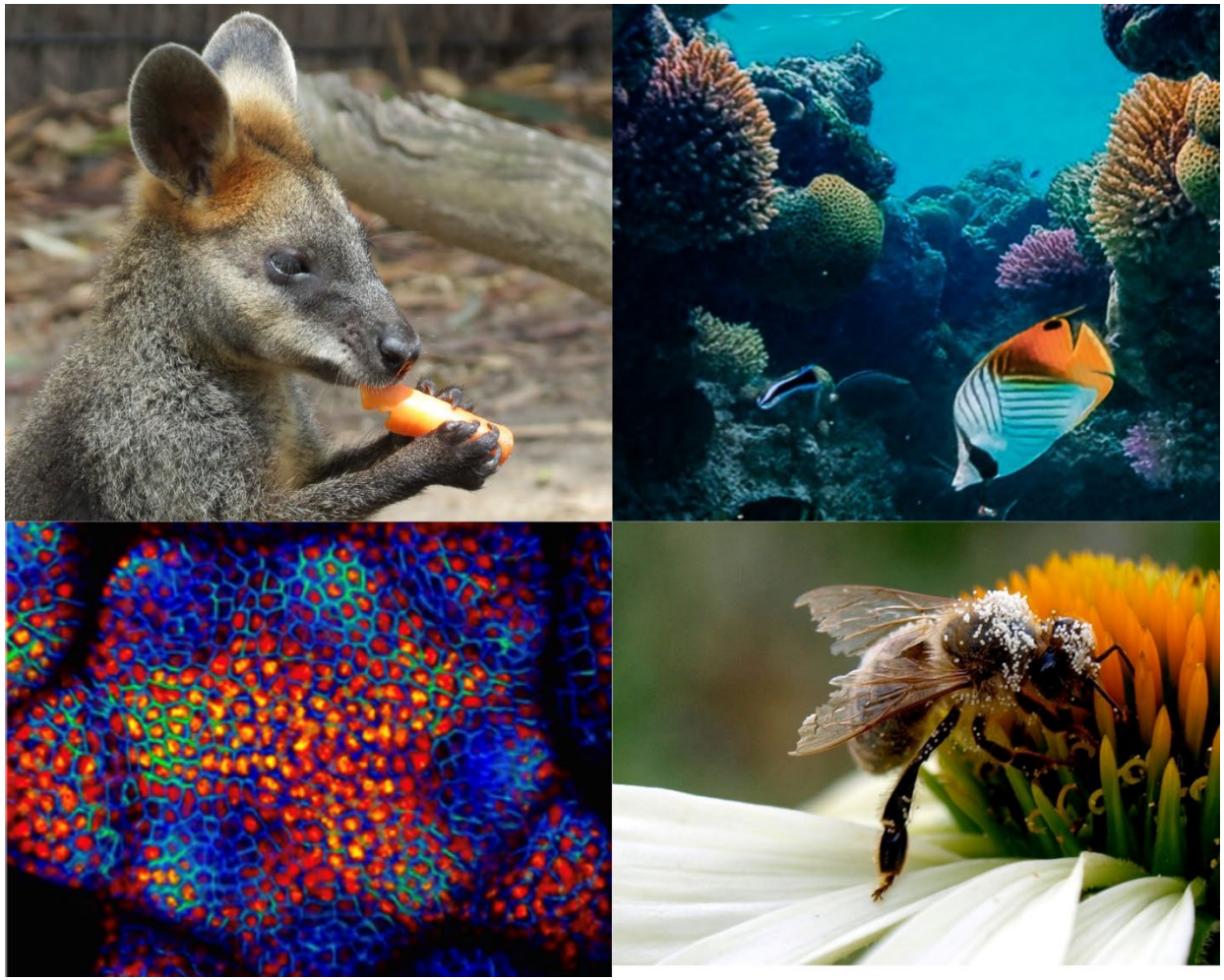
THE UNIVERSITY OF SYDNEY

SOLES Honours Projects in 2021

School of Life and Environmental Sciences



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Biochemistry and Molecular Biology Honours Projects 2021

Title	Description	Name	Surname	Contact
Investigating the mechanism of transgenerational epigenetic inheritance	This project will use a selection of molecular biology techniques (eg PCR), biochemistry (eg protein expression, characterization, crystallisation) and genetic manipulations (eg CRISPR) to characterize genes involved in transgenerational epigenetic inheritance using the model organism C. elegans.	Alyson	Ashe	https://www.sydney.edu.au/science/about/our-people/academic-staff/alyson-ashe.html
Developing new antibiotics by targeting specific molecular interactions in bacteria	Antibiotic resistance is an increasing problem globally and this project aims to develop a new class of broad spectrum antibiotics by targeting a never exploited interaction in bacteria. Techniques you will use include protein chemistry, structural biology, peptide evolution and microbial assays.	Ann	Kwan	https://www.kwanlabusyd.com/
Engineering of hydrophobins	Hydrophobins are fungal proteins that naturally assemble at interfaces to form robust coatings. This project focuses on the expanding the functionality of hydrophobins through “smart” engineering to produce a coating that promote the adhesion and growth of osteoblasts in 3D-printed bone implants.	Ann	Kwan	https://www.kwanlabusyd.com/
Identifying metabolites that change with radiotherapy schemes	Radiotherapy is used commonly to treat cancers but often the clinical benefits and side effects may not be	Ann	Kwan	https://www.kwanlabusyd.com/

	apparent for months or years. This project uses mass spectrometry and NMR experiments to identify and quantify metabolites that may act as early predictors of treatment success.			
Developing specific inhibitors that target periodontal diseases	Porphyromonas gingivalis is a “keystone” pathogen in chronic periodontitis which affects a quarter of the world’s population. This project aims to develop “Trojan horse” inhibitors against a set of proteins that steal haem (and analogues) from the host and are associated with virulence.	Ann	Kwan	https://www.kwanlabusyd.com/
Accelerated wound repair	We are building 3D tissue components in the Charles Perkins Centre. Our biomaterials have been used in human clinical trials. We seek Honours students interested in researching the scientific basis and building the next generation of biomaterials for organ and tissue augmentation and repair.	Anthony	Weiss	https://www.weisslab.net/
Gene editing to improve the flavour of food crops	CRISPR genome editing is now being used to develop novel plant products worldwide. Australia recently passed regulations that enable the commercialisation of products produced with CRISPR SDN-1 induced mutations. The Honours projects in our lab centre on metabolic engineering with CRISPR/Cas9 to produce novel market-oriented plant products.	Brian	Jones	https://www.sydney.edu.au/science/about/our-people/academic-staff/brian-jones.html
Genomics of reproductive biology - 2 students	We have a discovery of a gene pathway that might impact seasonal reproductive biology in the canine.	Claire	Wade	

	The goal of the wider project is to characterise our ability to manipulate seasonal reproduction in mammals via this pathway. This may have important global benefits in food security.			
Molecular Mechanism of Insulin Resistance	Insulin resistance is a major physiological problem that is associated with an inability of insulin to regulate glucose and lipid metabolism. We now know that metabolism is central to many diseases and how it is regulated in health and disease is a major question.	David	James	https://www.sydney.edu.au/science/about/our-people/academic-staff/david-james.html
Role of Protein Phosphorylation in Cellular Function	Using advances in mass spectrometry-based proteomics this project aims to uncover how phosphorylation affects the function of proteins and cells in both healthy and diseased states.	David	James	https://www.sydney.edu.au/science/about/our-people/academic-staff/david-james.html
Dissecting the architecture of the Insulin Signaling Pathway	The aim of this pathway is to understand how the insulin signalling pathway regulates metabolic homeostasis.	David	James	https://www.sydney.edu.au/science/about/our-people/academic-staff/david-james.html
Insulin Mediated Regulation of Lipolysis	Insulin regulates many aspects of metabolism including a process called lipolysis that involves the release of fatty acids into the circulation. Here we will shed light on the mechanism by which insulin regulates lipolysis.	David	James	https://www.sydney.edu.au/science/about/our-people/academic-staff/david-james.html
Genetics of Healthy Ageing	By exploiting the vast genetic landscape of an outbred mouse population we aim to explore the molecular cause of a range of diseases that limit healthy ageing in humans. This includes cardiovascular	David	James	https://www.sydney.edu.au/science/about/our-people/academic-staff/david-james.html

	disease, bone function, diabetes, liver disease and insulin resistance.			
Understanding antifungal drug synergy and antagonism	There is an urgent need for new antifungal therapies. We can use drug-drug synergy to improve existing antifungals, however occasionally the second drug causes antagonism.This study is to probe the molecular basis of synergistic and antagonistic responses using Q-PCR and probes for oxidative stress.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php
Safer, selective insecticides	In this project, you will investigate insect hormone receptors as targets for selective insecticides, comparing the receptors of pest and beneficial insects such as honey bees and their in-hive parasites. This project involves working with insects, molecular biology, genetics and biochemistry.	Emily	Remnant	https://www.sydney.edu.au/science/about/our-people/academic-staff/emily-remnant.html
Development of Laboratory Simulations to build student experimental design and troubleshooting skills.	I am developing simulations of experiments in 3D and VR using the Games Engine, Unity. The vision is to allow the user to experience the consequences of their actions so that they gain advanced trouble-shooting skills and are able to critically evaluate the limitations of the methods and resulting data. Prior programming skills not required.	Gareth	Denyer	https://www.sydney.edu.au/science/about/our-people/academic-staff/gareth-denyer.html
Delaying senescence in mesenchymal stem cells	A key challenge with stem cell therapies is obtaining sufficient cell numbers. Prolonged in vitro cell expansion can lead to senescence, in which cells stop proliferating and lose their phenotype. This project explores the use of tropoelastin to extend the functional lifespan of stem cells.	Giselle	Yeo	www.sydney.edu.au/science/about/our-people/academic-staff/giselle-yeo.html

