explore symbiosis between corals and algae that is crucial for reef formation and resilience.

Antimalarials

Globally, malaria causes around 250 million infections and 700,000 deaths per year. We tackle this problem in three ways:

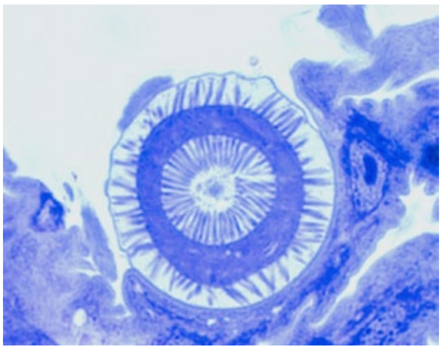
(i) We expose malaria parasites to drugs, select for drug resistance, and identify mutations that confer resistance. We then measure the evolutionary fitness consequences of these mutations to better understand how resistance can spread, so we can devise prevention strategies.

(ii) We are testing a novel approach of delivering antimalarials to mosquitoes rather than people. This broadens the categories of antimalarials we can use and offers cheap and simple disease control.

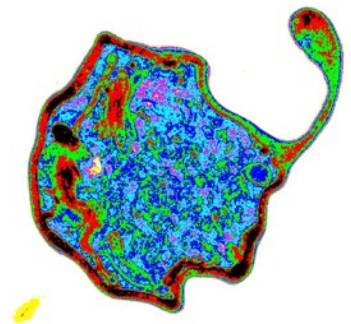
(iii) A gene drive is a system of biased inheritance designed to modify a population. It involves genetic engineering to increase the transmission of specific genetic material from parents to offspring. We are developing gene drives intended to collapse the malaria parasite population by creating a sex bias in the population.

Coral symbiosis

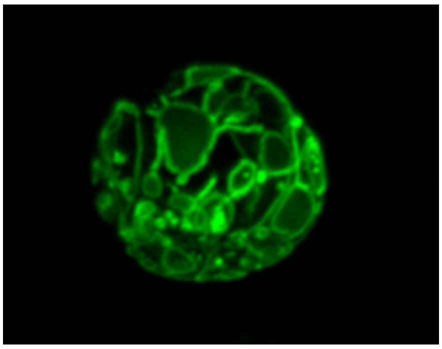
In a symbiotic partnership, algae living inside coral animal cells deliver up to 95 per cent of the partnership's energy needs through photosynthesis. Coral bleaching occurs when corals eject their colourful algal symbionts in response to overheating. To help address this growing cause of coral reef loss, we study how the partners communicate, how they select appropriate matches between host and symbiont, and how they exchange resources such as nitrogen, carbon, and sugars.



Malaria parasite in the mosquito stage of the life cycle.



Malaria parasite in the sexual stage of the life cycle – from a human.



Malaria parasite genetically engineered to express a green fluorescent protein so we can track the parasite across the two-host life cycle.

Dr Iliana Medina Guzman

Dr Iliana Medina Guzman

- Behaviour
- Macroevolution
- Ecology
- Evolution

iliana.medina@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/805782-iliana-medina-guzman

I am passionate about understanding our natural world, in particular how animals interact with their environment and with other species. Knowing our world and having a deep understanding of how and why it is the way it is can help us connect better to our surroundings and ultimately promote the importance of protecting our wildlife and ecosystems.

My research interests combine the worlds of behavioural ecology and macroevolution. I am curious about the evolution of animal behaviours and the adaptations that these have to their habitat. Why have these strategies evolved? How do they affect the evolutionary destiny of the species? For most of my research, I combine work in the field, laboratory or museum with broad-scale comparative analyses. This integrative approach allows us to understand in-depth the evolutionary drivers of the diversity of forms and colours we see in nature.

The two main research areas in my group are the ecology and evolution of bird nests and the evolution of colours in animals, mainly birds and insects. By looking at the evolutionary history of traits like nests or colour we can understand the diversity in our world. Nests are fundamental for the reproduction of birds and they can vary significantly from species to species, adapting to the particular lifestyle of each species. We explore which environmental pressures have driven the evolution of particular nest features, such as the size or shape of the nest.

Colour is used by animals for defence, mate attraction and to control their temperature. As such, it is a critical trait for survival. In my group we also use museum collections and information from the field and laboratory to reveal why the incredible colours we observe in nature have evolved.

The Cotton Harlequin Bug (Tectocoris diophthalmus) is an Australian insect that presents warning colourations to advertise its repellent odour to potential predators. It is one of our research model systems.

Grey fantail (Rhipidura albiscada) sitting on its nest.

Professor Shai Meiri

Professor Shai Meiri

- Macroecology, macroevolution and conservation
- Reptile ecophysiology and natural history
- Phylogeny and taxonomy of Middle Eastern reptiles
- Island biogeography

shai.meiri@unimelb.edu.au

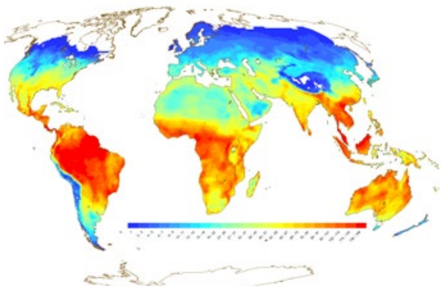
findanexpert.unimelb.edu.au/profile/1128121-shai-meiri

Working in the field, lab and museums, my research group studies the diversity, evolution, ecology, biogeography and conservation of land vertebrates – especially reptiles.

Lizards and snakes comprise the largest order of land vertebrates. We study reptiles in the field to understand their basic natural history, ecophysiology, and conservation needs, developing conservation metrics and measures at regional and local scales. We develop global-scale datasets of distribution and species traits, and derive and test hypotheses regarding their evolution, ecology and biogeography.

Increasingly, we use these datasets to determine conservation needs and prioritise species and regions for conservation. We strive to identify neglected and little-known species and regions and highlight potential threats they face. For example, we work in one of the less-explored regions of the world: the Saharo-Arabian desert belt.

We also use island reptiles as models for the study of adaptation, speciation, community assembly, and extinction.



The Global Assessment of Reptile Distributions (GARD) – a consortium of scientists from across the world – is creating the first database of all (>12,000) reptile species, on which this map is based.

A species described for the first time by our group: the cat snake in Mt. Gilboa, Israel. Photo: Ben Shermeister.

