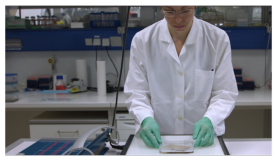




BACHELOR OF SCIENCE - HONOURS
Medical, Molecular & Forensic Sciences

How do I apply for Honours?
You can apply online at the following link:
https://www.murdoch.edu.au/study/how-to-apply/apply-to-murdoch

You can also contact Honours Support by emailing:
college.honours@murdoch.edu.au

You can apply during the last semester of your undergraduate degree or after graduating. There is no time limit on when you can return to do Honours after completing your undergraduate degree.

What is the deadline for applications?
You can commence your Honours study in either Semester 1 or Semester 2. Course work for the required skills units VLS683 begins in O-week of your commencing semester. For this reason, applications should be submitted at least 6 weeks before the start of semester to allow time to process. Applications after this time may be accepted but please contact the Honours Chair prior to submission.

How do I find a supervisor and project?
Contact members of MU academic staff in your area of interest to enquire about available projects. There is information on staff research interests and potential project opportunities at https://www.murdoch.edu.au/study/study-levels/honours/honours-opportunities.
You can also complete your Honours study with an external supervisor at one of the many research institutes around Perth – contact your Honours Chair if you are interested in this option.

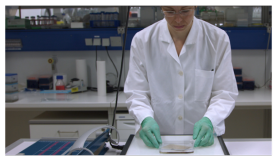
When will I hear if my application has been accepted?
Generally, you will receive an offer of admission within 2-3 weeks of submitting your application. However, if you are awaiting results you will not receive an offer until your results have been finalised.

What is the commencement dates for the 2023 Honours program?
Semester 1: Monday 20th February 2023 (O-week)
Semester 2: Monday 24th July 2023 (O-week).
The Honours induction for both semesters will run on the first day of O-week in the mandatory VLS683 unit.

Skills Unit: VLS683
Students are required to complete and pass the mandatory skill unit, VLS683 in the first semester of their honours study. Check details in the Handbook for VLS683 for your semester:
https://handbook.murdoch.edu.au/units/19/VLS683

Is there any funding available to support my Honours project?
Students enrolled in Honours are allocated maintenance funding to directly support their project. These funds can be used to help meet research costs such as consumables, field costs etc.





Are there scholarships available for Honours?
There are a number of scholarships available for Honours. Information about scholarships can be found at:
https://www.murdoch.edu.au/study/scholarships/scholarship-finder

You can also speak with the Scholarships Office staff for additional advice.

Further questions?
You can contact the Honours Chairs (contact details below), Honours Coordinator, Kumar Perumal at college.honours@murdoch.edu.au or on 9360 7659.

Honours Academic Chairs for MMFS:

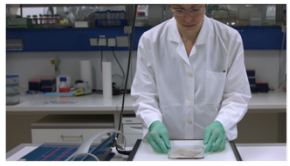
Dr Andrew Currie
A.Currie@murdoch.edu.au
9360 7426

BIOMEDICAL SCIENCE
VETERINARY BIOLOGY

Dr Jason Terpolilli
J.Terpolilli@murdoch.edu.au
9360 6104

MOLECULAR BIOLOGY
CROP AND PASTURE SCIENCE
FORENSIC BIOLOGY AND TOXICOLOGY





Murdoch University

Research opportunity:	Honours	x	Masters		PhD	
Project title:	Diversity in Numbers					

Short project description & main objectives: Poor numeracy/quantitative skills (QS) development is a widespread issue across Australian tertiary education institutions. Lack of fundamental QS can impede students' progression in STEM degrees, and disadvantage individual students across other domains of life (e.g., financial literacy and active citizenship). A review of science programs across 13 Australian universities reveals surprising consistency in how QS are, or are not, taught. At most institutions, QS were explicitly taught in one core 100-level unit and in 1-3 units later in the degree.

This project evaluates an alternative curricula model for numeracy skills development: the course wide implementation of online, feedback-rich, numeracy modules, available to students for the duration of their degree to promote ongoing QS development in undergraduate STEM cohorts. Pilot modules have been developed, and more are in development, each focusing on a core QS concept (e.g., measures of central tendency, statistical testing, unit conversions).. Articles are chosen to expand student awareness of the diversity of the global population, and to illustrate how QS enhance understandings of the world. The DiN modules have built-in active learning exercises, with interactive content and rich automated feedback to maximise learning. This Australian Council of Deans of Science funded project will use qualitative and quantitative methods to evaluate the design and impact of DiN modules, guided by the following research questions:

Do QS modules, tailored to unit content, and scaffolded through an undergraduate degree:
1. Improve student confidence and/or mastery of core numeracy skills and concepts?
2. Reduce student anxiety associated with numeracy skills and concepts?
3. Promote increased student awareness of QS as a tool to explore global diversity