Functional Genomics of SARS-CoV2 infection	In this project we are using new unbiased functional genomics techniques to map out human factors required for SARS-CoV2 infections. This project involves working both with modified human cell lines and human stem cell derived tissues.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
Mechanisms of actions for deadly toxins and venoms	We use whole genome CRISPR genome editing to identify the mechanisms of action for medically relevant drugs, environmental toxins, and deadly venoms. This project involves CRISPR genome editing and molecular biology, human cell culture including stem cell derived tissues, and animal work.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
A New cell death gene	We have evaluated all human genes for a role in resistance to 27 commonly used chemotherapies and identified new gene RDD1 (Required for Drug-induced Death 1) which we are characterizing. This project involves CRISPR genome editing, flow cytometry, microscopy, molecular biology, and transgenic mice.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
Human stem cell and organoid biology	We can generate most human organs (called organoids) in a dish, and use CRISPR to change the genetic code and learn how our genes contribute to disease. In this project you will apply these technologies to human brain development, human pain system, muscular dystrophy or wasting, or heart function.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
New pain therapies	Our goal is to develop new ways to treat pain that target the underlying cause and not just to treat the	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php

	symptoms. In this project we use new genome editing (CRISPR) and genetic techniques to find genes and pathways that are necessary and sufficient to drive pain diseases.			
Is dietary fat intake biologically regulated? Are the metabolic effects of ketogenic diets dependent on their fat-protein ratio?	Humans and rodents strongly regulate protein intake. If our diet is protein-deficient, we eat more to reach our protein intake target, but this inadvertently causes obesity. We study if fat intake is also biologically regulated and if fat:prot in ketogenic diets determines their health effects.	Jibran	Wali	https://www.sydney.edu.au/science/about/our-people/academic-staff/jibran-wali.html
mRNA display for the design of new cancer therapeutics	Transcription factors are critical players in many, if not all, cancers, and yet have not been widely explored as therapeutic targets. We will harness mRNA display of massive peptide/protein libraries to design new molecules that directly target these transcription factors.	Joel	Mackay	http://sydney.edu.au/science/molecular_bioscience/mackay/selfdir2.php
How do chromatin remodellers reshape the genome?	The remodelling of chromatin is critical for all genome biology - replication, transcription and repair - and disease, but the mechanisms by which remodelling enzymes achieve this outcome is not well understood. We will use molecular, cell and structural biology methods to address this mechanism.	Joel	Mackay	http://sydney.edu.au/science/molecular_bioscience/mackay/selfdir2.php
Bromodomains as epigenetic cancer targets	Recently, proteins that drive epigenetic gene regulation have been recognized as important targets for cancer and other diseases. We will use CRISPR gene editing to explore the mechanisms by which bromodomain proteins regulate gene	Joel	Mackay	http://sydney.edu.au/science/molecular_bioscience/mackay/selfdir2.php

	expression, opening up new ways to target these proteins in disease.			
Effect of dietary carbohydrate quality on fetal development and cardiometabolic health	Environmental conditions during early development can affect long term risk of disease. The objective of this project is to determine the effect of carbohydrate quality on energy balance, maternal adiposity and nutritional status, and fetal developmental outcomes in a mouse model.	Kim	Bell-Anderson	https://www.sydney.edu.au/science/about/our-people/academic-staff/kim-bell-anderson.html
Big data analysis of mouse metabolic phenotype	The Promethion metabolic screening platform at the CPC measures energy expenditure, respiratory quotient, physical activity and food and water intake continuously over several days in mice. This project seeks to create an automated process for the analysis of data collected from thousands of mice.	Kim	Bell-Anderson	https://www.sydney.edu.au/science/about/our-people/academic-staff/kim-bell-anderson.html
Understanding cell polarity in plants	Plants create some of the most striking architectures on earth and these shapes can also play a key role in crop production. This project uses live-imaging and molecular genetics to understand how plant cells coordinate their polarity, which determines growth rates and growth directions.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio
The control of plant architecture by cell-type boundaries	Cell-type boundaries in plants play a central role in controlling both leaf formation and shape, both of which are important to crop production.This project utilises live-imaging and molecular genetics to understand how these boundaries work.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio
Multi-Omic Data Analysis and	Experiments involving proteomics and metabolomics generate enormous	Mark	Larance	https://www.larancelab.com/

Visualisation for Intermittent Fasting	amounts of data, that need to be processed, tested for statistical significance and integrated. The visualisation of these data is particularly difficult and this project will address this in the context of intermittent fasting.			
Characterisation of the novel hormone erusiolin	Erusiolin is a novel hormone we discovered that we hypothesise plays a role in appetite regulation. This project is to characterise the role of this hormone in mammalian physiology using human clinical trial samples, CRISPR knock-out mice, peptide injection experiments and bioinformatic analysis.	Mark	Larance	https://www.larancelab.com/
Systems proteomics of the intermittent fasting response	Intermittent fasting provides metabolic benefits. But how the proteome in each tissue is altered is not fully understood. Our goal is to use state-of-the-art proteomic analysis to uncover the complex interaction between organ systems that leads to the beneficial effects of intermittent fasting.	Mark	Larance	https://www.larancelab.com/
Assess the influence of the genetic background in a mouse model for auto-inflammatory brain disease - https://youtu.be/r_ShdeDtz1M	Chronic production of the cytokine interferon-a causes an auto-inflammatory brain disease in mice. Our findings have identified that the genetic background of mice affects disease development and severity. Using molecular and genetic approaches, this project aims at identifying the underlying cause.	Markus	Hofer	www.hoferlab.com
Determining the molecular and genetic basis of type I	Microglia are the brain's immune cells. Our past research showed that the commonly used microglia cell line C8-	Markus	Hofer	www.hoferlab.com

interferon-unresponsiveness in C8-B4 murine microglia - https://youtu.be/r_ShdeDtz1M	B4 is resistant to type I interferons, which are master regulators of immune responses. Using in vitro approaches, this project will clarify the molecular pathway mediating this resistance.			
Examine the phagocytic capacity of microglia in response to the pro-inflammatory cytokines interleukin-6 (IL-6) and interferon-alpha (IFN-a) - https://youtu.be/r_ShdeDtz1M	Microglia are the brain's immune cells and phagocytose cell debris. IL-6 and IFN-a activate microglia in different ways. Here, we will assess how both cytokines regulate phagocytosis in microglia.	Markus	Hofer	www.hoferlab.com
Characterise a novel cumulative mouse model for neurodevelopmental diseases - https://youtu.be/r_ShdeDtz1M	Immune activation during pregnancy is a risk factor for neurodevelopmental disorders in offspring. With colleagues at Westmead's Children's hospital we are studying a novel mouse model that better recapitulates human immune activation than existing models.	Markus	Hofer	www.hoferlab.com
Imaging transcription in real time at single molecule resolution	This project will use in vitro techniques in stem cells to study the molecular basis of transcription during cell fate decision. This will work take advantage of cutting edge approaches based on single molecule science, super resolution microscopy, genome editing (crispr/cas9), and genomics.	Mathias	Francois	https://www.centenary.org.au/cen_program/david-richmond-laboratory-for-cardiovascular-development-gene-regulation-and-editing-program/
Molecular and cellular biology of vascular development during embryogenesis	The biological question is centred around the molecular control of cell fate during lymphatic endothelial cell specification by a novel transcriptional effector. Techniques used will cover a broad range of skills from confocal	Mathias	Francois	https://www.centenary.org.au/cen_program/david-richmond-laboratory-for-cardiovascular-development-gene-regulation-and-editing-program/

	microscopy to gene editing (crispr/cas9) and transcriptomics.			
The effect of iron on the photosynthetic apparatus and chlorophyll biosynthetic pathway	Iron is the most abundant transition metal and plays the essential role in the redox reaction of electron transport. Some cyanobacteria have evolved a number of responses to cope with the conditions of iron deficiency, including the changed photosynthetic apparatus to propose new energy pathways.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.
Molecular adaptation of photosynthesis powered by long-wavelength light	The project aims to study the structure and function of photopigment-binding protein complexes, which can be controlled in desired light and nutrient conditions. The research outcome will provide a molecular blueprint for the adaptation of photosynthesis with optimized energy transfer pathway.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.
Synthetic biology tools for cyanobacteria	Synthetic biology promises to transform every aspect of our lives, from medicines to agriculture to industry. This project will develop new versatile cloning plasmids for gene expression in cyanobacteria - these are especially interesting for biotechnology since they can use CO2 as a feedstock.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Tracking antibiotic resistance genes and mobile genetic elements in the environment	Mobile genetic elements (MGEs) like integrons are at the heart of the antibiotic resistance problem. In this project, we will develop novel assays to probe the activity of integrons in different environmental compartments, to understand their contribution to the movement of resistance genes	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html

Green Chemistry - Biocatalysis For Production Of High-Value Chemicals	Biocatalysis aims to replace petrochemicals with microbial reactions on renewable feedstocks. We are interested in developing better expression systems for monooxygenases - these enzymes add oxygen to organic modules, yielding alcohols and epoxides, which are important for many industries.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Biodegradation of trifluralin - a persistent herbicide	Herbicides are widely used in agriculture to control weeds, but some (e.g. trifluralin) have toxic side-effects and can persist for a long time in soil. We have enriched a microbial culture that biodegrades trifluralin. The project will seek to identify the microbes, enzymes and genes responsible.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
How do insertion sequences mobilise antibiotic resistance genes	IS in the IS26 family mobilise antibiotic resistance genes. We recently demonstrated that they undertake a novel reaction that may explain their success. The project will examine whether IS in other families found associated with antibiotic resistance genes can undertake the same type of reaction.	Ruth	Hall	https://www.sydney.edu.au/science/about/our-people/academic-staff/ruth-hall.html
Developing new compounds to target bacterial FtsY: in search of new antibiotics	Antibiotic resistance represents an increasingly serious threat to global public health. We propose that the receptor for the bacterial Signal Recognition Particle (SRP) represents an ideal target for the development of novel antibiotics. In this project we will perform screening of developed compounds using biophysical methods and in vivo assays.	Sandro	Ataide	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/ataide-lab.html

Quantitative cross-linking mass spectrometry in bacterial or cardiovascular disease	This project will develop quantitative strategies for exploring the protein interactome in different models of disease	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Exploring the nutritional requirements of Campylobacter jejuni infections	This project will explore how nutritional cues from human gut infection modify the Campylobacter jejuni proteome and metabolome	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Novel virulence factors of Pseudomonas aeruginosa required for cystic fibrosis lung infection	This project will explore the effects of novel virulence factor gene deletions on Pseudomonas aeruginosa phenotypes and omics profiles	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Exploring the role of N-glycosylation in Campylobacter jejuni	This project will explore the role of N-glycosylation in protection against Campylobacter jejuni proteases	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Investigating potential vaccine antigens of Pseudomonas aeruginosa	This project will investigate the protective capabilities of Pseudomonas aeruginosa antigens in mouse models of cystic fibrosis lung disease	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Understanding eIF4E-mediated potyvirus resistance	This project will characterise the structure and function of resistance-conferring eIF4E variants and establish the physicochemical rules that underlie eIF4E-based recessive resistance. This study will pave the way for the identification and design of new and robust forms of recessive resistance.	Tara	Christie	https://www.sydney.edu.au/science/about/our-people/academic-staff/tara-christie.html
Physiological functions of spring-loaded 'suicidal' proteins (serpins) in plants	Most serpins act as potent, irreversible 'suicide-substrate' inhibitors of proteases (i.e. enzymes that cleave proteins or peptides). However, the physiological functions	Thomas	Roberts	https://www.sydney.edu.au/science/about/our-people/academic-staff/thomas-roberts.html

	of most plant serpins remain unknown. This project aims to elucidate the roles of key serpins in model plant species through a combination of bioinformatics and biochemical experiments.			
The next Manuka? Identifying bioactive compounds in honey from bees feeding on fields of Indian mustard	Indian mustard is an important crop for oil production and soil rehabilitation. The aim of this project is to identify valuable bioactive compounds in honey from bees feeding on fields of Indian mustard. This would involve sophisticated chemical analysis including HPLC and mass spectrometry.	Thomas	Roberts	https://www.sydney.edu.au/science/about/our-people/academic-staff/thomas-roberts.html
Induction of of fibrosis by SARS-CoV-2	SARS-CoV-2 is able to cause severe lung injury through the process of fibrotic injury. This project will examine the mechanisms by signalling by the TGF-b pathway may contribute to this phenomenon and evaluate this pathway as a drug target.	Tim	Newsome	https://www.sydney.edu.au/science/about/our-people/academic-staff/timothy-newsome.html