Dr Rebecca Morris

Dr Rebecca Morris

- Marine ecology
- Restoration
- Nature-based solutions

rebecca.morris@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/791937-rebecca-morris

I conduct interdisciplinary research to inform the effective design and implementation of nature-based solutions that address two pervasive challenges: coastal habitat loss and the growing risks of erosion and flooding.

Reefs for resilience

This work centres on restoring and engineering biogenic reefs – including oysters, mussels and corals – that function as living breakwaters. Projects assess how reef structure influences hydrodynamics, promotes larval recruitment, and supports ecosystem services such as fisheries, biodiversity and water filtration.

Vegetated living shorelines

We design hybrid nature-based systems that combine biodegradable and non-biodegradable structures – such as rock fillets and modular reefs – with habitat restoration. These approaches modify hydrodynamic and geomorphic conditions to improve habitat establishment and shoreline stability across tropical and temperate regions.

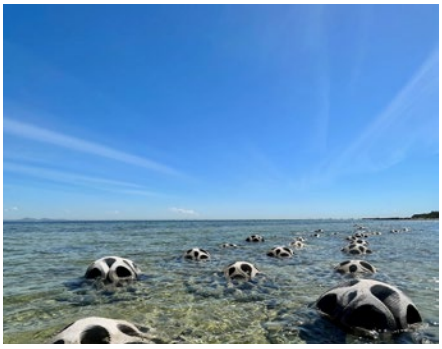
Living shoreline mosaics

We investigate how integrating multiple habitat types – including oyster reefs, mangroves, seagrass, saltmarsh and dunes – can enhance coastal protection. By comparing single-habitat and mosaic installations, we quantify benefits in wave attenuation, sediment stabilisation and ecological interactions.

Living Shorelines Australia

I co-lead a national initiative translating research into practice by developing guidelines, project databases and decision-support tools to mainstream living shorelines in coastal management. This collaborative effort supports knowledge-sharing among practitioners and policymakers.

A living shoreline of oyster reef, mangrove and saltmarsh in Narooma, NSW.



The Dell Eco Reef in Clifton Springs, VIC.

Hybrid mangrove pods in Altona, VIC.

Associate Professor John Morrongiello

Associate Professor John Morrongiello

- Fish ecology
- Life history
- Climate change
- Evolutionary ecology
- Fisheries

john.morrongiello@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/19545-john-morrongiello

I am a quantitative ecologist working in marine and freshwater systems, investigating how animals respond to environmental change on contemporary and evolutionary time scales. I am keenly interested in the impacts of, and adaptations to, fishery activity, natural and human-induced flow variability, and environmental change. I ask questions at different levels of biological organisation, ranging from individuals to assemblages, using field-based and experimental techniques.

Climate change and fishing impacts in aquatic environments

My research primarily focuses on understanding the evolutionary causes of within-species phenotypic diversity and its ecological consequences in individual fitness, species persistence and assemblage composition. Understanding these fundamentals allows me to explore more applied questions.

An important part of my work has focused on quantifying the impacts of climate change on fishes and predicting likely impacts of this on fishery productivity. I have used otolith-based data to recreate global-scale oceanographic dynamics, and I am currently investigating the role of fishery activity in inducing trait selectivity and density-dependent processes (additive and synergistic effects of fishing and warming).

Statistical modelling

I have developed novel models to analyse individual-level thermal reaction norms and species-wide thermal responses in fish, and the environmental drivers of life-history trait variation, in particular growth, recruitment and movement. I use sophisticated analytical techniques to provide inference at different levels of biological organisation (often concurrently), ranging from within individual variation to among-population, regional and species-wide trends. My reseach is often directly implemented by end users.

Professor Raoul Mulder

Professor Raoul Mulder

- Evolutionary biology
- Behavioural ecology
- Communication
- Mating systems
- Student learning

r.mulder@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/4072-raoul-mulder

My dual aims are to improve our understanding of the natural world and take an evidence-based approach to understanding what makes for impactful learning in the university.

I am fascinated by the causes and consequences of variability in mating systems, particularly the relative importance of sexual and natural selection, the role of visual and acoustic signals and the way in which cooperation and conflict interact in complex social groups. Much of my work combines field studies of behaviour with the use of molecular markers to assign parentage, to better understand the fitness outcomes of different individual strategies.

Why birds?

They exhibit remarkable variation in their life histories, their reproductive success is neatly contained in a nest and they can be readily marked for individual identification. And of course, they are endlessly engaging and surprising in their natural history and behaviour.

Raoul Mulder removing a Madagascar paradise flycatcher from a mistnet.

Raoul Mulder measuring a black swan.

Dr Paul Nabity

Dr Paul Nabity

- Host-parasite ecology
- Genomics
- Ecophysiology
- Hemiparasites
- Galls

paul.nabity@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1057857-paul-nabity

I advance understanding of parasite-host interactions to inform better management of ecologically and agriculturally significant organisms.

Evolution of herbivory

Insects that feed on plants create challenges in agriculture and ecosystems. Evolution of this feeding habit induced sophisticated changes in plants and attacking insects, which needed to evade plants' immune responses or other defences. Some insects evolved the ability to usurp control over plants and engineer new plant phenotypes (abnormal growths) called galls. I use comparative approaches to reveal the mechanisms that enable plant feeding by insects, including gall growth, and apply this information to predict species interactions and improve plant function.

Resource trade-offs

Under stress, plants divert energy from growth to defence, and some switch from making resources (through photosynthesis) to taking resources, becoming parasitic on other plants. I use insects and plants as antagonists on other plants to reveal the context underlying resource trade-offs. Understanding how and why this shift from production to consumption occurs is core to predicting interactions and managing parasites in our rapidly changing environment.

Two different insect species attacked the same leaf but transformed it differently, showing that the insect, not the plant, controls the phenotypic shift.

Some plants that are parasites of other plants, such as the red flowered paintbrush, can tap into the roots of different hosts to take resources.

Professor Moira O'Bryan

Professor Moira O'Bryan

- Male infertility
- Germ cell biology

moira.obryan@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/672127-moira-o'bryan

Approximately four per cent of young Australian men are infertile. For the majority, no cause can be identified. Similarly, numerous epidemiological studies have revealed that infertile men have a higher morbidity and die younger than their fertile counterparts. The reasons for this burden are unknown. Within the Male Infertility and Germ Cell Biology lab, we aim to define how sperm are produced, the causes of infertility and the implications of infertility for health more broadly. Insights obtained from this research will inform human and animal health, evolutionary processes, contraceptive development and cell biology.

