Our lab (SKB Lab- where science is fun!) is interested in understanding the molecular basis of phenotypic variation in plants. We use a combination of genetic, molecular, biochemical and computational analysis to study the basis of phenotypic variation. The lab uses next generation genetics to address fundamental questions linking development and evolution. The areas under which the students will have an opportunity to carry out their honours are listed below. To do project in my lab you need to have a strong understanding of molecular genetics. Knowledge of biochemistry and molecular biology would also be helpful. There is no requirement for you to have done any courses in plant biology and need not have done the research methods course.

**SKB-1: Temperature responses in plants**

Feb. or July 2016 start

SKB lab is interested in understanding the mechanisms through which plants sense and respond to changes in ambient temperature. The lab uses natural variants and mutants to identify and characterise genes controlling thermal perception and response in plants. The specific project will be negotiated through discussions with the student.

Key References:

**SKB-2: Genetics of trinucleotide repeat expansions (plants and/or human cell lines)**

Feb. or July 2016 start

Genetics of trinucleotide repeat expansions SKB lab recently identified a trinucleotide repeat expansion associated genetic defect in a natural strain of *Arabidopsis thaliana* (Bur-0). This is the first example of a triplet expansion associated genetic defect described outside humans. The lab currently exploits this system to study fundamental mechanisms underlying repeat expansions and their phenotypic consequences. Projects are available to carry out mechanistic characterisation of these phenotypic responses. The specific project will be negotiated through discussions with the students.
Key references:


**SKB-3: Computational genetics of alternative splicing**

Co-supervised with Dr Sridevi Sureshkumar (collaboration with Monash Bioinformatics Platform)

Feb. or July 2016 start

We have been developing tools and technologies to assess the impacts of environmental responses on alternative splicing. The project would be at the interface of computational analysis and lab experiments. Students who have an interest in exploiting computational tools to address biological problems and those who have an interest in demonstrating experimentally computationally generated models are encouraged to apply. You will be working with RNA-Seq data sets from Arabidopsis and/or other species to generate and test computational predictions and derive fundamental biological insights.

Key references:


**John Beardall**

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**JB-1: Influence of climate change on growth and physiology of marine and freshwater phytoplankton**

Feb. or July 2016 start

The global environment is currently experiencing a period of significant change in climate as a result of human activities. Although the planet has experienced very significant variations in CO₂ levels and temperature in the geological past, the rate at which the present changes are occurring is extraordinary. Anthropogenic influences have resulted in an enhancement in atmospheric carbon dioxide levels that will amount to between a 2- to 3-fold increase over the next century and this has already led to a measurable rise in global temperature and drop in oceanic pH

This project would involve studies on the impacts of elevated CO₂ and/or temperature and UVB on various aspects of growth, photosynthesis and nutrient acquisition of marine and freshwater microalgae.
Relevant references


**JB-2: Project by negotiation**

Feb. or July 2016 start

The Beardall lab has interests in a range of aspects of algal eco-physiology. These include not only the climate change related topics mentioned above in JB-1, but also studies of the biology of extremophilic algae, the responses of algae to pollutants, uses of algae in bioremediation and aspects of algal bloom physiology. We also have interests in Algal Biotechnology and there may be opportunities for projects in collaboration with industry including, for women, 4 month paid internships (see [http://www-veski.org.au/inspiring-women/internships](http://www-veski.org.au/inspiring-women/internships)). Honours projects can be tailored to a student’s interests so come and discuss possibilities!

**Relevant references:**


**JO-1: Investigation of morphological evolution in land plants**

Feb 2016 start

The origin of land plants was one of the most important events in the earth’s evolutionary history, allowing metazoans to colonize land. Key features associated with the evolution of the land plant body plan were the origin of a multicellular diploid sporophyte with three dimensional tissue patterning, leading to the plants that are familiar to us today. Projects use genetics, molecular biology and genomics experiments to investigate gene function using two model land plants to understand the molecular basis of morphological evolution.
in land plants. For example, gain- and loss-of function mutations can provide insight to gene function and can be generated by a number of molecular approaches, and the action of genes can be monitored by examining expression patterns of specific genes either by in situ hybridization or by utilizing the jellyfish Green Fluorescent Protein. Two primary questions we are focusing on include (1) how did the alternation of generations in land plants evolve? and (2) how is the body plan of land plants established via the interaction between genes and the environment? Results will provide insight into how major changes in body plan evolved in the land plants.