Biology Honours Projects 2021

Title	Description	Name	Surname	Contact
Investigating the mechanism of transgenerational epigenetic inheritance	This project will use a selection of molecular biology techniques (eg PCR), biochemistry (eg protein expression, characterization, crystallisation) and genetic manipulations (eg CRISPR) to characterize genes involved in transgenerational epigenetic inheritance using the model organism C. elegans.	Alyson	Ashe	https://www.sydney.edu.au/science/about/our-people/academic-staff/alyson-ashe.html
Discovery of new C. elegans species and their viral pathogens	C. elegans are a valuable model organism that are found globally. But, their biodiversity, range and associated viruses in Aus. are unknown. This project will perform sampling around the Sydney region, followed by molecular biology techniques and deep sequencing to define known and novel species.	Alyson	Ashe	https://www.sydney.edu.au/science/about/our-people/academic-staff/alyson-ashe.html
The capacity of oyster reefs to improve water quality	Oysters are the kidneys of coastal environments, but most of this important oyster habitats have been lost due to harvesting and contamination. This project aims to gather and combine published data in a meta-analysis on the role of oysters in regulating water quality.	Ana	Bugnot	https://www.sydney.edu.au/science/about/our-people/academic-staff/ana-bugnot.html
Characterizing bioturbation activity in sediments surrounding oyster reefs	Sediment burrowing animals (bioturbators) play key roles in the healthy functioning of marine sediments. This study will characterise the species living close to oyster reefs and assess their role in promoting nutrient cycling of oyster deposits.	Ana	Bugnot	https://www.sydney.edu.au/science/about/our-people/academic-staff/ana-bugnot.html
Diet x microbiome	Our gut microbiome impacts health through its contribution to digestion and interaction with the enteric endocrine, lymphoid and	Andrew	Holmes	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-holmes.html

interactions in animal health	nervous systems. Projects can be focussed on mechanisms through which diet can manipulate microbe outcomes or animal outcomes (immunometabolic functions).			
Characterising biophysical patterns of water use among Australian tree species	Water drives productivity for many Australian plants yet the physiological and biophysical properties that govern water use is poorly characterised. Working with the Mt Annan botanic gardens and a range of techniques this project will investigate properties among contrasting Eucalyptus taxonomy.	Andrew	Merchant	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-merchant.htmlLinks to an external site.
Comparative measures of carbon capture among Australian native vegetation	Under predicted climatic changes, net carbon exchange between the biosphere and the atmosphere will be impacted. Leaf chemical and physiological properties governing net carbon capture will be characterised among Australian plant taxa to support modelling of future vegetation carbon exchange.	Andrew	Merchant	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-merchant.htmlLinks to an external site.
Understanding animal aggregations	Collective animal behaviour is a widespread and crucially important phenomenon, occurring in organisms from bacteria to humans. Recent developments in technology have allowed us the opportunity to understand the mysteries of collective systems. Your project will involve lab and fieldwork as well as the opportunity to engage with advanced analytical techniques to break new group in this field	Ashley	Ward	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/animal-behaviour-lab.html
Predicting the future of Antarctic krill in a changing ocean	Krill are fundamental to the success of the Antarctic ecosystem, yet as our climate changes, the future is uncertain. This project will investigate how krill will cope under conditions of elevated temperatures and decreasing pH in the Southern Ocean. The project will combine lab work at the Australian Antarctic Division with analysis based in Sydney	Ashley	Ward	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/animal-behaviour-lab.html

Gene editing to improve the flavour of food crops	CRISPR genome editing is now being used to develop novel plant products worldwide. Australia recently passed regulations that enable the commercialisation of products produced with CRISPR SDN-1 induced mutations. The Honours projects in our lab centre on metabolic engineering with CRISPR/Cas9 to produce novel market-oriented plant products.	Brian	Jones	https://www.sydney.edu.au/science/about/our-people/academic-staff/brian-jones.html
Biology of egg-laying and live birth in skinks	You will work on a lizard with an unusual reproductive strategy: both live-bearing and egg-laying. The projects will answer questions such as: Do oviparous and viviparous lizards interbreed? Has oviparity 're-evolved'? Suitable for students wishing to build their molecular biology skills.	Camilla	Whittington	www.camillawhittington.com
The biology of male pregnancy in seahorses	Several projects are possible, including those addressing: - Do seahorse dads transport amino acids to developing babies? - How do seahorse dads protect the babies from infection? These projects would suit students interested in fundamental biology/physiology.	Camilla	Whittington	www.camillawhittington.com
Is reproductive mode affected by environment?	This project will determine whether environmental conditions can modify the reproductive phenotype of egg-laying and live-bearing lizards. It will help determine whether phenotypic plasticity has played a role in the evolution of viviparity. It would suit a student interested in physiology/lab work	Camilla	Whittington	www.camillawhittington.com
Does size matter for plant uptake and soil cycling of organic N?	We currently have little more than a "black box" view of what limits the production of plant-available nutrients. This study will move beyond the black box view of nutrient availability and tease apart the limiting steps in release of plant-available nutrients.	Charles	Warren	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/plant-ecophysiology-and-ecosystem-processes.html

Uncovering the source of CO2 that's respired when dry soil is rewet	Soil respiration is one of the largest components of the global C cycle, and also one of the hardest to model. A key aspect of this difficulty is that we do not have a good mechanistic understanding of how drying followed by rewetting affect soil processes. This project will uncover the source of the carbon that is respired when a dry soil is rewet.	Charles	Warren	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/plant-ecophysiology-and-ecosystem-processes.html
How do soil microbes fine-tune their cellular composition to cope with nutrient imbalances?	Phosphorus availability is a large challenge for soil microbes because their "food" (plant litter or organic matter) rarely meets their physiological requirements. Organisms can minimise nutrient limitations by altering their physiological requirements. This project will determine how soil microbial modulate their cellular composition to cope with nutrient imbalances.	Charles	Warren	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/plant-ecophysiology-and-ecosystem-processes.html
Can native tree habitat variation be estimated from lidar?	Canopy height data for a remnant forest at the USyd Llara farm will be compared to measurements of species and trunk diameter at ground level. Use of lidar for agricultural purposes has increased in recent years and may contain information of on- and near-farm wildlife habitats	David	Gallacher	https://www.sydney.edu.au/science/about/our-people/academic-staff/d-gallacher.html
Safer, selective insecticides	In this project, you will investigate insect hormone receptors as targets for selective insecticides, comparing the receptors of pest and beneficial insects such as honey bees and their in-hive parasites. This project involves working with insects, molecular biology, genetics and biochemistry.	Emily	Remnant	https://www.sydney.edu.au/science/about/our-people/academic-staff/emily-remnant.html
Pandemic in the pacific: Honeybee virus dynamics during	In this project you will investigate the origins of a novel incursion of parasitic mites in honeybees in Fiji, and characterise the viral diversity transmitted from mites to bees over time as the invasion spreads. This project	Emily	Remnant	https://www.sydney.edu.au/science/about/our-people/academic-staff/emily-remnant.html

an early Varroa invasion.	involves molecular biology, genomics and bioinformatics.			
Physiological and behavioural responses of animals to environmental variability	How can animals compensate behaviourally or physiologically for potentially negative effects of environmental variability? This is not a distinct project but a research area within which a project can be designed. Check out recent publications on Scopus or Google Scholar for more details.	Frank	Seebacher	https://www.sydney.edu.au/science/about/our-people/academic-staff/frank-seebacher.html
Is dietary fat intake biologically regulated? Are the metabolic effects of ketogenic diets dependent on their fat-protein ratio?	Humans and rodents strongly regulate protein intake. If our diet is protein-deficient, we eat more to reach our protein intake target, but this inadvertently causes obesity. We study if fat intake is also biologically regulated and if fat:prot in ketogenic diets determines their health effects.	Jibran	Wali	https://www.sydney.edu.au/science/about/our-people/academic-staff/jibran-wali.htmlLinks to an external site.
Do all fuels burn the same?	Studies have examined the flammability of individual fuels rather than mixtures that naturally occur. In this project, the flammability of mixed fuels will be compared to individual fuels through burning experiments, coupled with physical and chemical characterisations of the fuels.	Malcolm	Possell	https://www.sydney.edu.au/science/about/our-people/academic-staff/malcolm-possell.html
Near infrared spectroscopy as a fire severity metric – application to the real world	Two possible projects: (1) Examine the relationships between near-infra red (NIR) spectroscopy and the burning conditions of mixed/composite fuels; (2) examine whether relationships identified among burning conditions and laboratory grade NIR scans hold true when using substantially cheaper, portable handheld devices?	Malcolm	Possell	https://www.sydney.edu.au/science/about/our-people/academic-staff/malcolm-possell.html
Understanding cell polarity in plants	Plants create some of the most striking architectures on earth and these shapes can also play a key role in crop production. This	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio

	project uses live-imaging and molecular genetics to understand how plant cells coordinate their polarity, which determines growth rates and growth directions.			
The control of plant architecture by cell-type boundaries	Cell-type boundaries in plants play a central role in controlling both leaf formation and shape, both of which are important to crop production.This project utilises live-imaging and molecular genetics to understand how these boundaries work.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio
Genetic regulation of leaf shape	This project will investigate how an important group of transcription factors, homeodomain proteins, control plant development. You will have the opportunity to use and build skills in genetics, molecular biology and developmental biology.	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html
Using gene editing to study gene function in plants	This project will use gene editing to study gene function testing the potential to generate multiple mutations and to tag genes with a reporter to follow gene expression. You will have the opportunity to use and build skills in genetics, molecular biology and developmental biology.	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html
Investigating flower development to aid production of hybrid wheat	Wheat is one of the world's most important sources of food. A major goal in agriculture is making superior hybrid wheat. This project will study development of male reproductive organs in varieties important for making hybrids. The project will build skills in developmental biology and genetics.	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html
The impacts of COVID-19 on Sydney's rat population	Ongoing work in the City of Sydney Council region indicates that Brown Rat populations may have gone down in the city, due to a reduction of resources (fewer people eating in the city etc). This project will involve trapping rats, and looking at other sources of data, to see if rats have increased in the city	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html

	and is it resource driven. The project will compare commercial to residential areas to see if human movement changes have affected rat densities.			
Do extracts from cat fur affect rodent behaviour?	Lab rats show fear responses to cat fur, and there is evidence that wild rats do as well. We have a number of extracts from cat fur and we are interested if they are the active component for this fear response. Work will be done either at the University of Sydney using lab rats or at Macquarie University fauna park using wild rats.	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html
Do Antechinus species smell different?	Many small mammal species look similar, but this would be expected if their main sense in communication is smell. Differences in pheromone profiles may be important in the speciation process and mate selection. We are interested in testing these differences in pheromone profiles using the marsupial genus, Antechinus. This will involve getting samples from different species of Antechinus, and examining there differences in the laboratory.	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html
Spatial and population modelling of koalas in the Liverpool Plains	Populations of koalas are declining in the well-known koala hotspot of the Liverpool Plains, NW NSW. This project will look at building a a spatially explicit population model, incorporating landscape and diease, to address the best way of addressing koala decline.	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html
Studying koala movements to reduce road fatalities	Koalas are declining in many parts of Australia, and road fatalities are a major contributor. Fences can be effective in reducing koala mortality, but are very expensive and have their own issues in fragmenting populations. We aim to study the movement of koalas with accelerometers, as	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html