Male infertility and germ cell biology

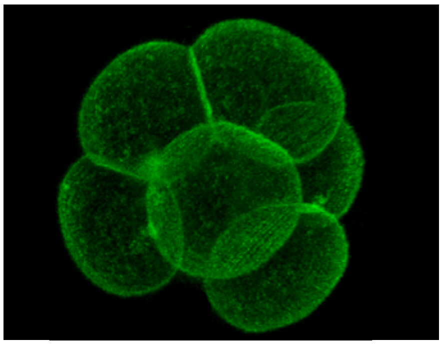
My research group aims to identify key mechanisms required for male germ cell development, the aetiology of human male infertility and the interplay between fertility and health. This is achieved using a range of genomic, biochemical and cell biological methods, including the development of unique model systems and state-of-the art imaging methods.

Building a functional sperm

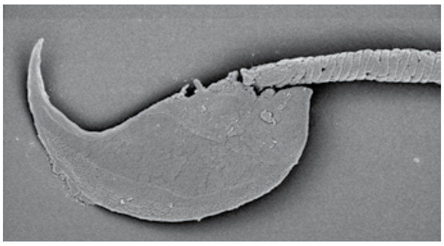
Sperm are a triumph of design. While their development is complex, the final sperm cell is elegant in its simplicity. The shape of the sperm is dictated by a range of cytoskeletal elements and their regulatory pathways and is a key determinant of function and ultimately evolutionary processes. Within our lab, we aim to identify these processes and ultimately harness this knowledge to identify causes of infertility, contraceptive targets and to understand fundamental mechanisms of cell biology more broadly.

The genetic causes of human male infertility

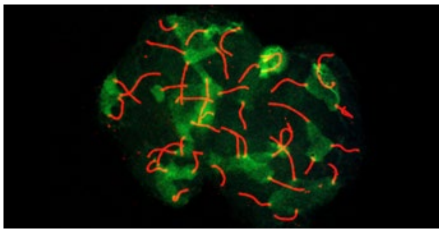
In partnership with the International Male Infertility Genomics Consortium, we are identifying genetic mutations that lead to human male infertility. In order to validate causality, we are modelling these genetic variants in animal models. In doing so, we are providing diagnostic certainty and identifying novel pathways required for fertility.



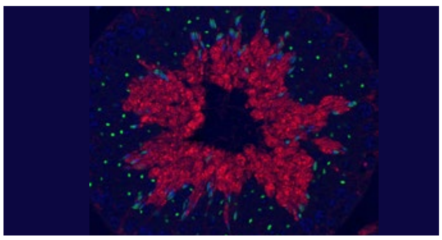
Eight-cell stage mouse embryo: cell membranes are marked with green fluorescent protein (GFP). Image credit: Gemma Stathatos.



Scanning electron micrograph of a mouse sperm head. Image credit: Denis Korneev.



Mouse spermatocyte meiotic chromosome spread: chromosomes are shown in green and synaptonemal complexes in red. Image credit: Jo Merriner.



Mouse testis section stained for cell nuclei (blue), acrosomes (green) and ACRV1 (red). Image credit: Jessica Dunleavy.

Professor Kirsten Parris

Professor Kirsten Parris
Melbourne Centre for Cities; Melbourne Biodiversity Institute

- Urban ecology
- Amphibian ecology
- Conservation biology
- Animal behaviour
- Ecological ethics

k.parris@unimelb.edu.au
findanexpert.unimelb.edu.au/profile/18071-kirsten-parris

I improve understanding of nature in cities, and how people can better share the urban environment with other species.

Urban ecology and conservation biology

Cities can provide important habitat for native wildlife, but they also present many challenges to species persistence. I focus on the ecology of frogs, birds and insects in urban environments, and on practical ways to conserve their populations into the future. I work with colleagues in urban planning and design to identify new approaches to building cities that better support wildlife, for the benefit of people and nature.

Animal behaviour

Animals in cities face a range of novel stressors, including chemical pollution, noise pollution and exposure to artificial light at night. I collaborate with researchers in Switzerland and France to study how frogs, birds and freshwater insects are changing their behaviour in response to these pressures.

Ecological ethics

I am interested in the ethics of ecological research and how ecologists consider different values in their work. These include the expected benefits of the information gained from a study, the welfare of individual animals, and the interests of populations or species.

A motorbike frog living its best suburban life in Fremantle, Western Australia.

Sleeping tawny frogmouths in Royal Park, Melbourne.

A hoverfly visiting a flax lily in Royal Park, Melbourne.

Professor Andrew Pask

Professor Andrew Pask

- Reproductive biology
- Evolution-development (Evodevo)
- Genetics and genomics
- Developmental biology

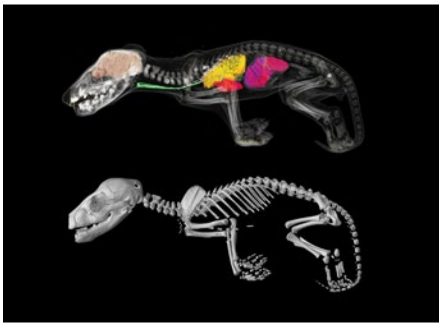
a.pask@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/4401-andrew-pask

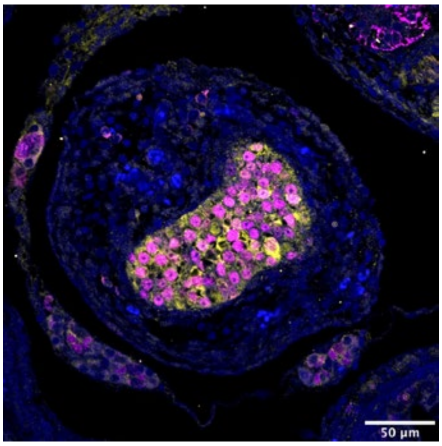
Australia has one of the world's worst track records in mammalian extinctions. We are working to develop much needed genetic and assisted reproductive technologies to help save our threatened and endangered wildlife and maybe even think about bringing them back after extinction. Human fertility is also dropping at an alarming rate, with an unprecedented increase in reproductive disorders attributed to exposure to chemicals in the environment that interfere with our natural hormones. My lab examines how these chemicals impact our development and cause both short and long-term impacts on our reproductive health.