Rowan Brookes  
Education Honours Project (School of Biological Sciences)

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RO-1: Exploring science students’ perceptions of the value of group work

This project is in collaboration and co-supervision with Dr Susie Ho (susie.ho@monash.edu)

Feb. or July 2016 start

The capacity to work effectively in teams is highly valued by employers in most sectors (Carnevale 1990; Casner-Lotto & Barrington 2006). In particular, group work promotes development of emotional intelligence and communication skills (Bennett, Dunne & Carré 1999). These competencies are graduate attributes that are in demand in a rapidly changing world in a range of disciplines. In science, advancement and innovation are built on the core skills developed through collaborative inquiry, such as the ability to observe, listen and respond to new ideas developed by others. Thus, the development of group work skills during the undergraduate years is critically important for entry into most careers and essential for a career in science.

We are seeking an undergraduate with a demonstrated interest in education to, under supervision, design and undertake research for publication in an international education journal. We envision this project will untangle the components, skills and competencies that science students value in themselves and other team members during group work.

Rob Bryson-Richardson

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http://myopathyresearch.org

RBR-1: Investigating disease mechanisms for myopathy

Feb. or July 2016 start

Myopathies, or muscle diseases, are a diverse range of conditions ranging in severity from mild muscle weakness to lethality. Despite the genetic basis of many of these disorders being known, how mutation of these genes results in disease is still not
understood. You will utilise zebrafish models of human muscle disease in order to investigate the function of the gene involved and how they are disrupted in disease.

**RBR-2: Blood flow in cardiac development and congenital heart disease**

Feb or July 2016 start

The flow of blood through the embryonic heart is an important signal that influences the development of the heart itself. The lining of the heart senses flow over its surface and can stimulate gene expression in response. We have identified flow responsive genes in the heart and this project will examine their function in cardiac development, the phenotype resulting from their loss, and their potential involvement in congenital heart disease.

Both projects will involve a range of key experimental techniques including, microinjection, immunolabelling, in situ hybridisation, confocal and widefield microscopy, and molecular biology. The projects are areas of active research and therefore the exact details of the projects will be decided closer to the commencement of the honours year, projects may be tailored to your own interests through discussion with Dr Bryson-Richardson.

**Martin Burd**

Room: 233a, 18 Innovation Walk  
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**MB-1: Long-term assessment of pollen limitation in polycarpic perennial plants**

July 2016 start

For many years, conventional thinking among biologists held that female reproductive success of organisms is not limited by access to mates: there will almost always be more than enough males available so that no eggs go unfertilized. This idea, known as Bateman’s Principle, was thought to apply to plants as well as animals. In the context of flowering plant reproduction, Bateman’s Principle would say that seed and fruit production will not be limited by a plant’s acquisition of pollen: pollen and pollinators will almost always be sufficiently abundant to allow plants to produce as many seeds as they can afford given their store of resources.

Two decades ago, I collated data from hundreds of published experiments to show that this expectation was incorrect (*Botanical Review* 60:83–139, 1994). Pollen limitation of female reproductive success turns out to be common in angiosperms, showing up in about two-thirds of the species surveyed. Subsequent analyses by several groups over the last two decades have confirmed this result: pollen-limitation of fruit and seed production is very common in flowering plants.

There is, however, a shortcoming in the evidence on which all these studies have been based. Field experiments testing pollen limitation have been not been conducted over the lifetime of long-lived, polycarpic plants. Plants may appear to be pollen limited in one breeding season, but any increased seed output under experimental pollen addition in one year could be balanced by reduced survival or fecundity in the long run, so that lifetime female fitness is not pollen limited. At best, field tests of pollen limitation have run for two or three years in succession. No one has ever conducted such tests over longer time spans in long-lived polycarpic plants. At a meeting of botanical researchers at the Munich Botanical Garden in June 2015, we identified the lack of long-term data on pollen limitation as a serious shortcoming in our understanding of plant reproductive evolution.
This honours project will be the start of such an experiment. The project will involve frequent, regular visits to several plant populations to artificially pollinate selected individuals. Their reproductive success will then be compared to that of unmanipulated control plants. This procedure will be maintained for 10–15 years by future honours students. The result, while a long way off, will be the kind of evidence one rarely sees in biology. In the short run, we need to identify species that appear to be significantly pollen limited in the short-run, and to determine whether the degree of pollen limitation varies among individual plants (for example, are larger plants less pollen-limited than smaller ones?) or over the course of a flowering season (for example, are early flowers more pollen limited than later ones?) Students considering this project should enjoy working outdoors, have a driving license, and have the motivation to do repetitive experimental tasks for many weeks in order to reap the rewarding data at the end.