	well as road and traffic conditions, to better manage landscape for koalas			
Lantana control: Does the identification of a beneficial use improve community-based management	A group of landholders in the Tarbuck Bay area, NSW have united to tackle lantana infestations on their properties. A community-based approach to lantana management will be evaluated. The influence of identified local beneficial uses of this weed on group motivation will be assessed.	Michael	Walsh	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/precision-weed-control-group.html
Investigating the role of bacteria in growing oyster mushrooms	Oyster mushrooms can be grown on many different substrates, including straw, spent coffee grounds and paper waste. Bacteria colonize the substrate together with the mushroom mycelium. The project will study the succession of bacterial diversity during mushroom growth on different substrates.	Michael	Kertesz	https://www.sydney.edu.au/science/about/our-people/academic-staff/michael-kertesz.html
Optimizing Nitrogen content in cultivated button mushrooms	Button mushrooms are grown in a selective compost, using chicken manure and soy-based supplements to provide the nitrogen (N) needed for mushroom growth. The project will investigate alternative N sources, studying their effect on the microbes in the compost, and on mushroom yield and N content.	Michael	Kertesz	https://www.sydney.edu.au/science/about/our-people/academic-staff/michael-kertesz.html
The effect of iron on the photosynthetic apparatus and chlorophyll biosynthetic pathway	Iron is the most abundant transition metal and plays the essential role in the redox reaction of electron transport. Some cyanobacteria have evolved a number of responses to cope with the conditions of iron deficiency, including the changed photosynthetic apparatus to propose new energy pathways.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.
Molecular adaptation of photosynthesis	The project aims to study the structure and function of photopigment-binding protein complexes, which can be controlled in desired light and nutrient conditions. The	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.

powered by long-wavelength light	research outcome will provide a molecular blueprint for the adaptation of photosynthesis with optimized energy transfer pathway.			
The unseeing regulatory network of Acaryochloris marina, a chlorophyll d-containing cyanobacteria	Many non-coding RNA (ncRNA) were expressed without defined functions. It is clear now that they have a very important regulatory roles.In A. marina many ncRNAs were actively expressed under certain conditions. Using bioinformatics tools, we will predict targeting genes and regulatory networks.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.
Physiology and behaviour of the marine crustacean *Cirolana harfordi*	The marine isopod Cirolana harfordi displays live birth, can venture, out onto land and, into hyposaline water. It is also a social animal and displays fearlessness in relation to predators. Various projects on the physiology and behaviour of this amazing animal are available.	Murray	Thomson	https://www.sydney.edu.au/science/about/our-people/academic-staff/murray-thomson.html
Using chemical camouflage to protect wheat seeds from mouse damage	This project will explore the potential for olfactory camouflage to reduce the house mouse's ability to find newly sown wheat grains as a non-toxic alternative to control mouse damage on wheat yields. It will be field based, working in collaboration with CSIRO	Peter	Banks	https://conservation-behaviour.sydney.edu.au
Messing with their minds: using information to improve wildlife monitoring devices	This field project will explore how information can be used to manipulate decision-making by animals in order to better detect wildlife. It will explore how strategic use of information can increase rates of wildlife detections by harnessing animal motivations to visit monitoring devices	Peter	Banks	https://conservation-behaviour.sydney.edu.au
Measuring the environmental value of our University campus	The paradox: humans need plants to survive but many humans have "plant blindness". This project aims to critique methods for valuing trees (e.g. economic, environmental,	Rosanne	Quinnell	https://www.sydney.edu.au/science/about/our-people/academic-staff/rosanne-quinnell.html

	ecological, psychological) focusing on the flora of our USYD campuses.			
Effects of hive insulation on bee colony thermoregulation	To rear their larvae, honeybees need to regulate the temperature inside the hive around an optimum of 34.5°C. This project will test the effect of hive design and insulation on colony temperature regulation under heat stress.	Tanya	Latty	www.tanyalatty.com
Designing artificial flowers for studying the behaviour of wild pollinators	In this project, you will design and test artificial flowers for use with wild, free-flying pollinators. This project would suit a student with an interest in design/craft. This project can be extended to investigate flower preferences of insects using artificial flowers.	Tanya	Latty	www.tanyalatty.com
Understanding temperature variation within honeybee colonies	For optimal health, honeybees need to regulate the temperature inside the hive to about 34.5°C. This project will use sensors throughout the hive to investigate how colonies respond to temperature fluctuations.The data we collect will help us protect beehives in a rapidly warming world.	Tanya	Latty	www.tanyalatty.com
How do blue banded bees choose which flowers to visit?	Blue banded bees are important and abundant pollinators. In this project, you will investigate flower preferences in blue banded bees with the goal of understanding which floral traits are preferred by foraging blue banded bees. This project will require data collection during the summer months.	Tanya	Latty	www.tanyalatty.com
How does pollinator choice behaviour influence interactions between flowers?	Rewarding flowers can either benefit nearby flower species by attracting additional pollinators to the area (facilitation), or they can compete with nearby flowers by stealing pollinators (competition). This project will investigate the floral attributes that influence competition and facilitation.	Tanya	Latty	www.tanyalatty.com

Alpine scavenging dynamics	The project will involve monitoring vertebrate and insect scavengers on animal carcasses along an altitudinal gradient in Kosciuszko National Park. The results will inform how decomposition processes shift with altitude and provide insights into the impacts of climate change on food web dynamics.	Thomas	Newsome	https://thomasnewsome.com/
Communication, courtship, and adaptation in the wild	This work will use beach-dwelling flies to examine how organisms gather and exchange visual information in order to solve life's daily challenges. The questions are many, but will entail fieldwork on Australia's beautiful beaches and lab-based analyses of behaviour, colour, and visual perception.	Thomas	White	https://tomwhite.io
Underwater cows: marine herbivores and restoration of underwater forests	This project explores the multiple benefits of restoring marine underwater forests via the removal of herbivores and their potential use as a food resource. It involves field and aquarium experiments at the Sydney Institute of Marine Science.	Ziggy	Marzinelli	https://www.sydney.edu.au/science/about/our-people/academic-staff/e-marzinelli.html

Cell and Developmental Biology Honours Projects 2021

Title	Description	Name	Surname	Contact
Investigating the mechanism of transgenerational epigenetic inheritance	This project will use a selection of molecular biology techniques (eg PCR), biochemistry (eg protein expression, characterization, crystallisation) and genetic manipulations (eg CRISPR) to characterize genes involved in transgenerational epigenetic inheritance using the model organism C. elegans.	Alyson	Ashe	https://www.sydney.edu.au/science/about/our-people/academic-staff/alyson-ashe.html
Diet x microbiome interactions in animal health	Our gut microbiome impacts health through its contribution to digestion and interaction with the enteric endocrine, lymphoid and nervous systems. Projects can be focussed on mechanisms through which diet can manipulate microbe outcomes or animal outcomes (immunometabolic functions).	Andrew	Holmes	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-holmes.html
CRISPR/Cas9 genome editing for market-oriented novelty in plants	CRISPR genome editing is now being used to develop novel plant products worldwide. Australia recently passed regulations that enable the commercialisation of products produced with CRISPR SDN-1 induced mutations. The Honours projects in our lab centre on metabolic engineering with CRISPR/Cas9 to produce novel market-oriented plant products.	Brian	Jones	https://www.sydney.edu.au/science/about/our-people/academic-staff/brian-jones.html
Micro-cell variants in the yeast pathogen Cryptococcus and their role in infection	Micro-cells occur in Cryptococcus during human infection stress. In this project we will determine 1) what triggers microcell production; 2) whether the number of micro-cells changes over time during the growth phase of cultures; 3) whether micro-cells are are capable of reverting to normal cells.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php

The production of morphologically altered Cryptococcus cells in response to stress	Growth in the mammalian host can be stressful for fungal pathogens. Cryptococcus can respond by developing unusual cellular morphologies that may allow dormant survival. We will examine these in detail using microscopy, microbiological growth dynamics, cellular probes and molecular methods.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php
Understanding antifungal drug synergy and antagonism	There is an urgent need for new antifungal therapies. We can use drug-drug synergy to improve existing antifungals, however occasionally the second drug causes antagonism.This study is to probe the molecular basis of synergistic and antagonistic responses using Q-PCR and probes for oxidative stress.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php
Delaying senescence in mesenchymal stem cells	A key challenge with stem cell therapies is obtaining sufficient cell numbers. Prolonged in vitro cell expansion can lead to senescence, in which cells stop proliferating and lose their phenotype. This project explores the use of tropoelastin to extend the functional lifespan of stem cells.	Giselle	Yeo	www.sydney.edu.au/science/about/our-people/academic-staff/giselle-yeo.html
Functional Genomics of SARS-CoV2 infection	In this project we are using new unbiased functional genomics techniques to map out human factors required for SARS-CoV2 infections. This project involves working both with modified human cell lines and human stem cell derived tissues.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
Mechanisms of actions for deadly toxins and venoms	We use whole genome CRISPR genome editing to identify the mechanisms of action for medically relevant drugs, environmental toxins, and deadly venoms. This project involves CRISPR genome editing and molecular biology, human cell culture including stem cell derived tissues, and animal work.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php

A New cell death gene	We have evaluated all human genes for a role in resistance to 27 commonly used chemotherapies and identified new gene RDD1 (Required for Drug-induced Death 1) which we are characterizing. This project involves CRISPR genome editing, flow cytometry, microscopy, molecular biology, and transgenic mice.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
Human stem cell and organoid biology	We can generate most human organs (called organoids) in a dish, and use CRISPR to change the genetic code and learn how our genes contribute to disease. In this project you will apply these technologies to human brain development, human pain system, muscular dystrophy or wasting, or heart function.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
New pain therapies	Our goal is to develop new ways to treat pain that target the underlying cause and not just to treat the symptoms. In this project we use new genome editing (CRISPR) and genetic techniques to find genes and pathways that are necessary and sufficient to drive pain diseases.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
Understanding cell polarity in plants	Plants create some of the most striking architectures on earth and these shapes can also play a key role in crop production. This project uses live-imaging and molecular genetics to understand how plant cells coordinate their polarity, which determines growth rates and growth directions.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio
The control of plant architecture by cell-type boundaries	Cell-type boundaries in plants play a central role in controlling both leaf formation and shape, both of which are important to crop production.This project utilises live-imaging and molecular genetics to understand how these boundaries work.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBioLinks to an external site.