I head the Evo-Devo-Repro group. My research uses comparative mammalian genetics to identify critical and conserved genes driving development, particularly of the craniofacial region and reproductive tract. My work in reproduction has uncovered novel roles for estrogen in male development and helped define the impacts of environmental contaminants on male reproductive health.

My comparative genetics work has led to the sequencing of several marsupial genomes, including that of the extinct Tasmanian Tiger. I use genome-wide, cross-species comparisons to define regions of the genome targeted by evolution to drive diversity and adaptation.



Tasmanian Tiger micro CT scan depicting internal structures.



Marsupial dunnart testis on day 2 post partum showing the first testis cord (yellow) with germ cells (pink).

Dr Nicole Rafferty

Dr Nicole Rafferty

- Community ecology
- Species interactions
- Pollination
- Phenology
- Climate change ecology

nicole.rafferty@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1057787-nicole-rafferty

I aim to understand how climate change is affecting plants, pollinators, and their interactions in diverse habitats.

Temporal ecology

Phenology is the study of cyclic and seasonal natural phenomena, including the life stages of plants and animals. Climate change-induced phenological shifts can alter the temporal overlap of different species, leading to local extinctions of interdependent species. I investigate how climate change affects the temporal dimension of plant-pollinator interactions across various habitats, including tallgrass prairies, subalpine meadows, and semi-arid ecosystems.

Traits that structure interactions between species

I use models to test whether variation in species' interactions can be explained by plant traits – such as flower colour and nectar sugar content – and/or pollinator traits, such as bee body size and tongue length. I aim to determine which traits structure plant-pollinator interactions, and how those traits are affected by climate warming.

Experimental plant-pollinator communities in a glasshouse.

A bee visiting a manzanita flower.

Associate Professor Suzie Reichman

Associate Professor Suzie Reichman

- Pollution
- Ecotoxicology
- Soil chemistry
- Environmental risk assessment

suzie.reichman@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/28291-suzie-reichman

Globally, pollution is widespread and a substantial problem that compromises human and environmental health as well as the ecosystem services we rely on for clean air and water, agriculture and recreation. While we have achieved substantial global economic growth over the past few decades it has often been associated with large amounts of pollution. In Australia, it is estimated we have over 160,000 contaminated sites containing about 75,000 different chemicals and with clean-up costs of approximately $160 billion. Our pollution problem is substantial and we need safe, effective and evidence-based approaches to assess and sustainably manage it.

Effects of contaminants in the terrestrial environment

My research group aims to reduce the risk of contaminated land to humans and the environment, focusing on the effects of contaminants in the terrestrial environment such as in soil, plants, invertebrates and human health. We use ecotoxicology and soil chemistry principles to solve knowledge gaps in the environmental risk assessment and remediation of contaminated land. My research group covers traditional pollutants (eg metals and hydrocarbons) as well as emerging chemicals such as per and poly-fluoroalkyl substances (PFAS) and microplastics. Currently, we have a focus on urban pollution and Antarctica.

The outcomes from my research group have been incorporated into government guidance and policy used by industry to make more accurate risk assessments of contaminated land and by the community to garden more safely.

Some of my areas of research include:

- Environmental risk assessment relating to potentially contaminated land
- Ecotoxicological testing of plants and invertebrates (eg earthworms, springtails, tardigrades, rotifers and nematodes)
- Bioavailability processes in soil systems
- Heavy metal and trace element biogeochemistry
- Phytoremediation and phytomining; biosolids and land application of wastes; mining remediation.

Eucalyptus grown in mine tailings.

Research to support soil remediation targets.

Antarctic moss collection for tardigrade and rotifer ecotoxicity research.

Associate Professor Charles Robin

Associate Professor Charles Robin

- Population genetics
- Molecular evolution
- Insecticide resistance
- Gene drives
- Detoxifying enzymes

crobin@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/6345-charles-robin

How do we control pest insect populations without damaging biodiversity?

My research is motivated by two general questions:

1. What is the genetic basis of the adaptation that shapes the wonderous biodiversity observed on planet earth?
2. How can we control pest insects without damaging that biodiversity?

More specifically, my lab group focuses on the microevolutionary processes of adaptation, the molecular evolution of gene families, especially those involved with detoxification processes in insects, and genetic methods of pest control such as RNAi and gene drives. The approaches we take are typically genetic (linkage mapping, association studies, transgenic manipulations, and allele frequency change in lab populations) and are explicitly couched in an evolutionary context where we often examine within and between species variation in genomic datasets to identify the genetic targets of natural selection.

The lab also deploys population simulation analyses (eg for gene drive modelling), has contributed to some theory (eg to account for recombination among paralogs in gene family evolution) and has an interest in the history of invertebrate taxonomy.

Much of our research has focused on the model insect Drosophila melanogaster but we have also focused on major insect pests of agriculture, such as the cotton bollworm but we also study major insect pests Helicoverpa armigera and the green peach aphid Myzus persicae.

Two Drosophila melanogaster males fighting. We can understand so much biology by working with this species because of the sophisticated genetic tools, deep literature and ease of manipulation in the lab.

Helicoverpa armigera is the chief reason why transgenic cotton is grown. We have been involved in characterising the genome of this major agricultural pest.

Professor Andrew Robinson

Professor Andrew Robinson

- Biosecurity risk management
- Applied statistics
- Forest modelling and inventory

apro@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/119566-andrew-robinson

Biosecurity is a critically important function of national government but also a shared responsibility with state governments, industry, other stakeholders and every citizen. The Centre of Excellence for Biosecurity Risk Analysis (CEBRA) strives to support the national regulators in managing biosecurity risk by identifying or developing new tools and ways of thinking. Since its inception in 2006 the Centre has worked closely with the Department of Agriculture, Water and the Environment (DAWE) (and and the Ministry for Primary Industries (MPI), since 2013) to help traverse the maturation as science-based regulators.

Biosecurity risk management

Biosecurity is the suite of activities undertaken by national and state regulators and other stakeholders to protect Australia's environment, agriculture, economy, health and social and cultural amenity from invasive pests and diseases — in short, to protect our way of life! Biosecurity risk management demands a delicate balance between enabling travel and trade and all the benefits that these activities bring and protecting the values that we hold dear. Science to support biosecurity risk management calls on a wide range of skills, including statistics, applied mathematics, economics, biology, ecology and sociology.