Richard Burke

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RB-1: Modelling human pathogenic mutations in Chloride channel genes

Feb. or July 2016 start

Mutations in the Chloride channel gene CLCN-5 cause Dents disease, a condition that affects the proximal renal tubules of the kidney and is characterized by excess calcium in the urine, formation of kidney stones and chronic kidney failure. CLCN5 and another two highly related mammalian genes, CLCN3 and 4 are represented by a single gene, Clc-c, in the Drosophila genome. Interestingly, while knockout of any of the three CLCN genes in mouse gives viable animals with relatively mild symptoms, our knockout of the fly Clc-c gene results in early lethality and mosaic analysis shows Clc-c cells have proliferation and survival defects compared to wild type cells.

In this project, transgenic fly strains containing wild type and mutated versions of human CLCN-5 will be generated and used to test whether the human gene can functionally replace the fly gene. Pathogenic mutations affecting different physiological functions (as determined by cell culture electrophysiology studies) of the encoded chloride channel will be tested to determine which of these functions is required for cell survival and proliferation in vivo. The fly model can then be used to screen for drugs able to restore function to defective CLCN-5 proteins.

RB-2: Screening for drugs able to restore function to defective copper transport proteins

Feb. or July 2016 start

Missense mutations in the copper transport proteins ATP7A and B result in Menkes and Wilson diseases. Drosophila has a single homolog of these two proteins, ATP7. Knockout of ATP7 in the fly causes early developmental lethality which can be rescued to adult viability with a GFP-labelled genomic copy of the gene. Human pathogenic mutations have been introduced into this genomic rescue construct and the mutated versions exhibit reduced or no rescue ability compared to wild type. This system will now be used to test whether the function of the mutated ATP7 proteins can be restored by feeding various compounds / drugs to flies containing only the mutated form of the copper transporter. At the
same time, confocal microscopy will be used to monitor the in vivo localization and stability of the ATP7-GFP proteins.

**RB-3: In vivo zinc transport protein visualization and manipulation**

Feb. or July 2016 start

The MiMIC system in Drosophila allows endogenous genes with a MiMIC transposable element in a coding intron to be converted into various formats by recombination mediated cassette exchange (RMCE). For example, a MiMIC-containing gene can be converted into a “protein-trap” form: an artificial exon containing in-frame GFP coding sequence is incorporated into the gene’s mRNA, producing a GFP-fusion protein that allows the in vivo gene transcription pattern and protein localization to be monitored by fluorescence microscopy. Such protein traps usually remain fully functional. This system has the additional advantage that the endogenous gene can then be “knocked out” using a RNA-interference mediated gene knockdown of the GFP transcript incorporated into the gene’s mRNA. This allows robust knockdown of the gene with both temporal and spatial control, enabling us to determine the in vivo function of the affected gene.

We have several Drosophila strains containing MiMIC cassettes within coding introns zinc efflux genes. These will be used, via the above techniques, for a detailed functional characterization of each of these genes.

**RB-4: Mitochondrial DNA typing, a useful tool for the identification of skeletal remains**

Feb. 2016 start

This project is based at the Victorian Institute of Forensic Medicine (VIFM) and be co-supervised by Dadna Hartman

Unlike nDNA, mtDNA is located within mitochondrion, with as many as 1000 mitochondrion per cell each harbouring several copies of mtDNA. Importantly, mtDNA is inherited from the mother; as a result, all those in the maternal line all have the same mtDNA. In addition, mtDNA is considerably smaller in size compared to nDNA, having said that, although nDNA has many more bases than mtDNA, mtDNA is present in far greater copies than nDNA. For this reason, mtDNA is useful in situations where the amount of DNA sample is very limited, such as when dealing with skeletal remains or crime specimens (such as hair, saliva or blood). VIFM undertakes mtDNA analysis for the identification of deceased persons.

As the utility of mtDNA analysis gains momentum, improvements are sought to expedite the process of analysis, interpretation of data, and ultimately shorter reporting times. The MBL is seeking to improve its mtDNA analysis pipeline by refining the amplification parameters and reagents.