Multi-Omic Data Analysis and Visualisation for Intermittent Fasting	Experiments involving proteomics and metabolomics generate enormous amounts of data, that need to be processed, tested for statistical significance and integrated. The visualisation of these data is particularly difficult and this project will address this in the context of intermittent fasting.	Mark	Larance	https://www.larancelab.com/
Characterisation of the novel hormone erusiolin	Erusiolin is a novel hormone we discovered that we hypothesise plays a role in appetite regulation. This project is to characterise the role of this hormone in mammalian physiology using human clinical trial samples, CRISPR knock-out mice, peptide injection experiments and bioinformatic analysis.	Mark	Larance	https://www.larancelab.com/
Systems proteomics of the intermittent fasting response	Intermittent fasting provides metabolic benefits. But how the proteome in each tissue is altered is not fully understood. Our goal is to use state-of-the-art proteomic analysis to uncover the complex interaction between organ systems that leads to the beneficial effects of intermittent fasting.	Mark	Larance	https://www.larancelab.com/
Genetic regulation of leaf shape	This project will investigate how an important group of transcription factors, homeodomain proteins, control plant development. You will have the opportunity to use and build skills in genetics, molecular biology and developmental biology.	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html
Using gene editing to study gene function in plants	This project will use gene editing to study gene function testing the potential to generate multiple mutations and to tag genes with a reporter to follow gene expression. You will have the opportunity to use and build skills in genetics, molecular biology and developmental biology.	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html
Investigating flower	Wheat is one of the world's most important sources of food. A major goal in agriculture	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html

development to aid production of hybrid wheat	is making superior hybrid wheat. This project will study development of male reproductive organs in varieties important for making hybrids. The project will build skills in developmental biology and genetics.			
Production of Canine induced pluripotent stem cells (iPSC) using Sendia Virus to reprogram Canine Peripheral Blood Mononuclear Cells.	The project would investigate the methodologies for the development of putative induced pluripotent stem cells (IPSCs) from differentiated dog peripheral blood mononuclear cells that would be safe and efficacious for the future treatment of canine degenerative disease.	Paul	Sheehy	https://www.sydney.edu.au/science/about/our-people/academic-staff/paul-sheehy.html
Development of a Bovine mammary cell model of Coxiella burnetii infection, propagation and shedding.	Coxiella burnetii is an obligate intracellular pathogen and the causative agent of Q Fever. This project proposes the use of a bovine mammary epithelial cell line as the basis for an in vitro model to investigate the cytopathogenic mechanisms of Coxiella burnetii infection.	Paul	Sheehy	https://www.sydney.edu.au/science/about/our-people/academic-staff/paul-sheehy.html
Induction of of fibrosis by SARS-CoV-2	SARS-CoV-2 is able to cause severe lung injury through the process of fibrotic injury. This project will examine the mechanisms by signalling by the TGF-b pathway may contribute to this phenomenon and evaluate this pathway as a drug target.	Tim	Newsome	https://www.sydney.edu.au/science/about/our-people/academic-staff/timothy-newsome.html
Effect of dietary carbohydrate quality on fetal development and cardiometabolic health	Environmental conditions during early development can affect long term risk of disease. The objective of this project is to determine the effect of carbohydrate quality on energy balance, maternal adiposity and nutritional status, and fetal developmental outcomes in a mouse model.	Kim	Bell-Anderson	https://www.sydney.edu.au/science/about/our-people/academic-staff/kim-bell-anderson.html
Imaging transcription in	This project will use in vitro techniques in stem cells to study the molecular basis of	Mathias	Francois	https://www.centenary.org.au/cen_program/david-richmond-laboratory-for-cardiovascular-

real time at single molecule resolution	transcription during cell fate decision. This will work take advantage of cutting edge approaches based on single molecule science, super resolution microscopy, genome editing (crispr/cas9), and genomics.			development-gene-regulation-and-editing-program/
Molecular and cellular biology of vascular development during embryogenesis	The biological question is centred around the molecular control of cell fate during lymphatic endothelial cell specification by a novel transcriptional effector. Techniques used will cover a broad range of skills from confocal microscopy to gene editing (crispr/cas9) and transcriptomics.	Mathias	Francois	https://www.centenary.org.au/cen_program/david-richmond-laboratory-for-cardiovascular-development-gene-regulation-and-editing-program/
The effect of iron on the photosynthetic apparatus and chlorophyll biosynthetic pathway	Iron is the most abundant transition metal and plays the essential role in the redox reaction of electron transport. Some cyanobacteria have evolved a number of responses to cope with the conditions of iron deficiency, including the changed photosynthetic apparatus to propose new energy pathways.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.
Molecular adaptation of photosynthesis powered by long-wavelength light	The project aims to study the structure and function of photopigment-binding protein complexes, which can be controlled in desired light and nutrient conditions. The research outcome will provide a molecular blueprint for the adaptation of photosynthesis with optimized energy transfer pathway.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.

Ecology and Evolutionary Biology Honours Projects 2021

Title	Description	Name	Surname	Contact
DigiFarm: incorporating biodiversity into farming decisions	We aim to develop a digitally enabled network which will monitor native flora and fauna to inform sustainable agricultural practices. We will test new methods in camera trapping and acoustic recorders (birds and bats) in quantifying on-farm biodiversity across time and space.	Aaron	Greenville	https://aarongreenville.com/ecosystem-dynamics-lab/
Simpson Desert Insights: designing Citizen Science programs for identifying wildlife in remote camera trap images	Remote camera traps are now commonly used in wildlife studies around the globe. This project will work closely with DigiVol at the Australian Museum to determine the level of uncertainty in using Citizen Scientists to identify species in remote camera trap images	Aaron	Greenville	https://aarongreenville.com/ecosystem-dynamics-lab/
Discovery of new C. elegans species and their viral pathogens	C. elegans are a valuable model organism that are found globally. But, their biodiversity, range and associated viruses in Aus. are unknown. This project will perform sampling around the Sydney region, followed by molecular biology techniques and deep sequencing to define known and novel species.	Alyson	Ashe	https://www.sydney.edu.au/science/about/our-people/academic-staff/alyson-ashe.html
Characterising biophysical patterns of water use among Australian tree species	Water drives productivity for many Australian plants yet the physiological and biophysical properties that govern water use is poorly characterised. Working with the Mt Annan botanic gardens and a range of techniques this project will investigate properties among contrasting Eucalyptus taxonomy.	Andrew	Merchant	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-merchant.htmlLinks to an external site.

Comparative measures of carbon capture among Australian native vegetation	Under predicted climatic changes, net carbon exchange between the biosphere and the atmosphere will be impacted. Leaf chemical and physiological properties governing net carbon capture will be characterised among Australian plant taxa to support modelling of future vegetation carbon exchange.	Andrew	Merchant	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-merchant.htmlLinks to an external site.
Understanding animal aggregations	Collective animal behaviour is a widespread and crucially important phenomenon, occurring in organisms from bacteria to humans. Recent developments in technology have allowed us the opportunity to understand the mysteries of collective systems. Your project will involve lab and fieldwork as well as the opportunity to engage with advanced analytical techniques to break new group in this field	Ashley	Ward	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/animal-behaviour-lab.html
Predicting the future of Antarctic krill in a changing ocean	Krill are fundamental to the success of the Antarctic ecosystem, yet as our climate changes, the future is uncertain. This project will investigate how krill will cope under conditions of elevated temperatures and decreasing pH in the Southern Ocean. The project will combine lab work at the Australian Antarctic Division with analysis based in Sydney	Ashley	Ward	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/animal-behaviour-lab.html
Using digital technologies to track farmland ecological condition in remote arid Australia	This project aims to analyse new digital ecoacoustic monitoring datasets from Australian farms and natural habitats to: a) build metrics that evaluate “soundscapes” in agricultural land uses and compare with on-ground monitoring of wildlife and landscape condition, and b) evaluate the ability of digital technologies to fill knowledge gaps on biodiversity in remote farming landscapes.	Ayesha	Tulloch	https://www.sydney.edu.au/science/about/our-people/academic-staff/ayesha-tulloch.html

Biology of egg-laying and live birth in skinks	You will work on a lizard with an unusual reproductive strategy: both live-bearing and egg-laying. The projects will answer questions such as: Do oviparous and viviparous lizards interbreed? Has oviparity 're-evolved'? Suitable for students wishing to build their molecular biology skills.	Camilla	Whittington	www.camillawhittington.com
The biology of male pregnancy in seahorses	Several projects are possible, including those addressing: - Do seahorse dads transport amino acids to developing babies? - How do seahorse dads protect the babies from infection? These projects would suit students interested in fundamental biology/physiology.	Camilla	Whittington	www.camillawhittington.com
Is reproductive mode affected by environment?	This project will determine whether environmental conditions can modify the reproductive phenotype of egg-laying and live-bearing lizards. It will help determine whether phenotypic plasticity has played a role in the evolution of viviparity. It would suit a student interested in physiology/lab work	Camilla	Whittington	www.camillawhittington.com
Does size matter for plant uptake and soil cycling of organic N?	We currently have little more than a "black box" view of what limits the production of plant-available nutrients. This study will move beyond the black box view of nutrient availability and tease apart the limiting steps in release of plant-available nutrients.	Charles	Warren	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/plant-ecophysiology-and-ecosystem-processes.html
Uncovering the source of CO2 that's respired when dry soil is rewet	Soil respiration is one of the largest components of the global C cycle, and also one of the hardest to model. A key aspect of this difficulty is that we do not have a good mechanistic understanding of how drying followed by rewetting affect soil processes. This project will uncover the source of the carbon that is respired when a dry soil is rewet.	Charles	Warren	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/plant-ecophysiology-and-ecosystem-processes.html