Principal supervisor:	Dr Sarah Etherington
Other supervisors:	*To be confirmed* A/Prof Natalie Warburton Dr Shu Hui Koh A/Prof Garth Maker
Contact details for further information:	s.etherington@murdoch.edu.au
Closing date for applications:	N/A
Start & finish date of project:	Ongoing
Available part-time?	Yes
Available to international students?	Yes

If applicable:

Research centre/group:	
Desired background of applicants:	
Additional funding/scholarship provided:	
Other benefits:	The education sector is the main employer of science graduates nationally, though science graduates rarely consider education (in a broader context, beyond the school environment), as something they may have interest in or aptitude for. Students completing this project will graduate with an understanding of the theory of science education, as well as gaining transferable skills in qualitative research.
Extra Comments:	

Research opportunity:	Honours	x	Masters	x	PhD	x
Project title:	Imaging the effects of magnetic fields on oligodendrocytes.					

Short project description & main objectives: A key neuropathological feature of multiple sclerosis (MS) is the death of oligodendrocytes (OLs), the myelinating cells in the brain and spinal cord that are crucial for normal brain activity. Recent preclinical research by the CIs identified repetitive transcranial magnetic stimulation (rTMS) as a putative therapy for improving the survival and maturation of newborn OLs [1] and encouraging remyelination by new and surviving OLs [2]. These data have resulted in our completed phase I and current phase II clinical trials of rTMS in people with MS. However, the mechanism by which rTMS affects OL health and repair remains unclear.

Our team recently found that repetitive magnetic stimulation in vitro (rMS – no cranium) reduces the inflammatory properties of astrocytes, suggesting that rTMS may have an indirect effect on OLs – acting instead on astrocytes and influencing astrocytic signalling. This incubator grant application aims to carry out preclinical experiments to explore this new hypothesis and elucidate the mechanisms whereby rTMS promotes the survival of and myelination by OLs. We use an in vitro approach to specifically dissect the direct and indirect effects of rTMS on OLs. A better understanding of the distinct effects of rTMS on different brain cell types, and how these effects interact to promote OL survival and myelination will guide the design and optimisation of treatment parameters to improve outcomes for people with MS.

The overall aim of the project is to characterise the direct and indirect effects of rMS on OLs, and to determine if these effects, separately or together, can prevent OL death following a reactive oxygen species challenge.

1. Investigate the direct effects of rMS stimulation on OL survival and maturation

    Enriched cultures of OLs will be stimulated with rMS. We will image immediate changes in calcium levels and quantify subsequent OL survival and maturation.

2. Investigate the effects of rMS stimulation of astrocytes on OL survival and maturation (indirect effects).

    Enriched cultures of astrocytes will be stimulated with rMS and the culture media collected 20 minutes later containing secreted molecules. This conditioned media will be applied to enriched cultures of differentiating OPCs. We will image immediate changes in calcium levels and quantify subsequent OL survival and maturation.

3. Investigate the protective nature of the intrinsic and extrinsic effects of rMS on OL survival in injury models mimicking MS

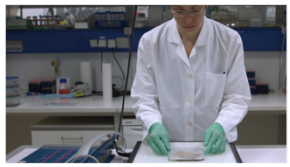
    Enriched cultures of OLs will be pre- treated with rMS, astrocyte conditioned media, or both. One day later, cultures will be challenged with hydrogen peroxide (H2O2), which models the elevated levels of reactive oxidant species found in MS autoimmune attacks. One day after the challenge, the cultures will be fixed and stained to assess OL differentiation and maturation. The number of surviving OLs will be compared between the treatment groups.

1. Cullen CL, Pepper RE, Clutterbuck MT, Pitman KA, Oorschot V, Auderset L, Tang AD, Ramm G, Emery B, Rodger J, Jolivet RB, Young KM. Periaxonal and nodal plasticity modulate action potential conduction in the adult mouse brain. Cell Reports 2021 Jan 19;34(3):108641. doi: 10.1016/j.celrep.2020.108641.

2. Cullen CL, Senesi M, Tang AD, Clutterbuck MT, O'Rourke ME, Auderset L, Rodger J and Young KM. Low intensity transcranial magnetic stimulation promotes the survival and maturation of newborn oligodendrocytes in the adult mouse brain. Glia. 2019 Aug;67(8):1462-1477. doi: 10.1002/glia.23620.