Importantly, as the DNA findings can form part of an evidence brief to courts in Australia, it is important that the statistical measure provided for the DNA evidence is sound. Currently, our statistical measures are provided based on the EMPOP mtDNA database, which lacks any mtDNA haplotype information for Australia. The MBL would like to build a dataset for Australia, beginning with a pilot project of approximately 50 samples. The MBL has collected samples from volunteers for the purpose of building such data sets, this project would have to profile approximately 50 samples and determine the mtDNA profiles (haplotypes) for these samples. It is envisaged that this dataset will be the beginning of an Australian data collection.

The skills you will acquire during the project will include DNA extraction techniques; mtDNA amplification; DNA sequencing, DNA sequence analysis; mtDNA haplotyping (bioinformatics); and mtDNA phylogenetic studies (bioinformatics).
David Chapple

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DC-1: Behavioural and evolutionary ecology of lizards I
Feb. or July 2016 start

I am interested in talking to students about developing an honours project on lizards that is related to my current research on the evolutionary ecology of environmental change. The project may incorporate fieldwork and lab-based experiments on Lampropholis or Egernia Group lizards, or comparative analyses and macroecological studies on squamate reptiles. The specific details of the project will be developed during discussions with the student.

DC-2: Behavioural and evolutionary ecology of lizards II
Feb. or July 2016 start

I am interested in talking to students about developing an honours project on lizards that is related to my current research on the evolutionary ecology of environmental change. The project may incorporate fieldwork and lab-based experiments on Lampropholis or Egernia Group lizards, or comparative analyses and macroecological studies on squamate reptiles. The specific details of the project will be developed during discussions with the student.

Steven Chown

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Projects to Be Announced

Rohan Clarke

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RC-1: Project by Negotiation
Feb. or July 2016 start

The Clarke lab is interested in various aspects of avian movement ecology. Current research in our group includes projects on avian malaria dynamics in a diverse bird community, the conservation management of threatened species, and interactions between offshore development, seabirds and other marine vertebrates. Any honours project would be tailored to best meet the student’s interests and our research objectives.
**Tim Connallon**

Room: 107, 12 Innovation Walk  
Email: Tim.Connallon@monash.edu

Research in the lab uses quantitative genetic and population genetic models to build better bridges between theory and data, and to generate new empirical predictions that may be tested using targeted lab experiments and/or analyses of public datasets. Topics of interest in the lab include: The evolution of sexual dimorphism, the maintenance of genetic variation for fitness and disease, the genetic basis of adaptation, the evolution of genome structure, sex chromosome evolution, and the interaction between dispersal and geographically local adaptation. Potential honours projects may strike a balance between theoretical work, data analysis, and lab experiments using Drosophila. Project specifics will be negotiated with the individual student, and tailored to fit their research interests, strengths, and learning goals.

**TC-1: Sexual dimorphism and adaptation to environmental change**

Co-supervised with Dr Carla Sgrò  
Feb 2016 or July 2016 start

**TC-2: Assorted topics in population and quantitative genetics**

Feb 2016 or July 2016 start  
Contact Tim for further details.

**Carly Cook**

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**CS-2: Putting evolution in conservation management**

Co-supervised by Carla Sgrò  
Feb 2016 or July 2016 start  
The project will be developed in consultation with the student. Please see our respective webpages for a summary of our research interests.

**Damian Dowling**

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Webpage: www.damiandowlinglab.com

**DD-1: Project by negotiation I**

Feb 2016 start  
Research in Damian Dowling’s group focuses on the study of evolutionary conflicts and their consequences. We are particularly interested in two forms of conflict – inter-genomic and sexual.
Inter-genomic conflict

Our mitochondria produce most of our energy requirements and are thus vital to eukaryote life. Curiously, however, their functionality hinges on interactions between genes that reside over two obligate genomes, one of which is only inherited through mothers (the mitochondrial), and the other which is inherited through both parents (the nuclear). These sexually asymmetric patterns of inheritance set that stage for intergenomic and sexually antagonistic conflicts to ensue over metabolic demands, with the maternally inherited mitochondrial genome evolving to work optimally in females, but suboptimally in males.

OR

Sexual conflict

Traditionally, the act of sexual reproduction was viewed as a harmonious interaction, in which females and males benefitted equally. However, it is now widely acknowledged that when it comes to reproduction, the evolutionary best-interests of each of the sexes do not always coincide. For example, consider the optimal mating rate of each of the sexes - there lies one clear source of conflict. We explore the effect of sexual conflict on components of life-history – reproduction and ageing. We are also interested in uncovering the proximate basis of such conflicts – and we have been exploring the roles of oxidative stress in mediating levels of sexually antagonistic adaptation.