How do soil microbes fine-tune their cellular composition to cope with nutrient imbalances?	Phosphorus availability is a large challenge for soil microbes because their "food" (plant litter or organic matter) rarely meets their physiological requirements. Organisms can minimise nutrient limitations by altering their physiological requirements. This project will determine how soil microbial modulate their cellular composition to cope with nutrient imbalances.	Charles	Warren	https://www.sydney.edu.au/science/our-research/research-areas/life-and-environmental-sciences/plant-ecophysiology-and-ecosystem-processes.html
The role of odour in foraging ecology of mammalian herbivores	Understanding how herbivores such as wallabiesor deer use plant odour to find food will help us protects plants by manipulating this interaction	Clare	McArthur	https://www.sydney.edu.au/science/about/our-people/academic-staff/clare-mcarthur.html
How does animal personality affect foraging and problem solving in possums; & does this influence their parasitic load?	You can investigate any of these links: personality, diet, foraging, problem-solving and parasites in urban or woodland possums to help us understand the behavioural ecology of this urbanised species	Clare	McArthur	https://www.sydney.edu.au/science/about/our-people/academic-staff/clare-mcarthur.html
Heuristics used by foragers: can we trick them into eating something different?	This projects units behavioural ecology with cognitive research to test whether decoys (e.g. phantom decoys) alters the food choices of wild animals	Clare	McArthur	https://www.sydney.edu.au/science/about/our-people/academic-staff/clare-mcarthur.html
Can native tree habitat variation be estimated from lidar?	Canopy height data for a remnant forest at the USyd Llara farm will be compared to measurements of species and trunk diameter at ground level. Use of lidar for agricultural purposes has increased in recent years and may contain information of on- and near-farm wildlife habitats	David	Gallacher	https://www.sydney.edu.au/science/about/our-people/academic-staff/d-gallacher.html
Safer, selective insecticides	In this project, you will investigate insect hormone receptors as targets for selective	Emily	Remnant	https://www.sydney.edu.au/science/about/our-people/academic-staff/emily-remnant.html

	insecticides, comparing the receptors of pest and beneficial insects such as honey bees and their in-hive parasites. This project involves working with insects, molecular biology, genetics and biochemistry.			
Pandemic in the pacific: Honeybee virus dynamics during an early Varroa invasion.	In this project you will investigate the origins of a novel incursion of parasitic mites in honeybees in Fiji, and characterise the viral diversity transmitted from mites to bees over time as the invasion spreads. This project involves molecular biology, genomics and bioinformatics.	Emily	Remnant	https://www.sydney.edu.au/science/about/our-people/academic-staff/emily-remnant.html
Physiological and behavioural responses of animals to environmental variability	How can animals compensate behaviourally or physiologically for potentially negative effects of environmental variability? This is not a distinct project but a research area within which a project can be designed. Check out recent publications on Scopus or Google Scholar for more details.	Frank	Seebacher	https://www.sydney.edu.au/science/about/our-people/academic-staff/frank-seebacher.html
Biomarkers for thermal stress in native fish	This project will use sophisticated molecular genetic tools to identify patterns of gene expression that are associated with thermal stress in recreational fish species to improve breeding and restocking programs.	Joy	Becker	https://www.sydney.edu.au/science/about/our-people/academic-staff/joy-becker.html
Impact of thermal stress on the gastrointestinal microbiota of important recreational fish species	The project will study changes in the GIT microbiota of important recreational fish species in response to thermal stress.	Joy	Becker	https://www.sydney.edu.au/science/about/our-people/academic-staff/joy-becker.html
The impacts of COVID-19 on Sydney's rat population	Ongoing work in the City of Sydney Council region indicates that Brown Rat populations may have gone down in the city, due to a reduction of resources (fewer people eating in the city etc). This project will involve trapping rats, and looking at other sources of	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html

	data, to see if rats have increased in the city and is it resource driven. The project will compare commercial to residential areas to see if human movement changes have affected rat densities.			
Do extracts from cat fur affect rodent behaviour?	Lab rats show fear responses to cat fur, and there is evidence that wild rats do as well. We have a number of extracts from cat fur and we are interested if they are the active component for this fear response. Work will be done either at the University of Sydney using lab rats or at Macquarie University fauna park using wild rats.	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html
Do Antechinus species smell different?	Many small mammal species look similar, but this would be expected if their main sense in communication is smell. Differences in pheromone profiles may be important in the speciation process and mate selection. We are interested in testing these differences in pheromone profiles using the marsupial genus, Antechinus. This will involve getting samples from different species of Antechinus, and examining there differences in the laboratory.	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html
Spatial and population modelling of koalas in the Liverpool Plains	Populations of koalas are declining in the well-known koala hotspot of the Liverpool Plains, NW NSW. This project will look at building a a spatially explicit population model, incorporating landscape and diease, to address the best way of addressing koala decline.	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html
Studying koala movements to reduce road fatalities	Koalas are declining in many parts of Australia, and road fatalities are a major contributor. Fences can be effective in reducing koala mortality, but are very expensive and have their own issues in fragmenting populations. We aim to study the	Mathew	Crowther	https://www.sydney.edu.au/science/about/our-people/academic-staff/mathew-crowther.html

	movement of koalas with accelerometers, as well as road and traffic conditions, to better manage landscape for koalas			
Physiology and behaviour of the marine crustacean Cirolana harfordi	The marine isopod Cirolana harfordi displays live birth, can venture, out onto land and, into hyposaline water. It is also a social animal and displays fearlessness in relation to predators. Various projects on the physiology and behaviour of this amazing animal are available.	Murray	Thomson	https://www.sydney.edu.au/science/about/our-people/academic-staff/murray-thomson.html
Effects of hive insulation on bee colony thermoregulation	To rear their larvae, honeybees need to regulate the temperature inside the hive around an optimum of 34.5°C. This project will test the effect of hive design and insulation on colony temperature regulation under heat stress.	Tanya	Latty	www.tanyalatty.com
Designing artificial flowers for studying the behaviour of wild pollinators	In this project, you will design and test artificial flowers for use with wild, free-flying pollinators. This project would suit a student with an interest in design/craft. This project can be extended to investigate flower preferences of insects using artificial flowers.	Tanya	Latty	www.tanyalatty.com
Understanding temperature variation within honeybee colonies	For optimal health, honeybees need to regulate the temperature inside the hive to about 34.5°C. This project will use sensors throughout the hive to investigate how colonies respond to temperature fluctuations.The data we collect will help us protect beehives in a rapidly warming world.	Tanya	Latty	www.tanyalatty.com
How do blue banded bees choose which flowers to visit?	Blue banded bees are important and abundant pollinators. In this project, you will investigate flower preferences in blue banded bees with the goal of understanding which floral traits are preferred by foraging blue banded bees. This project will require data collection during the summer months.	Tanya	Latty	www.tanyalatty.com

How does pollinator choice behaviour influence interactions between flowers?	Rewarding flowers can either benefit nearby flower species by attracting additional pollinators to the area (facilitation), or they can compete with nearby flowers by stealing pollinators (competition). This project will investigate the floral attributes that influence competition and facilitation.	Tanya	Latty	www.tanyalatty.com
Alpine scavenging dynamics	The project will involve monitoring vertebrate and insect scavengers on animal carcasses along an altitudinal gradient in Kosciuszko National Park. The results will inform how decomposition processes shift with altitude and provide insights into the impacts of climate change on food web dynamics.	Thomas	Newsome	https://thomasnewsome.com/
Communication, courtship, and adaptation in the wild	This work will use beach-dwelling flies to examine how organisms gather and exchange visual information in order to solve life's daily challenges. The questions are many, but will entail fieldwork on Australia's beautiful beaches and lab-based analyses of behaviour, colour, and visual perception.	Thomas	White	https://tomwhite.io
Does the environment or the genetics of the host drive plant-associated microbiomes?	Marine habitat-forming hosts such as kelps, seagrass and corals are surrounded by a soup of microbes – does the environment have a stronger influence on their microbiomes than their genetics/phenotype?	Ziggy	Marzinelli	https://www.sydney.edu.au/science/about/our-people/academic-staff/e-marzinelli.html
The role of facilitation in ecosystem restoration	Traditionally, marine restoration has focused on managing physical or biological factors that negatively influence restoration success. This project aims at harnessing positive interactions - particularly facilitation - to enhance the success of restoration of key coastal marine habitat-formers.	Ziggy	Marzinelli	https://www.sydney.edu.au/science/about/our-people/academic-staff/e-marzinelli.html
Underwater cows: marine herbivores and	This project explores the multiple benefits of restoring marine underwater forests via the removal of herbivores and their potential use	Ziggy	Marzinelli	https://www.sydney.edu.au/science/about/our-people/academic-staff/e-marzinelli.html

restoration of underwater forests	as a food resource. It involves field and aquarium experiments at the Sydney Institute of Marine Science.			

Genetics and Genomics Honours Projects in 2021

Title	Description	Name	Surname	Contact
Discovery of new C. elegans species and their viral pathogens	C. elegans are a valuable model organism that are found globally. But, their biodiversity, range and associated viruses in Aus. are unknown. This project will perform sampling around the Sydney region, followed by molecular biology techniques and deep sequencing to define known and novel species.	Alyson	Ashe	https://www.sydney.edu.au/science/about/our-people/academic-staff/alyson-ashe.html
Investigating the mechanism of transgenerational epigenetic inheritance	This project will use a selection of molecular biology techniques (eg PCR), biochemistry (eg protein expression, characterization, crystallisation) and genetic manipulations (eg CRISPR) to characterize genes involved in transgenerational epigenetic inheritance using the model organism C. elegans.	Alyson	Ashe	https://www.sydney.edu.au/science/about/our-people/academic-staff/alyson-ashe.html
The risk of disease spread by marine restoration strategies	Rehabilitation of marine urban sediments involves the reintroduction of burrowing animals once lost from these habitats. These activities, however, can pose a risk to the spread of common marine diseases. This project aims to evaluate the presence of common vectors of diseases in these animals.	Ana	Bugnot	https://www.sydney.edu.au/science/about/our-people/academic-staff/ana-bugnot.html
Diet x microbiome interactions in animal health	Our gut microbiome impacts health through its contribution to digestion and interaction with the enteric endocrine, lymphoid and nervous systems. Projects can be focussed on mechanisms through which diet can manipulate microbe outcomes or animal outcomes (immunometabolic functions).	Andrew	Holmes	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-holmes.html

Brumby Genetic Diversity	Apply cutting-edge genetic and genomic methodologies to better understand the genetic diversity of brumbies in Australia. This may include, but is not limited to: inbreeding estimation and the establishment of genetic lineages, as well as the identification of "risk genes" for certain health traits.	Brandon	Velie	https://www.equinegeneticsandgenomics.com/
Unraveling drug sensitivity in the horse – a genetic approach	Information pertaining to the genetic involvement of drug metabolism in horses is lacking. The aim of the current project is to identify genomic regions associated with sedative sensitivity in horses by combining state-of-the-art genomic technologies with deep knowledge of equine physiology.	Brandon	Velie	https://www.equinegeneticsandgenomics.com/
Gene editing to improve the flavour of food crops	CRISPR genome editing is now being used to develop novel plant products worldwide. Australia recently passed regulations that enable the commercialisation of products produced with CRISPR SDN-1 induced mutations. The Honours projects in our lab centre on metabolic engineering with CRISPR/Cas9 to produce novel market-oriented plant products.	Brian	Jones	https://www.sydney.edu.au/science/about/our-people/academic-staff/brian-jones.html
Biology of egg-laying and live birth in skinks	You will work on a lizard with an unusual reproductive strategy: both live-bearing and egg-laying. The projects will answer questions such as: Do oviparous and viviparous lizards interbreed? Has oviparity 're-evolved'? Suitable for students wishing to build their molecular biology skills.	Camilla	Whittington	www.camillawhittington.com
Investigation of chronic superficial keratitis (pannus) in Australian bred	Complete a mapping project that will identify a mutation or mutations that affect chronic superficial keratitis risk in the Australian racing Greyhound. The goal is to produce a genetic test to identify susceptible individuals before they breed and ideally to	Claire	Wade	https://www.sydney.edu.au/science/about/our-people/academic-staff/claire-wade.htmlnone