With our primary stakeholders, namely Australia's Department of Agriculture, Water and the Environment and New Zealand's Ministry for Primary Industries, CEBRA works across these areas to co-develop and deliver problem-centred research projects. Our primary motivation is to help our stakeholders deliver more efficient, robust, science-based biosecurity outcomes. These projects range from estimating the market and non-market value of the biosecurity system to Australia or the utility of bulk milk testing for diseases to developing risk-based inspection schemes that reward compliance and can change stakeholder behaviour, and efficient surveillance systems for invasive pests.

An example of a container ship in Port Philip Bay piled high with sea containers. Sea containers are a known pathway for invasive pests and pathogens.

A biosecurity greenhouse. These plants are being grown out to see if they are infected by pathogens. This check can take years.

Associate Professor Nicholas Robinson

Associate Professor Nicholas Robinson

- Genomics
- Disease resistance
- Aquaculture
- Genomic selection
- Gene editing

robinson.n1@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/799435-nicholas-robinson

My mission is to develop knowledge that can be applied to solve or help mitigate against some of the world's largest disease problems for aquaculture, thereby improving the sustainability of worldwide aquaculture.

Fish and shellfish are healthy sources of protein and nutrients, and aquaculture production is growing around the world. But there are many challenges faced by these industries. Access to reliable, fast growing, disease resistant and stress resilient seedstock is needed to ensure ongoing sustainability. My research concerns the application of genomics to the genetic improvement of fish and shellfish in aquaculture.

White spot syndrome virus disease

White spot syndrome virus (WSSV) is a contagious and lethal disease that causes billions of dollars of losses globally. It can decimate whole prawn farms within a few days of infection and preventative measures have proven ineffective. Our research demonstrated that genomic selection could be used to achieve more than 10% improved resistance within one generation of selection and that there is high potential for future genetic improvement using this technology.

Sea lice infestations affecting Atlantic salmon

Sea lice are a major pest species affecting fish welfare in many countries. Current preventative measures and treatments are not completely effective. We know that Atlantic salmon vary in their ability to resist infection by lice and that some species of salmon are particularly resistant to lice. I am leading two research projects working closely with industry and a team of overseas collaborators to better understand the genes involved in conferring resistance to sea lice and developing strategies for creating a more resistant strain of Atlantic salmon. These projects are using the latest transcriptomics, CRISPR-Cas9 (molecular scissor) and gene-mapping technologies.

Barramundi seedstock

Barramundi is an iconic tasty fish species growing in popularity around the world. I have been working with the main supplier of seedstock to barramundi farmers to implement genomic selection for creating an elite strain of fast-growing resilient stock.

I investigate the genetic mechanisms affecting the ability of Atlantic salmon to resist sea lice infestation.

I work with major aquaculture industry partners around the world, such as Atlantic salmon producers in Norway.

Dr Perran Ross

Dr Perran Ross

- Insect pest management
- Endosymbionts
- Climate change adaptation
- Experimental evolution

perran.ross@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/550093-perran-stott-ross

I aim to understand how insects respond to environmental stress and to develop new tools to control insect pests and disease vectors.

Mosquito responses to climate change

Mosquitoes are important disease vectors in Australia, but there is limited information on how they will respond to our changing climate. To predict the future distributions of local and invasive mosquito species under climate change, I test their ability to adapt to hot, cold and dry environments. This research will inform better management of local mosquito populations and prepare Australia to tackle invasive mosquito threats.

Endosymbionts for insect pest control

With the rapid rise of insecticide resistance, new tools are urgently needed to manage insect pests. Endosymbionts – organisms that live inside a host – can offer a more sustainable alternative to insecticides, but we need to understand the long-term sustainability of endosymbiont-based control in changing climates.

Working with a global network of collaborators including researchers and government agencies, I develop and test endosymbiont strains for pest control applications, including *Wolbachia* bacteria that block the transmission of dengue virus.

These two aphids are genetically identical, but the one on the right carries an endosymbiont that changes its colour from light green to dark green.

A female mosquito feeding on a blood of a human volunteer in the laboratory.

Dr Morgan Saletta

Dr Morgan Saletta

- Crowdsourcing/citizen science and analysis
- Science, technology and global challenges
- Information ecosystems/environments
- Strategic thinking in a Volatile, Uncertain, Complex and Ambiguous (VUCA) world
- History and philosophy of science

msaletta@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/169725-morgan-saletta

The Hunt Lab focuses on intelligence and security studies to address global challenges such as biosecurity, environmental change and unhealthy information environments.

Our interdisciplinary research and teaching spans strategic and futures thinking, structured analytic techniques, and critical thinking. Our work integrates science, social science, and the arts.

Our SWARM project developed a cloud-based platform and novel structured analytic techniques to enhance intelligence analysis through collaborative reasoning.

We also employ crowdsourced methods to monitor and analyse misinformation related to Australian state and national elections, contributing to research on healthy, democratic information environments.

Professor Devi Stuart-Fox

Professor Devi Stuart-Fox

- Animal colouration
- Biological optics
- Sensory ecology
- Macroecology

d.stuart-fox@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/155120-devi-stuart-fox

The vivid colours of the natural world are one of the most striking and beautiful aspects of life's diversity. Our team studies the biology of light and colour. How are these colours produced and perceived in different animal groups, and what is their biological function? We tackle questions at different scales of biological organisation – from optical properties at the nanometre scale to global patterns of colour diversity.

Biological optics and visual ecology

We study the mechanisms that produce vivid colours and diverse optical effects, such as iridescence, metallic appearance and highly reflective surfaces. The biological function of these complex optical effects depends on how they are perceived, so we also study visual perception using a combination of visual physiology, behavioural experiments and computational modelling.

Near-infrared properties and thermal control in animals

More than half of the energy in direct sunlight falls within near-infrared (NIR) wavelengths, beyond the limit of human and animal vision. Absorption of solar radiation in these wavelengths significantly affects heat gain, yet almost nothing is known of the diversity and mechanisms of near-infrared properties in animals, let alone their adaptive value. We are investigating the relationship between climate and reflectance of both visible and near-infrared light in a range of taxa, from reptiles and birds to butterflies and beetles.