Alistair Evans

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AE-1: Animal Evo-devo

A potential project is described below, but other suggestions for topics under this general heading will also be considered.

How do you build an animal? Developmental and macroevolutionary controls of body and appendage proportions

Co-supervised by Richard Burke

Feb 2016 or July 2016 start

How are the shapes and proportions of body parts of an animal controlled during development? Are there constraints on how they can evolve over time? Recent work has shown that proportions of elements such as teeth, fingers, limbs and vertebrae in mammals and birds are controlled by a simple developmental rule. The mechanisms controlling the development of these elements limit the evolutionary potential in vertebrates, and shape the diversity of life that we see around us. In this project we will examine this rule for body parts and organ systems of invertebrate animals. We will look at body elements such as antennae, limbs and body segments in a very wide range of invertebrates, including insects, spiders and crustaceans, to see if they also follow the simple rule. We will also look at insect development, including fruit fly Drosophila, to see how these proportions change during the development of the embryo and larva.
This potentially ground-breaking project will result in excellent peer-reviewed papers with the student as co-author. The project is suitable for students with a zoological or developmental genetics background. Depending on the skills and interests of the student, various components of the project can be enlarged or reduced.

**AE-2: Palaeontology**

A potential project is described below, but other suggestions for topics under this general heading will also be considered.

**The Dolphins that Tried to be Sharks: Using Teeth to Uncover the Life and Times of the Extinct Squalodontidae**

Co-supervised by Erich Fitzgerald (Museum Victoria)

Feb 2016 or July 2016 start

One of the strangest groups of cetaceans in history were the bizarre squalodontids (shark-toothed dolphins), so-called because of their characteristically serrated triangular teeth, which are completely unlike the teeth of any living whale or dolphin. The squalodontids were the dominant group of dolphins for 20 million years, before going extinct about 10 million years ago. What went so well, but then so wrong, for the squalodontids? Clues to their rise and fall may lie in their strange teeth. What were they doing with teeth that look more suited to a shark? What might they have been feeding on? And how do their teeth compare to other marine mammals that might have replaced them? Using fossil and modern tooth collections at Museum Victoria, the student will combine 3D imaging and shape analysis to determine exactly how the shape of squalodontid teeth influenced their function, and reflects the diet and role of squalodontids in ancient oceans.

**Ros Gleadow**

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Email: ros.gleadow@monash.edu

**RG-1: Toxic crops: physiological and molecular analysis of cyanide deployment in sorghum**

Co-supervised by Dr Cecilia Blomstedt

Feb 2016 start

Sorghum is the 5th most important grain crop in the world but it makes cyanide, sometimes at concentrations high enough to kill grazing animals. We have created mutants sorghum with altered cyanogenic status. The “adult cyanide deficient class” (*acdc*) initially contain normal levels of cyanide but as they mature its production is switched off. The molecular nature of the mutation is unknown but it appears to be linked to developmental traits. In this project students will grow mutant sorghum under different conditions and test them at different developmental stages. This will be compared to gene expression using qPCR of the biosynthetic genes, leaf anatomy and composition using Raman Biospectroscopy. [An alternative project will compare the cyanide production in Australian native sorghum with domesticated and mutant sorghum.]
**RG-2: The role of gender in plant invasions**

Co-supervised by Assoc. Prof. Martin Burd

July 2016 start

There is some evidence that gender of invasive plants varies with their position relative to the invasion front. The project will examine the ecology of plant invasion using the dioecious *Pittosporum undulatum* as a model species. *Pittosporum* is an Australian tree, native to coastal South Eastern Australia that has become highly invasive in other parts of Australia and in other parts of the world. The project will investigate the way in which invasive populations change relative to native populations, with a more specific focus on floral characteristics and sex ratios.

**Matt Hall**

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Website: www.mattdhall.com

**MH-1: Evolutionary ecology of pathogen resistance, ageing and life history investment (up to 2 projects available)**

Feb 2016 or July 2016 start

The Hall Lab has openings for students interested in the evolutionary ecology of infectious disease, ageing or life history investment. Using the freshwater crustacean, *Daphnia magna*, research in the Hall group investigates why hosts vary in the strategies they use to limit pathogen damage, and what physiological processes limit the ability of animal to excel at fighting infection, reproducing, or living a long time. Please see my webpage for a summary of my research interests. All projects will be developed in consultation with the student.