Greyhounds (2 students)	prevent the passing of the risk variants to progeny.			
Inheritance of Factor XI deficiency in the Finnish Spitz dog breed (1 student)	The Finnish Spitz breed has an emerging inherited Factor XI (Blood clotting) deficiency. Our team has been contacted by breeders in the USA who will provide genotyping arrays for animals in an affected pedigree. The aim is to create a genetic test for the condition	Claire	Wade	https://www.sydney.edu.au/science/about/our-people/academic-staff/claire-wade.html
Genomics of reproductive biology - 2 students	We have a discovery of a gene pathway that might impact seasonal reproductive biology in the canine. The goal of the wider project is to characterise our ability to manipulate seasonal reproduction in mammals via this pathway. This may have important global benefits in food security.	Claire	Wade	https://www.sydney.edu.au/science/about/our-people/academic-staff/claire-wade.html
Understanding antifungal drug synergy and antagonism	Description to come	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php
Safer, selective insecticides	In this project, you will investigate insect hormone receptors as targets for selective insecticides, comparing the receptors of pest and beneficial insects such as honey bees and their in-hive parasites. This project involves working with insects, molecular biology, genetics and biochemistry.	Emily	Remnant	https://www.sydney.edu.au/science/about/our-people/academic-staff/emily-remnant.html
Pandemic in the pacific: Honeybee virus dynamics during an early Varroa invasion.	In this project you will investigate the origins of a novel incursion of parasitic mites in honeybees in Fiji, and characterise the viral diversity transmitted from mites to bees over time as the invasion spreads. This project involves molecular biology, genomics and bioinformatics.	Emily	Remnant	https://www.sydney.edu.au/science/about/our-people/academic-staff/emily-remnant.html
Functional Genomics of	In this project we are using new unbiased functional genomics techniques to map out human factors required for SARS-CoV2	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php

SARS-CoV2 infection	infections. This project involves working both with modified human cell lines and human stem cell derived tissues.			
Mechanisms of actions for deadly toxins and venoms	We use whole genome CRISPR genome editing to identify the mechanisms of action for medically relevant drugs, environmental toxins, and deadly venoms. This project involves CRISPR genome editing and molecular biology, human cell culture including stem cell derived tissues, and animal work.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
A New cell death gene	We have evaluated all human genes for a role in resistance to 27 commonly used chemotherapies and identified new gene RDD1 (Required for Drug-induced Death 1) which we are characterizing. This project involves CRISPR genome editing, flow cytometry, microscopy, molecular biology, and transgenic mice.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
Human stem cell and organoid biology	We can generate most human organs (called organoids) in a dish, and use CRISPR to change the genetic code and learn how our genes contribute to disease. In this project you will apply these technologies to human brain development, human pain system, muscular dystrophy or wasting, or heart function.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
New pain therapies	Our goal is to develop new ways to treat pain that target the underlying cause and not just to treat the symptoms. In this project we use new genome editing (CRISPR) and genetic techniques to find genes and pathways that are necessary and sufficient to drive pain diseases.	Greg	Neely	http://sydney.edu.au/science/people/greg.neely.php
Understanding cell polarity in plants	Plants create some of the most striking architectures on earth and these shapes can also play a key role in crop production.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio

	This project uses live-imaging and molecular genetics to understand how plant cells coordinate their polarity, which determines growth rates and growth directions.			
The control of plant architecture by cell-type boundaries	Cell-type boundaries in plants play a central role in controlling both leaf formation and shape, both of which are important to crop production.This project utilises live-imaging and molecular genetics to understand how these boundaries work.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio
Characterisation of the novel hormone erusiolin	Erusiolin is a novel hormone we discovered that we hypothesise plays a role in appetite regulation. This project is to characterise the role of this hormone in mammalian physiology using human clinical trial samples, CRISPR knock-out mice, peptide injection experiments and bioinformatic analysis.	Mark	Larance	https://www.larancelab.com/
Genetic regulation of leaf shape	This project will investigate how an important group of transcription factors, homeodomain proteins, control plant development. You will have the opportunity to use and build skills in genetics, molecular biology and developmental biology.	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html
Using gene editing to study gene function in plants	This project will use gene editing to study gene function testing the potential to generate multiple mutations and to tag genes with a reporter to follow gene expression. You will have the opportunity to use and build skills in genetics, molecular biology and developmental biology.	Mary	Byrne	https://www.sydney.edu.au/science/about/our-people/academic-staff/mary-byrne.html
Synthetic biology tools for cyanobacteria	Synthetic biology promises to transform every aspect of our lives, from medicines to agriculture to industry. This project will develop new versatile cloning plasmids for gene expression in cyanobacteria - these	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html

	are especially interesting for biotechnology since they can use CO2 as a feedstock.			
Tracking antibiotic resistance genes and mobile genetic elements in the environment	Mobile genetic elements (MGEs) like integrons are at the heart of the antibiotic resistance problem. In this project, we will develop novel assays to probe the activity of integrons in different environmental compartments, to understand their contribution to the movement of resistance genes	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Green Chemistry - Biocatalysis For Production Of High-Value Chemicals	Biocatalysis aims to replace petrochemicals with microbial reactions on renewable feedstocks. We are interested in developing better expression systems for monooxygenases - these enzymes add oxygen to organic modules, yielding alcohols and epoxides, which are important for many industries.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Biodegradation of trifluralin - a persistent herbicide	Herbicides are widely used in agriculture to control weeds, but some (e.g. trifluralin) have toxic side-effects and can persist for a long time in soil. We have enriched a microbial culture that biodegrades trifluralin. The project will seek to identify the microbes, enzymes and genes responsible.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Plasmids found in Acinetobacter species	Plasmids found carrying antibiotic resistance genes in Acinetobacter species are quite different to those found in other Gram negative species. The project will examine how these novel plasmids replicate, if they can conjugate or can be mobilised and identify genes required for these processed.	Ruth	Hall	https://www.sydney.edu.au/science/about/our-people/academic-staff/ruth-hall.html
Quantitative cross-linking mass	This project will develop quantitative strategies for exploring the protein interactome in different models of disease	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html

spectrometry in bacterial or cardiovascular disease				
Exploring the nutritional requirements of Campylobacter jejuni infections	This project will explore how nutritional cues from human gut infection modify the *Campylobacter jejuni* proteome and metabolome	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Imaging transcription in real time at single molecule resolution	This project will use in vitro techniques in stem cells to study the molecular basis of transcription during cell fate decision. This will work take advantage of cutting edge approaches based on single molecule science, super resolution microscopy, genome editing (crispr/cas9), and genomics.	Mathias	Francois	https://www.centenary.org.au/cen_program/david-richmond-laboratory-for-cardiovascular-development-gene-regulation-and-editing-program/
Molecular and cellular biology of vascular development during embryogenesis	The biological question is centred around the molecular control of cell fate during lymphatic endothelial cell specification by a novel transcriptional effector. Techniques used will cover a broad range of skills from confocal microscopy to gene editing (crispr/cas9) and transcriptomics.	Mathias	Francois	https://www.centenary.org.au/cen_program/david-richmond-laboratory-for-cardiovascular-development-gene-regulation-and-editing-program/
The unseeing regulatory network of Acaryochloris marina, a chlorophyll d-containing cyanobacteria	Many non-coding RNA (ncRNA) were expressed without defined functions. It is clear now that they have a very important regulatory roles.In A. marina many ncRNAs were actively expressed under certain conditions. Using bioinformatics tools, we will predict targeting genes and regulatory networks.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.

Marine Science Honours Projects in 2021

Title	Description	Name	Surname	Contact
The capacity of oyster reefs to improve water quality	Oysters are the kidneys of coastal environments, but most of this important oyster habitats have been lost due to harvesting and contamination. This project aims to gather and combine published data in a meta-analysis on the role of oysters in regulating water quality.	Ana	Bugnot	https://www.sydney.edu.au/science/about/our-people/academic-staff/ana-bugnot.html
Characterizing bioturbation activity in sediments surrounding oyster reefs	Sediment burrowing animals (bioturbators) play key roles in the healthy functioning of marine sediments. This study will characterise the species living close to oyster reefs and assess their role in promoting nutrient cycling of oyster deposits.	Ana	Bugnot	https://www.sydney.edu.au/science/about/our-people/academic-staff/ana-bugnot.html
The biology of male pregnancy in seahorses	Several projects are possible, including those addressing: - Do seahorse dads transport amino acids to developing babies? - How do seahorse dads protect the babies from infection? These projects would suit students interested in fundamental biology/physiology.	Camilla	Whittington	www.camillawhittington.com
Physiology and behaviour of the marine crustacean Cirolana harfordi	The marine isopod Cirolana harfordi displays live birth, can venture, out onto land and, into hyposaline water. It is also a social animal and displays fearlessness in relation to predators. Various projects on the physiology and behaviour of this amazing animal are available.	Murray	Thomson	https://www.sydney.edu.au/science/about/our-people/academic-staff/murray-thomson.html

Does the environment or the genetics of the host drive plant-associated microbiomes?	Marine habitat-forming hosts such as kelps, seagrass and corals are surrounded by a soup of microbes – does the environment have a stronger influence on their microbiomes than their genetics/phenotype?	Ziggy	Marzinelli	https://www.sydney.edu.au/science/about/our-people/academic-staff/e-marzinelli.html
The role of facilitation in ecosystem restoration	Traditionally, marine restoration has focused on managing physical or biological factors that negatively influence restoration success. This project aims at harnessing positive interactions - particularly facilitation - to enhance the success of restoration of key coastal marine habitat-formers.	Ziggy	Marzinelli	https://www.sydney.edu.au/science/about/our-people/academic-staff/e-marzinelli.html
Underwater cows: marine herbivores and restoration of underwater forests	This project explores the multiple benefits of restoring marine underwater forests via the removal of herbivores and their potential use as a food resource. It involves field and aquarium experiments at the Sydney Institute of Marine Science.	Ziggy	Marzinelli	https://www.sydney.edu.au/science/about/our-people/academic-staff/e-marzinelli.html
Evaluating spatially variable patterns of 3D coral growth in the Coral Sea	The reefs of the Coral Sea are remote and exposed to numerous stressors. This project will use existing data to build 3D models of individual coral colonies from several different reefs to assess variability in structure and growth as it relates to environmental gradients.	Will	Figueira	https://www.sydney.edu.au/science/about/our-people/academic-staff/will-figueira.html
Evaluating demographic variability of fishes on remnant oyster reefs	Oyster reefs have declined rapidly around Australia over the past 100 years and various efforts are working to restore them. This project seeks to look at how reef characteristics affect fish demography and condition using otolith and lipid analysis of fish found on remnant reefs around Sydney.	Will	Figueira	https://www.sydney.edu.au/science/about/our-people/academic-staff/will-figueira.html
Evaluating factors driving the	Tropical fish settle seasonally to reefs around Sydney, typically dying out over	Will	Figueira	https://www.sydney.edu.au/science/about/our-people/academic-staff/will-figueira.html

recruitment and early settlement of tropical fishes into temperate habitats	the winter. This project will seek to characterize selective pressures on recruitment pulses of tropical fish throughout the season to better understand drivers of success.			