Bio-informed technologies and design

Structural colourants are used in a vast array of manufactured goods, from banknotes to plastics and paint, but are produced unsustainably from non-biodegradable materials. Nature produces the most vivid structural colours of all using just a few abundant, biodegradable materials. Natural materials have simultaneously been fine-tuned for other essential properties such as wear resistance, water-repellence and thermal control. We are collaborating with scientists in several other discipline areas to design better, multi-functional and more sustainable coloured materials informed by biology.

Biological optics and visual ecology: an iridescent jewel beetle (Temognatha chevrolatii) feeding on mallee flowers in Western Australia. Image credit: Amanda Franklin.

Near-infrared properties and thermal control in animals: human-vision (left) and near-infrared (right) photos of butterflies. Image credit: Joshua Munro.

Bio-informed technologies and design: Hallmark Research Initiative in Bio-Inspiration.

Professor Michael Stumpf

Professor Michael Stumpf

- Theoretical systems biology
- Cell fate decision making

mstumpf@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/588859-michael-stumpf

I want to understand how living cells function. Mathematical models allow us to study their dynamics and explore their complexity and the origins of this complexity. Developing such models, however, is challenging and requires new mathematical and statistical tools. Combining mathematical and biological research is a rewarding intellectual challenge, but from the understanding of cellular processes we will also gain important knowledge with applications in health and sustainable life more generally.

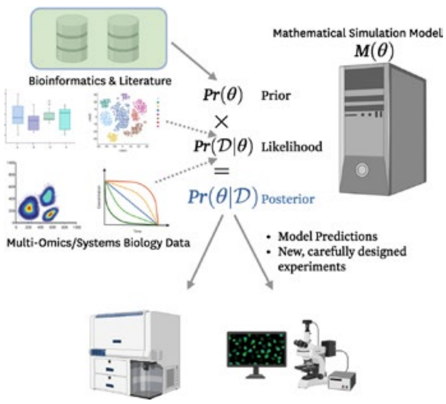
My research is focused on developing better predictive and mechanistic models of biological systems. My work is characterised by methodological breadth and development of state-of-the-art statistical and reverse engineering methods that allow biological and biomedical scientists to develop mechanistic models of biological systems. Mechanistic models capture our knowledge, and unlike statistical or machine learning models, which can strictly only interpolate available data, they also allow for extrapolation, thereby testing our knowledge.

Developing such mechanistic models described by systems of ordinary differential equations, stochastic differential equations, (stochastic) partial differential equations, Markov Jump processes or hybrids thereof is computationally and conceptually demanding. To meet these challenges my group and I have been developing:

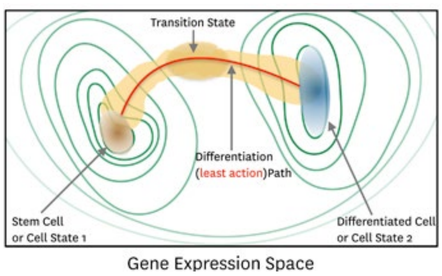
1. Stochastic simulation approaches and computationally efficient approximations.
2. Statistical and reverse-engineering approaches to learn the structure of models that describe cellular function from data and determine kinetic parameters of such models.
3. Model selection approaches that explore potentially large model spaces in order to identify sets of models support by available data and background information.
4. Multi-scale modelling methods which allow us to investigate processes ranging from molecular interactions inside cells to processes underlying tissue formation.
5. Statistical approaches for the analysis of in vivo live cell and tissue imaging data.

I have been applying these methods in a range of systems and synthetic biology applications, including:

1. Inference and analysis of biological networks, such as protein-protein interaction networks, gene regulation networks and metabolic networks and processes.
2. Model development and analysis of signal transduction processes and their effects on cell physiology in bacteria as well as in eukaryotic systems (especially mammalian cell lines, but also yeast).
3. Multi-scale modelling of immunological and developmental processes in the fruit fly Drosophila melanogaster and zebrafish Danio rerio as well as murine and human stem cell systems.
4. Design of novel pathways and cellular phenotypes in synthetic and engineering biology applications, especially in bacterial synthetic biology.



LEFT Developing mathematical models, for example from single-cell data, requires integration of different data sources and new computational techniques.



LEFT We are using mathematical modelling to understand from single cell data how cells make decisions and how we can control these decisions.

Dr Joshua Thia

Dr Joshua Thia

- Population genomics
- Agricultural pests
- Insecticide resistance
- Biological control
- Bacterial symbionts

joshua.thia@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/860739-joshua-thia

I am a molecular ecologist interested in the biodiversity and evolution of wild organisms and ecological communities. My research integrates genomics, experimental data, and predictive modelling to address fundamental questions in evolutionary biology, and applied challenges in conservation and pest management.

Evolution of insecticide resistance

I use genomic methods to study the genetic basis and spread of insecticide resistance in agricultural arthropod pests. These data are used to develop genetic markers for resistance monitoring and for informing management of resistance in field populations.

Natural enemies of agricultural pests

I am broadly interested in the insects and microbes that act as biological control agents in agroecosystems. This includes experimental work to understand their performance under different abiotic and biotic conditions, as well as using population genomic studies to understand their evolutionary ecology.

Population genomic methods

I have helped to develop best practice guidelines and new analytical approaches for population genomic data.

A canola field – the site for a field trial using released parasitic wasps to control aphid pests.
Photo credit: Joshua Thia.

Two species of parasitoids wasp that are biocontrol agents of fruit flies. Photo credit: Joshua Thia.

Associate Professor Paul Umina

Associate Professor Paul Umina

- Sustainable agriculture
- Entomology
- Ecotoxicology
- Invertebrate pest control

pumina@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/141077-paul-umina

The overuse of chemicals in agriculture leads to ecosystem degradation, threatens the resilience of our food systems and contributes to the evolution of insecticide resistance in many invertebrate pests. We are developing sustainable agricultural pest management practices for healthier ecosystems and improved food security.

Healthier farms and ecosystems

Our research improves the health and resilience of farming systems while protecting the natural environment. We work closely with farmers and industry partners to develop practical, on-farm solutions.

A core focus of our work is helping farmers manage invertebrate pests, protect beneficial insects, and make decisions that support long-term sustainability.

New approaches to pest control

Insect pests cause major crop losses across Australian agriculture. We are exploring new pest management strategies, including the use of naturally occurring microbes to limit the spread of plant viruses, alter how insects interact with host plants, and give beneficial insects a better chance to thrive in farming systems.