**Kathryn Hodgins**

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Projects to Be Announced

**Melodie McGeoch**

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**MM-1: Biological invasion and protected areas**

Feb 2016 or July 2016 start

Protected areas (parks) are not immune to being invaded by alien plants and animals, but the ecological risks can be high when this happens. Alien and invasive species enter parks...
via a wide range of pathways and many hypotheses have been proposed to explain what makes a park either susceptible or resistant to invasion. For example, local human population density, the number and length of roads and rivers as well as native diversity are just some of the factors thought to be involved. Preventing and controlling invasions is expensive, time consuming and often unsuccessful. If science were able to identify general, reliable predictors of park invasion, more effective and efficient management strategies could be designed. This research includes the opportunity to work in Australian parks, and will provide Honours level researchers with knowledge and skills in the fields of invasion biology, macroecology and statistical modelling. This project is supported by the Parks Victoria – Monash UniversityResearch Partnership Programme.

**MM-2: Prioritizing invasive species, invasion pathways and invasion sites**

Feb 2016 or July 2016 start

Two challenging areas in invasion management are predicting which weed species will arrive and have a significant impact and how best to allocate limited resources to manage the problem, including those species already having an impact. Channelling resources to where they are most needed and likely to be most cost-effective is therefore an integral and essential part of invasion management. The effective allocation of limited resources requires a process where problems and opportunities are ranked in order of realised or potential importance. There are three essential parts to prioritization for invasion management: species, pathways and areas (or sites). This project will develop a decision support framework and set of invasion management priorities for planning and channelling resource allocation within individual parks, and across sets of parks and reserves in particular bioregions of Victoria. At the same time it will test hypotheses about priority species x pathway x site interactions, by integrating multiple sources of information at a park scale. This project is supported by the Parks Victoria – Monash University Research Partnership Programme.

**Beth McGraw**

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Webpage: [www.vectorbiologygroup.com](http://www.vectorbiologygroup.com)

**BM-1: Understanding the genetic basis of dengue virus transmission in mosquitoes**

Feb or July 2016 start

I am an evolutionary biologist interested in how hosts and parasites interact. My lab group studies how mosquitoes transmit dengue virus and specifically how the mosquito genome controls virus transmission. To do this we infect mosquitoes with virus and study how virus moves through the body and is ultimately transmitted in the saliva. In association with studying that process we are currently examining mosquito lipid profiles, innate immune function and the role of symbiotic bacteria. An honours project would relate to one of these topic areas. Honours students in my group work in close association with a more senior researcher. I am happy to discuss potential projects in person.
Dustin Marshall
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Projects to Be Announced

Christen Mirth
Room: TBA
Email: christen.mirth@monash.edu
Webpage: TBA

Work in my lab explores the regulation and evolution of environmentally-dependent traits in species from the genus *Drosophila*. Recently, our efforts have focused on two traits that depend on nutritional cues: 1) body and organ size and, 2) larval foraging behaviour. We use the genetic tools available in *Drosophila melanogaster* to dissect how environmental signals, like nutrition, regulate larval growth and foraging choices. By analyzing the changes in these mechanisms across species, we hope to identify how these environmentally-dependent traits evolve to create species-specific differences in foraging behaviour and adult body size.

CM-1: How environmental conditions modify developmental trajectories to result in phenotypic plasticity.
Feb 2016 or July 2016 start

This project will explore how a range of environmental cues, including temperature and nutrition, modify the growth and patterning of larval tissues. The research objectives will be further developed with the student, according to his/her specific interests.

CM-2: Exploring the regulation and evolution of foraging behaviour.
Feb 2016 or July 2016 start

We will use either larval feeding behaviour or adult oviposition choice of species of *Drosophila* fruit flies to understand how animals make decisions relating to the macronutrient composition of the substrate. The project will further developed with the student, depending on his/her research interests.

Joslin Moore
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Webpage: http://joslinmooreresearch.wordpress.com/

JM-1: Plant ecology, modelling and management I
Feb. or July 2016 start
I develop projects in consultation with the student. My research group focuses on using experiments, ecological models and decision analysis to better understand and manage plant communities and populations. My group works predominantly on grassland restoration on the western edge of Melbourne and on peatland management and invasive plant species in the Victorian Alps. Check out my group’s website for more information.