Principal supervisor:	Dr Sarah Etherington
Other supervisors:	Associate Professor Jennifer Rodger (Perron Institute) Additional supervisors TBA
Contact details for further information:	s.etherington@murdoch.edu.au
Closing date for applications:	N/A
Start & finish date of project:	Ongoing
Available part-time?	By arrangement only
Available to international students?	Yes



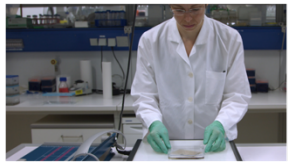


Murdoch University

If applicable:

Research centre/group:	
Desired background of applicants:	
Additional funding/scholarship provided:	
Other benefits:	
Extra Comments:	This project is a collaboration between Murdoch and the Perron Institute. Laboratory work will be conducted on-site at Perron (Nedlands).



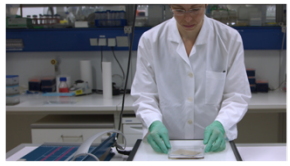


Research opportunity:	Honours	x	Masters		PhD	
Project title:	The impact of a Core Concepts approach on undergraduate physiology education.					
Short project description & main objectives: This project will evaluate the value and student experience of interactive, online, Physiology Core Concepts modules. These modules were developed with funding from The Physiological Society (UK) and will be evaluated using quantitative data obtained from online unit analytics as well as focus groups with students and academic staff at different institutions.						
Principal supervisor:	Dr Sarah Etherington					
Other supervisors:	*TBA*					
Contact details for further information:	s.etherington@murdoch.edu.au					
Closing date for applications:	N/A					
Start & finish date of project:	Ongoing					
Available part-time?	Yes					
Available to international students?	Yes					

If applicable:

Research centre/group:	
Desired background of applicants:	
Additional funding/scholarship provided:	
Other benefits:	The education sector is the main employer of science graduates nationally, though science graduates rarely consider education (in a broader context, beyond the school environment), as something they may have interest in or aptitude for. Students completing this project will graduate with an understanding of the theory of science education, as well as gaining transferable skills in qualitative research.
Extra Comments:	





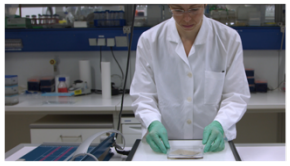
Research opportunity:	Honours	X	Masters	X	PhD	
Project title:	A case study: Genotyping and characterisation of an early onset motor neuron disease patient					
Short project description & main objectives: Motor neuron disease (MND) is a complex and fatal neurodegenerative disorder. Over 50 genes have been associated with MND risk. We have a local Peth patient who has been diagnosed with early onset MND and has donated DNA and skin cells for our research. **In this project,** we will undertake whole genome sequencing to find and characterize this patient's MND genotype. We will also use cultured cells from this patient to investigate biomarkers of their MND phenotype, in order to elucidate their unique disease pathology. These findings will determine which current treatment options are suitable for this patient and inform our design of novel antisense therapeutics.						

Principal supervisor:	Dr Ianthe Pitout
Other supervisors:	Profs Sue Fletcher, Anthony Akkari Mr Leon Larcher, Dr Sarah Rea
Contact details for further information:	I.pitout@murdoch.edu.au
Closing date for applications:	Closing date for honours
Start & finish date of project:	Mid-year 2023 – mid-year 2024
Available part-time?	possibly
Available to international students?	N/A

If applicable:

Research centre/group:	Centre for Molecular Medicine and Innovative therapeutics
Desired background of applicants:	Molecular biology, cell biology
Additional funding/scholarship provided:	Project consumables are funded
Other benefits:	Working within the centre that was integral to the development of the first genetic therapies for Duchenne's muscular dystrophy, and a NATA-accredited laboratory. Thus ensuring excellence in training and available mentorship.
Extra Comments:	Cell culture maintenance of cell lines, DNA and protein extractions, PCR and Sanger sequencing, bioinformatics analysis, agarose and SDS polyacrylamide electrophoresis, western blots, immunocytochemistry, confocal microscopy, cell viability and mitochondrial function assays, data analysis using ImageJ and SPSS





Research opportunity:	Honours	X	Masters	X	PhD	
Project title:	Generating an inducible cell model that enables constitutive activation of the cell's protein degradation pathway					

Short project description & main objectives: Most neurodegenerative diseases are characterised by the build up of toxic insoluble proteins that impair key cellular processes leading to neuronal dysfunction and death. In the pathobiology of neurodegeneration, autophagy, the garbage disposal pathway of the cell, is often impaired in vulnerable neurons. This results in a failure to clear insoluble proteins from the cytoplasm, leading to further cellular dysfunction.

We have designed a novel drug candidate targeting the autophagy pathway that is applicable to most neurodegenerative diseases. In order to validate our therapeutic approach, we require mechanistic studies of our target protein, the autophagy pathway and clearance of toxic insoluble proteins. **Therefore, in this study**, we will generate stable cell lines in HEK293 cells, using plasmids, to enable constitutive activation of the autophagy pathway and perform mechanistic studies to show the degradation of insoluble proteins in our cell model.