Tackling insecticide resistance

Insecticide resistance is a growing threat to effective pest control. Our work aims to help farmers manage this risk early by identifying high-risk pests and chemicals, tracking resistance genes, and developing early-warning tools. We also collaborate with industry to create local resistance management plans that support smarter chemical use and prolong the effectiveness of insecticides.

Protecting beneficial insects

While insecticides control pests, they can also harm beneficial insects such as predators, parasitoids and pollinators. We are identifying softer chemical options and promoting practices that reduce reliance on insecticides, helping to safeguard the insects that underpin healthy crops.

Dr Allison van de Meene

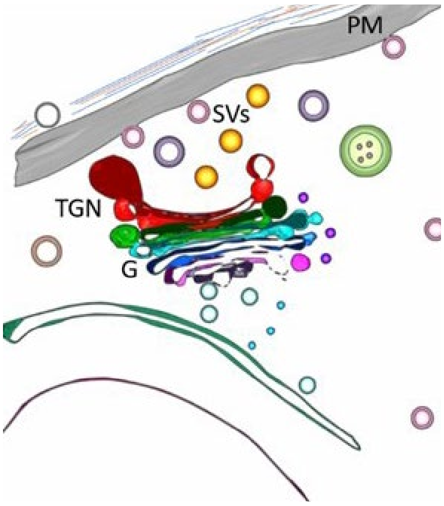
Dr Allison van de Meene

- Plant cell biology
- Algae
- Cell wall
- Microscopy
- Imaging

allison.van@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/906-allison-van-de-meene

Plants and algae provide the food, clean air and environmental quality on which we depend. Our overarching goal is to improve crop quality and better understand adaptations to environmental change through research that investigates the cell biology processes by which plants and algae form and modify their cell walls, traffic cargo throughout the cell and subsequently adapt to the environment.



Cell biology of plants and algae

My research seeks to identify the processes by which the cell walls of plants and algae are developed, maintained and changed throughout the life cycle and during interactions with the environment. My lab uses state-of-the-art microscopy techniques, including live cell imaging and electron microscopy, to localise sub-cellular components and relevant molecules and structures to understand structure-function relationships. This work is complemented by molecular-genetic, biochemical and biophysical techniques.

Advanced microscopy and imaging

Advanced microscopy techniques and imaging are remarkable tools to understand processes and functions at the cellular level. Utilising imaging techniques ranging from optical to electron microscopy and associated analytical technologies, this research develops insights into the microscale adaptations that occur during the life cycle of organisms and also during adaptations to the environment. My research also contributes to the development of cutting-edge techniques for investigating biological processes at the micro to nanoscale.

Associate Professor Angela van de Wouw

Associate Professor Angela van de Wouw

- Plant pathology
- Canola production
- Blackleg disease
- Genetic resistance

apvdw2@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/6544-angela-van-de-wouw

Our research focus is to develop sustainable strategies for growers to minimise the impact of crop diseases. Few agricultural diseases can be eradicated, and many are constantly evolving; our research is aimed at staying ahead of blackleg disease to give growers the best yields possible.

Minimising the impact of fungal diseases in agricultural crops

My research focuses on blackleg disease, the most devastating disease of canola worldwide. With industry partners, I use a 'genome to paddock' approach to development management strategies for growers to help minimise the impact of this disease. Specifically, this research has led to the development of:

- Molecular and glasshouse tools to characterise the resistance genes in all Australian canola cultivars
- A novel disease management strategy for canola growers — viz. rotation of cultivars with different sources of resistance over time
- Assays that monitor levels of disease in canola paddocks with the findings communicated to farmers who then implement appropriate disease control strategies
- The biannual Blackleg Management Guide (in collaboration with industry leaders) which farmers use to select cultivars to sow each year, and
- Assays to show that blackleg fungal isolates are becoming resistant to fungicides with increased fungicide usage.

Angela with the Marcroft Grains Pathology team, based in Horsham. We screen all Australian cultivars with a set of well-characterised blackleg isolates to determine which resistance genes are present in each cultivar. This information is then provided to growers so that they can select appropriate resistant varieties for their region. Image credit: Thea jane Photography.

Example of the new upper canopy infection symptoms caused by blackleg. Infection of the flowers results in direct yield loss as no pods, and therefore seed, are produced from these infected flowers.

Professor Madeleine van Oppen

Professor Madeleine van Oppen

- Coral-microbe symbioses
- Coral reef restoration
- Assisted evolution
- Ecological genomics
- Climate change impacts

madeleine.van@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/726007-madeleine-van-oppen

To enhance coral thermal bleaching tolerance via bioengineering approaches and assist corals in surviving this century while climate warming is brought under control (ie to 'buy time' for coral reefs).

Assisted evolution to enhance coral climate resilience

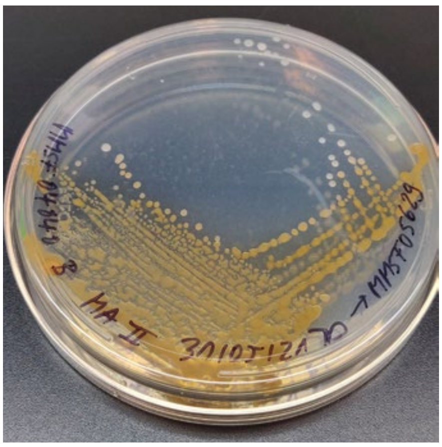
Climate change causes an increase in the frequency, intensity and duration of summer heatwaves, which are the main drivers of the rapid decline of coral reefs worldwide. Sustained periods of elevated temperatures cause the loss of microalgal endosymbionts from coral host tissues (coral bleaching), resulting in coral starvation and ultimately death. Climate models predict most reefs in the world will experience summer heatwaves and associated mass coral bleaching every summer before the end of this century. Many researchers and reef managers therefore argue that in addition to strong action to reduce the emission of greenhouse gases, active reef restoration is required to ensure coral reef persistence into the future. My team is using bioengineering methods to enhance thermal bleaching tolerance of corals aimed at producing tolerant coral stock for reef restoration. We use a range of approaches, including the experimental evolution of microalgal endosymbionts outside the host followed by reintroduction of heat-evolved strains into hosts, the development of bacterial probiotics, coral hybridisation and preconditioning.