A mid-year start enables projects that include fieldwork in the Victorian Alps.

**JM-2: Plant ecology, modelling and management II**

July 2016 start

I develop projects in consultation with the student. My research group focuses on using experiments, ecological models and decision analysis to better understand and manage plant communities and populations. My group works predominantly on grassland restoration on the western edge of Melbourne and on peatland management and invasive plant species in the Victorian Alps. Check out my group’s website for more information.

A mid-year start enables projects that include fieldwork in the Victorian Alps.

**Anne Peters**

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Phone: 99056287  
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Website: https://sites.google.com/site/petersresearchgroup/

The research group is diverse and offers a range of different projects that can be tailored to the interests of successful students. Group research expertise broadly fits into several categories including: animal behaviour, evolution, sexual selection, ornamentation, life-history, disease and immune ecology. Projects will be developed together with the student, and students can develop their own project, in close consultation regarding feasibility. The methods we use include behavioural observations, and capture of free-living birds, measurement and manipulation of physiological and immunological parameters. Research questions will be focused using already established study systems, the purple crowned fairy wren (*Malurus coronatus*) and superb fairy-wren (*Malurus cyaneus*), although other systems may be considered. Projects may be in collaboration with Dr Kaspar Delhey and/or Dr Justin Eastwood. For an overview of the sort of research we do, potential students should consult the Behavioural & Evolutionary Ecology of Birds research group website.

For further enquiries email Anne.

**AP-1: Avian behavioural ecology - lab**

This will be a project with a significant component of lab work, for example immune analyses or avian malaria, with a possibility to include fieldwork carried out at a local population of individually colour-ringed superb fairy-wrens (*Malurus cyaneus*).
**AP-2: Avian behavioural ecology - field**

This will be a mostly field-based project, with fieldwork carried out at a local population of individually colour-ringed superb fairy-wrens (*Malurus cyaneus*) at Lysterfield Park. Some prior experience with avian field work is highly desirable.

**Gerry Rayner**

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Webpage: http://monash.edu/science/about/schools/biological-sciences/staff/rayner.html

**GR-1: The effectiveness of inquiry-oriented learning in undergraduate science-perceptions versus reality**

Co-supervised by Dr Chris Thompson (School of Chemistry)

Feb or July 2016 start

Inquiry-oriented learning (IOL) involves students in elements of experimental design, the framing of testable hypotheses, and the analysis, interpretation and presentation of experimental data. This form of learning, which has been shown to enhance students' higher order thinking skills, including problem solving and critical thinking, provides a strong nexus between teaching and research. While IOL has re-established as a potent force for change in science, the student perspective has been largely overlooked, particularly for large enrolment, first year biology and chemistry units. This project will involve evaluation of IOL-related activities in biology and chemistry, and gathering of student perspectives for these activities compared to traditional recipe or cookbook-type practicals. This project has considerable potential to evaluate the effectiveness of IOL in science - in terms of the relationship between students' self-efficacy of their research ability and their actual ability - thereby leading to enhanced curricula and inculcation of genuine, higher order thinking skills.

![Figure 1: Model of the inquiry process (Justice et al., 2002:19).](image-url)
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RR-1: Reproduction and foraging of penguins
Co-supervised by André Chiaradia
July 2016 start

Little penguins, *Eudyptula minor*, live and breed in a large colony at Phillip Island southeast of Melbourne. As part of an ongoing program of the Phillip Island Nature Park (PINP) studying the population dynamics and biology of these penguins, a project opportunity exists to study the reproductive biology, behaviour and/or foraging of the penguins in the colony. Studies of parenting and foraging success are possible to understand the relationships between allocation of time and resources to food acquisition and reproduction. Other topics may be negotiated depending on student interests. The project is available for a mid-year start only and will probably require several days per week to be spent at Phillip Island between September and February. This project is co-supervised by Dr André Chiaradia of PINP.

RR-2: Project by negotiation
July 2016 start

I will consider projects suggested by students in the areas of ecological physiology of vertebrate animals in any environment. Let me know if you have your own project ideas.

Carla Sgrò
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- The focus of our research is to better understand how organisms adapt to environmental change.
- We also explore how evolution can be explicitly incorporated into biodiversity conservation and management.

CS-1: Adaptation to environmental change
Feb or July 2016 start

The project will be developed in consultation with the student. Please see my webpage for a summary of my research interests.
CS-2: Putting evolution in conservation management

Co-supervised by Carly Cook

Feb 2016 or July 2016 start
The project will be developed in consultation with the student. Please see our respective webpages for a summary of our research interests.