Microbiology Honours Projects in 2021

Title	Description	Name	Surname	Contact
Complex Systems Analysis - integrating microbiome and metabolome data for predicting health outcomes	Projects in this area are modelling/bioinformatic-focussed. They are based on data that we have previously generated in animal models and humans that includes matched datasets from microbiome, plasma metabolome and metabolic health outcomes.	Andrew	Holmes	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-holmes.html
Diet x microbiome interactions in animal health	Our gut microbiome impacts health through its contribution to digestion and interaction with the enteric endocrine, lymphoid and nervous systems. Projects can be focussed on mechanisms through which diet can manipulate microbe outcomes or animal outcomes (immunometabolic functions).	Andrew	Holmes	https://www.sydney.edu.au/science/about/our-people/academic-staff/andrew-holmes.html
Understanding antifungal drug synergy and antagonism	There is an urgent need for new antifungal therapies. We can use drug-drug synergy to improve existing antifungals, however occasionally the second drug causes antagonism.This study is to probe the molecular basis of synergistic and antagonistic responses using Q-PCR and probes for oxidative stress.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php
Micro-cell variants in the yeast pathogen Cryptococcus and their role in infection	Micro-cells occur in Cryptococcus during human infection stress. In this project we will determine 1) what triggers microcell production; 2) whether the number of micro-cells changes over time during the growth phase of cultures; 3) whether micro-cells are are capable of reverting to normal cells.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php
The production of morphologically	Growth in the mammalian host can be stressful for fungal pathogens.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php

altered Cryptococcus cells in response to stress	Cryptococcus can respond by developing unusual cellular morphologies that may allow dormant survival. We will examine these in detail using microscopy, microbiological growth dynamics, cellular probes and molecular methods.			
The use of cold plasma to kill viruses and fungi	Cold plasma uses high voltage electricity to generate reactive species and kill microbial pathogens. In this project we will determine if cold plasma can deactivate surrogate norovirus, coronavirus and Candida auris.This study aims to improve safety and reduce waste waste in food and medicine.	Dee	Carter	http://sydney.edu.au/science/people/dee.carter.php
Characterizing how plants interact with soil bacteria to mobilize soil sulfur	Both plants and microbes need sulfur (S) for growth, but only microbes can mobilize the organically bound sulfur found in soil. The project will characterize how signal molecules released by plant roots can stimulate soil bacteria to release more organic soil S for plants to use.	Michael	Kertesz	https://www.sydney.edu.au/science/about/our-people/academic-staff/michael-kertesz.html
Molecular biomarkers -a crystal ball for compost quality?	Microbial activity is the key to making mushroom compost that will produce great mushroom yields and quality. But which microbes are essential? The project will examine different stages of composting to identify microbial biomarkers at that can be used to optimize crop yield and quality.	Michael	Kertesz	https://www.sydney.edu.au/science/about/our-people/academic-staff/michael-kertesz.html
Investigating the role of bacteria in growing oyster mushrooms	Oyster mushrooms can be grown on many different substrates, including straw, spent coffee grounds and paper waste. Bacteria colonize the substrate together with the mushroom mycelium. The project will study the succession of bacterial diversity during mushroom growth on different substrates.	Michael	Kertesz	https://www.sydney.edu.au/science/about/our-people/academic-staff/michael-kertesz.html
Optimizing Nitrogen content in cultivated	Button mushrooms are grown in a selective compost, using chicken manure and soy-based supplements to provide the nitrogen	Michael	Kertesz	https://www.sydney.edu.au/science/about/our-people/academic-staff/michael-kertesz.html

button mushrooms	(N) needed for mushroom growth. The project will investigate alternative N sources, studying their effect on the microbes in the compost, and on mushroom yield and N content.			
Molecular mechanisms of antibiotic resistance evolution in a bacterial superbug	Strains of Staphylococcus aureus ("Golden Staph") that are resistant to antibiotics are a major health problem around the world. This project will use molecular methods to investigate the genes and proteins that enable plasmids to efficiently transmit resistance genes between bacterial strains.	Neville	Firth	https://www.sydney.edu.au/science/about/our-people/academic-staff/neville-firth.html
Synthetic biology tools for cyanobacteria	Synthetic biology promises to transform every aspect of our lives, from medicines to agriculture to industry. This project will develop new versatile cloning plasmids for gene expression in cyanobacteria - these are especially interesting for biotechnology since they can use CO2 as a feedstock.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Tracking antibiotic resistance genes and mobile genetic elements in the environment	Mobile genetic elements (MGEs) like integrons are at the heart of the antibiotic resistance problem. In this project, we will develop novel assays to probe the activity of integrons in different environmental compartments, to understand their contribution to the movement of resistance genes	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Green Chemistry - Biocatalysis For Production Of High-Value Chemicals	Biocatalysis aims to replace petrochemicals with microbial reactions on renewable feedstocks. We are interested in developing better expression systems for monooxygenases - these enzymes add oxygen to organic modules, yielding alcohols and epoxides, which are important for many industries.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html

Biodegradation of trifluralin - a persistent herbicide	Herbicides are widely used in agriculture to control weeds, but some (e.g. trifluralin) have toxic side-effects and can persist for a long time in soil. We have enriched a microbial culture that biodegrades trifluralin. The project will seek to identify the microbes, enzymes and genes responsible.	Nick	Coleman	https://www.sydney.edu.au/science/about/our-people/academic-staff/nicholas-coleman.html
Synthesis and regulation of bacterial surface polysaccharides (BSPs)	BSPs protect from host defences, but are also antigens detected by the host, making them useful vaccine targets. We are a leading group using molecular biology techniques to study how BSPs are made, and how synthesis is regulated. The project allows choice in strategies to be used	Peter	Reeves	https://www.sydney.edu.au/science/about/our-people/academic-staff/peter-reeves-169.html
Investigate presence of pathogenic E. coli in healthy human intestines.	We have a novel technique for identification of E. coli strains in the human gut, which has detected many potential pathogens in healthy people. A detailed genomic analysis is needed to compare the isolates with known pathogens, to determine their virulence capabilities.	Peter	Reeves	https://www.sydney.edu.au/science/about/our-people/academic-staff/peter-reeves-169.html
How do insertion sequences mobilise antibiotic resistance genes	IS in the IS26 family mobilise antibiotic resistance genes. We recently demonstrated that they undertake a novel reaction that may explain their success. The project will examine whether IS in other families found associated with antibiotic resistance genes can undertake the same type of reaction.	Ruth	Hall	https://www.sydney.edu.au/science/about/our-people/academic-staff/ruth-hall.html
Plasmids found in Acinetobacter species	Plasmids found carrying antibiotic resistance genes in Acinetobacter species are quite different to those found in other Gram negative species. The project will examine how these novel plasmids replicate, if they can conjugate or can be	Ruth	Hall	https://www.sydney.edu.au/science/about/our-people/academic-staff/ruth-hall.html

	mobilised and identify genes required for these processed.			
Resistance genomics in Acinetobacter baumannii	Assemble and annotate the draft genomes of multiply antibiotic resistant Acinetobacter baumannii and study their relationships to one another and to published genomes, evolution and global spread using a range of bioinformatic tools that enable resistance gene prediction, phylogenetic analysis etc.	Ruth	Hall	https://www.sydney.edu.au/science/about/our-people/academic-staff/ruth-hall.html
Exploring the nutritional requirements of Campylobacter jejuni infections	This project will explore how nutritional cues from human gut infection modify the Campylobacter jejuni proteome and metabolome	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Novel virulence factors of Pseudomonas aeruginosa required for cystic fibrosis lung infection	This project will explore the effects of novel virulence factor gene deletions on Pseudomonas aeruginosa phenotypes and omics profiles	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Exploring the role of N-glycosylation in Campylobacter jejuni	This project will explore the role of N-glycosylation in protection against Campylobacter jejuni proteases	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Investigating potential vaccine antigens of Pseudomonas aeruginosa	This project will investigate the protective capabilities of Pseudomonas aeruginosa antigens in mouse models of cystic fibrosis lung disease	Stuart	Cordwell	https://www.sydney.edu.au/science/about/our-people/academic-staff/stuart-cordwell.html
Induction of of fibrosis by SARS-CoV-2	SARS-CoV-2 is able to cause severe lung injury through the process of fibrotic injury. This project will examine the mechanisms by signalling by the TGF-b pathway may contribute to this phenomenon and evaluate this pathway as a drug target.	Tim	Newsome	https://www.sydney.edu.au/science/about/our-people/academic-staff/timothy-newsome.html

The effect of iron on the photosynthetic apparatus and chlorophyll biosynthetic pathway	Iron is the most abundant transition metal and plays the essential role in the redox reaction of electron transport. Some cyanobacteria have evolved a number of responses to cope with the conditions of iron deficiency, including the changed photosynthetic apparatus to propose new energy pathways.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.html
Molecular adaptation of photosynthesis powered by long-wavelength light	The project aims to study the structure and function of photopigment-binding protein complexes, which can be controlled in desired light and nutrient conditions. The research outcome will provide a molecular blueprint for the adaptation of photosynthesis with optimized energy transfer pathway.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.html
The unseeing regulatory network of Acaryochloris marina, a chlorophyll d-containing cyanobacteria	Many non-coding RNA (ncRNA) were expressed without defined functions. It is clear now that they have a very important regulatory roles.In A. marina many ncRNAs were actively expressed under certain conditions. Using bioinformatics tools, we will predict targeting genes and regulatory networks.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.html

Quantitative Life Sciences Projects in 2021

Title	Description	Name	Surname	Contact
Understanding cell polarity in plants	Plants create some of the most striking architectures on earth and these shapes can also play a key role in crop production. This project uses live-imaging and molecular genetics to understand how plant cells coordinate their polarity, which determines growth rates and growth directions.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio
The control of plant architecture by cell-type boundaries	Cell-type boundaries in plants play a central role in controlling both leaf formation and shape, both of which are important to crop production. This project utilises live-imaging and molecular genetics to understand how these boundaries work.	Marcus	Heisler	https://www.sydney.edu.au/science/about/our-people/academic-staff/marcus-heisler.html#collapseBio
Systems proteomics of the intermittent fasting response	Intermittent fasting provides metabolic benefits. But how the proteome in each tissue is altered is not fully understood. Our goal is to use state-of-the-art proteomic analysis to uncover the complex interaction between organ systems that leads to the beneficial effects of intermittent fasting.	Mark	Larance	https://www.larancelab.com/
Characterisation of the novel hormone erusiolin	Erusiolin is a novel hormone we discovered that we hypothesise plays a role in appetite regulation. This project is to characterise the role of this hormone in mammalian physiology using human clinical trial samples, CRISPR knock-out mice, peptide injection experiments and bioinformatic analysis.	Mark	Larance	https://www.larancelab.com/

Understanding correlations in dendritic systems	Stream/river networks are dendritic in nature. Spacetime models used to predict biological, physical and/or chemical variables are currently do not this dendritic correlation structure. This project will explore these correlations and incorporate them in a modeling framework.	Floris	van Ogtrop	https://www.sydney.edu.au/science/about/our-people/academic-staff/floris-vanogtrop.html
The unseeing regulatory network of Acaryochloris marina, a chlorophyll d-containing cyanobacteria	Many non-coding RNA (ncRNA) were expressed without defined functions. It is clear now that they have a very important regulatory roles.In A. marina many ncRNAs were actively expressed under certain conditions. Using bioinformatics tools, we will predict targeting genes and regulatory networks.	Min	Chen	https://www.sydney.edu.au/science/about/our-people/academic-staff/min-chen.htmlLinks to an external site.