Deciphering the roles of coral-associated microbes

Corals associate with a wide diversity of microbes, including photosynthetic dinoflagellates, fungi, bacteria, archaea and viruses, many of which are critical for coral health and survival. While we have a reasonable understanding of the identity of some of these microbial organisms, their functions within the coral holobiont are poorly understood. My team applies a diversity of methods ranging from metabarcoding, proteomics, metagenomics, metatrascriptomics and metabalomics to advanced visualisation, phenotyping and experimental manipulation to decipher the roles of coral-associated microbes.

Reefscape. Image credit: Ray Berkelmans © AIMS.

Algal cultures. Image credit: Marie Roman © AIMS



Bacteria on a plate. Image credit: Talisa Doering.

Professor Michelle Watt

Professor Michelle Watt

- Plant roots
- Plant physiology
- Water productivity
- Root microbiomes

watt.m@unimelb.edu.au

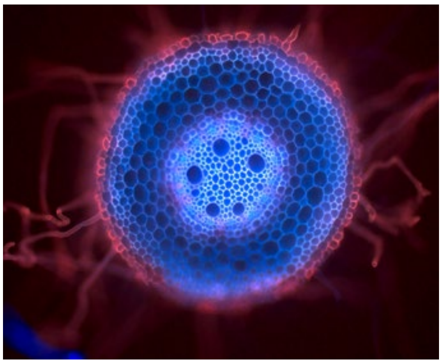
findanexpert.unimelb.edu.au/profile/862696-michelle-watt

Our mission is to discover and engineer how the root systems of plants grow and function to sustain healthy life on Earth and in future in space — because plant roots are the foundation of plants, and plants are the foundation of humanity.

My group discovers how the root systems of plants, including their microbiomes, grow and function in natural and agricultural environments. We want to improve root water use and carbon functions for food and environmental societal challenges. Roots are the 'hidden half' of plant science because they are below ground and out of sight of the human eye.

My group works with national and international collaborators and the University of Melbourne Imaging Centre to use advanced imaging technologies for our discoveries of roots. These include real-time live imaging, miniature ecosystems that fit under a microscope and 4D visualisation of roots in soil using computed tomography. We study root systems of diverse plants, from plants native to the Australian deserts to advanced breeding lines to plants for space habitation. The outputs of our research are new knowledge that we publish and root system designs for new plant types and growing environments that save water, land and energy.

Root system of a barley plant, grown by Dr. Vera Hecht at the Forschungszentrum Juelich. Image credit: Michelle Watt.



Cells inside a plant root. The different colours and sizes are related to the functions of the root like absorbing nutrients, transporting water to the shoot and returning carbon to the soil. Image credit: Dr. Pan Dong.

Professor Nina Wedell

Professor Nina Wedell

- Evolutionary Biology
- Sexual Selection
- Selfish Genetic Elements
- Insects

nina.wedell@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/82765-nina-wedell

My research is focused on illuminating the impact of genomic parasites in generating conflict within the genome, particularly the role of selfish genetic elements (SGEs) in shaping reproductive biology and shaping the evolutionary process in general.

SGEs and sexual selection

SGEs such as transposable elements, segregation distorters and maternally inherited symbionts are found in all organisms and can cause reproductive incompatibilities, feminisation, and male deaths that distort the sex ratio. Females may mate multiple times to promote sperm competition and avoid fertilisation by SGE-carrying sperm. I examine the impact of SGEs on male fertility in flies and sex-ratio-distorting endosymbionts in butterflies.

Sexually antagonistic (SA) alleles

SA alleles are genes expressed in both sexes that are advantageous to one sex but detrimental to the other. SA alleles can accumulate even when the advantage to one sex is less than the cost to the other. I study SA alleles in butterflies, moths and flies. In fruit flies (Drosophila melanogaster), transposable elements (TE) are inserted into the detoxification gene (Cyp6g1) conferring insecticide resistance and increased female fecundity, but can decrease male mating success and alter male aggression. TE insertions and Cyp6g1 duplications are associated with sex differences in resistance. I investigate the impact of multiple TE insertions on resistance evolution and their potential SA effects.

Multiply mating Drosophila pseudoobscura females promote sperm competition that undermine the transmission advantage of a sex-ratio distorting gene.

Some Australian populations of Eurema hecabe butterflies harbour feminising bacteria that affect the expression of male sexually selected signals.

Dr Kristoffer Wild

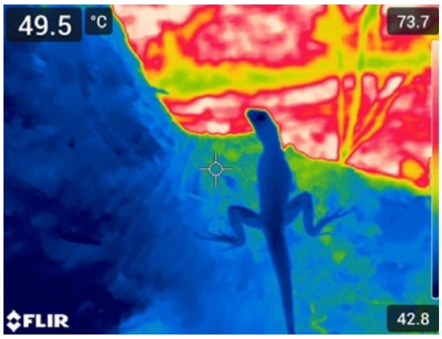
Dr Kristoffer Wild

- Physiological ecology
- Mechanistic niche modelling
- Movement ecology
- Life-history modelling
- Reptile ecology and evolution

kristofferw@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1030758-kristoffer-wild

I combine physiology, field ecology and modern mechanistic models to predict which animals are most vulnerable to climate extremes, so conservation can distinguish natural variability from disturbance-driven decline.



Energy in a changing world

Climate change is reshaping the environments animals must move through, forage in and ultimately survive. I study how climate, behaviour and physiology interact to shape energetics in ectotherms, with a focus on Australian arid-zone reptiles. I combine long-term field observations, physiological experiments and mechanistic models to understand how animals balance energy, heat and activity under variable environmental conditions. A key part of this work involves revitalising historical field datasets for new purposes, linking past ecological observations with modern approaches to better understand how animals have responded to environmental change over time.

I'm interested in linking individual traits, such as body temperature, home range, metabolism, and behaviour, to broader questions about the drivers of population change. By bringing together field ecology, physiology and mechanistic modelling, my research helps identify if animals can buffer environmental change through behaviour, and when heat, drought or disturbance may push populations beyond their capacity to cope.

Linking individual traits to population processes in a changing world

My Australian Research Council (ARC) Discovery Early Career Researcher Award (DECRA) project will extend my research interests by asking how individual traits scale up to shape boom-bust population dynamics in Australian terrestrial ectotherms. By integrating long-term field datasets from the arid zone, physiological experiments, genomic tools and mechanistic models, I aim to distinguish natural population fluctuations from disturbance-driven decline.

This information will be used to identify which traits helped animals survive in the past and to improve forecasts that can guide conservation under climate extremes.

UniMelb on-demand

Get to know us better
in your own time

SciMelb