Paul Sunnucks

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My research group is called PART: Persistence and Adaptation Research Team. 'Persistence' refers to persistent populations of wildlife. 'Adaptation' refers to a main mechanism for assisting with management of wildlife to achieve persistence: populations that are large, diverse and well-connected are generally going to fare better under human impacts that one that are not like that.

We use many tools from spatial population genetics, genomics, geographic information systems and diverse analyses in population biology to do the best science we can, at the same time as being as much help as possible to wildlife managers.

Our current projects (flagged 'in progress') can be seen at https://sites.google.com/site/sunnucksresearchgroup/home/our-research.
The other listed projects represent a subset of the things we work on. Our current publications at https://sites.google.com/site/sunnucksresearchgroup/home/our-publications show more of the range of our activities.

We encourage applications from smart, dedicated and imaginative aspiring researchers to work with and contribute to our Persistence and Adaptation Research Team.

PS-1: Project by negotiation I

Feb 2016 or July 2016 start
The project will be developed in consultation with the student.

PS-2: Project by negotiation II

Feb 2016 or July 2016 start
The project will be developed in consultation with the student.
Akane Uesugi
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**Adaptive evolution in invasive plants**

Plant invasions are a major environmental threat globally, particularly when exotic plants evolve to become highly competitive with native species. I am interested in plant chemical mechanisms underlying the evolution of invasiveness in multiple species of goldenrods, which are North American natives that has invaded worldwide.

**AU-1: Evolution of allelopathy and its effects on native Australian plants**

Feb or July 2016 start

The project will be developed in consultation with the student.

**AU-2: Evolution of mycorrhizal interactions through change in root exudates**

Feb or July 2016 start

The project will be developed in consultation with the student.
Coral Warr

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Drosophila Cellular and Developmental Genetics

In the Warr lab we are interested in how cells receive and respond to signals from the environment or from each other. We use Drosophila melanogaster as a model organism due to the sophisticated genetic and molecular approaches available to study gene function. All honours students in Coral’s lab gain experience in a range of widely applicable genetic, molecular biology, and cell biology techniques such as: cloning, RNA in situ hybridisation, immuno-histochemistry, reporter genes, RNA interference, as well as in Drosophila genetic experiments and production of transgenic Drosophila.

CW-1: Characterization of new genes controlling growth in Drosophila

February 2016 or July 2016 start

Understanding the mechanisms that control growth in animals is of critical importance. Dysregulation of growth in humans underlies many of the major diseases that afflict society, including cancer, growth disorders and obesity. Many of the known growth signalling pathways are conserved between flies and humans, and much of our current knowledge of human growth factors and the signalling pathways they activate comes from studies in flies. We are screening for new genes controlling growth and developmental timing in Drosophila and have already identified several new genes. Several possible projects are available to characterise the role of these genes, and can be tailored to student interests.

CW-2: MACPF (Membrane Attack Complex/Perforin-like) gene function in Drosophila development

Co-supervised by Dr Travis Johnson

February 2016 or July 2016 start

The Drosophila torso-like gene (tsl) is the only fly member of the Membrane Attack Complex / Perforin-like (MACPF) protein superfamily, which includes pore forming toxins that play key roles in vertebrate immunity. Some MACPF proteins are essential for developmental processes, and interestingly we have shown that Tsl has both developmental and immune roles. The tsl gene is needed for correct terminal patterning in the Drosophila embryo and acts upstream of the Torso receptor tyrosine kinase. Tsl also has other roles in Drosophila, as we have shown that it also functions in developmental timing and in immunity. However, the mechanism of action of Tsl in these processes is not well understood. Several possible projects are possible aimed at characterising the functions of torso-like in Drosophila, and can be tailored to student interests.
Bob Wong

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**BW-1: Behavioural and evolutionary ecology of fishes I**

Feb 2016 or July 2016 start

This project will investigate sexual selection and/or parental care in fish. The actual honours project will be developed by negotiation with the student. A good starting point would be to check out the research and publication links on my website.

**BW-2: Behavioural and evolutionary ecology of fishes II**

Feb 2016 or July 2016 start

This project will investigate sexual selection and/or parental care in fish. The actual honours project will be developed by negotiation with the student. A good starting point would be to check out the research and publication links on my website.