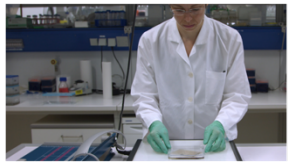
This basic research project is an important component of a broader drug development program for neurodegenerative diseases. Results from these cell based studies will lay the ground work for generating a mouse model to provide supporting evidence for the preclinical development of our novel drug candidate for neurodegenerative diseases.

Principal supervisor:	Dr Ianthe Pitout
Other supervisors:	Dr Sarah Rea, Professor Fletcher, Ms Alanis Lima, Ms Anna Mehdizadeh
Contact details for further information:	I.pitout@murdoch.edu.au
Closing date for applications:	Closing date for honours
Start & finish date of project:	Mid-year 2023 – mid-year 2024
Available part-time?	possibly
Available to international students?	N/A

If applicable:

Research centre/group:	Centre for Molecular Medicine and Innovative therapeutics
Desired background of applicants:	Molecular biology, cell biology
Additional funding/scholarship provided:	Project consumables are funded
Other benefits:	Working within the centre that was integral to the development of the first genetic therapies for Duchenne's muscular dystrophy, and a NATA-accredited laboratory. Thus ensuring excellence in training and available mentorship.
Extra Comments:	Cell culture maintenance of cell lines. DNA and protein extractions, PCR and Sanger sequencing analysis, agarose and SDS polyacrylamide electrophoresis, western blots, immunocytochemistry, confocal microscopy, cell viability and mitochondrial function assays, data analysis using ImageJ and SPSS.





Murdoch University

Research opportunity:	Honours	X	Masters		PhD	
Project title:	A combined radiotherapy and ferroptotic approach to treating mesothelioma					

Short project description & main objectives:

Cancer cells have developed many strategies to avoid being killed by both the host immune system and by cytotoxic assaults, such as chemotherapy and radiotherapy. Many studies have examined how cancer cells develop resistance to programmed cell death pathways such as apoptosis, and to the newly described ferroptopic pathway.

Ferroptosis is a form of regulated cell death caused by reactive oxygen species and associated with iron accumulation and lipid peroxidation. Ferroptosis is precisely regulated at multiple levels, including epigenetic, transcriptional, posttranscriptional and posttranslational layers. Recently, it was shown that ferroptosis plays a crucial role in radiotherapy-induced cell death. Radiotherapy kills tumour cells by both directly inducing DNA damage and by generating reactive oxygen species (ROS). Thus resistance to ferroptosis and insensitivity to radiotherapy are intrinsically linked.

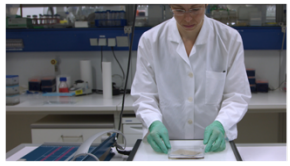
Our laboarotry at the National Centre for Asbestos Related disease focuses on mesothelioma, a uniformally fatal malignancy associated with asbestos exposure. The median survival for patients following diagnosis is approximately 12 months with only 5% surviving to 5 years. Mesothelioma is well recognised as being refractory to treatment and even the majority of patietns do not respond to the recently adopted checkpoint inhibitor (ICI) immunotherapy. In this project we will use our established and well characterised mesothelioma models to the therapeutic implications of targeting ferroptosis to overcome tumour radioresistance, the possibility of using ferroptosis regulators as potential predictive markers for radiotherapy efficacy, and the relevance of ferroptosis to radiotherapy combined with immunotherapy.

Principal supervisor:	Jenette Creaney
Other supervisors:	Alistair Cook
Contact details for further information:	Jenette.creaney@uwa.edu.au
Closing date for applications:	Honours July 2023 program
Start & finish date of project:	
Available part-time?	No
Available to international students?	

If applicable:

Research centre/group:	
Desired background of applicants:	
Additional funding/scholarship provided:	
Other benefits:	
Extra Comments:	





Murdoch University

Research opportunity:	Honours	x	Masters		PhD	x
Project title:	Repurposing anti-copper drugs to improve mesothelioma immunotherapy					

Short project description & main objectives:

Mesothelioma is an incurable cancer. While new therapies that increase anti-cancer immune responses have shown promise, most patients do not benefit from immunotherapy.

Metals such as copper accumulate in mesothelioma, are essential for tumour growth and help cancers evade the immune response. Using copper-binding drugs, we aim to reduce the copper available to the cancer, and understand how it improves the function of anti-cancer immune cells. We will investigate the changes in gene and protein expression of tumour cells in response to copper and copper chelation therapy. Additionally we will characterise the effect of treatments on immune cell (Tcells and macrophages) activity in-vitro. We will assess Tcell mediated killing of tumour cells using in-vitro coculture assays in the presence of copper chelation therapies. Finally, we will determine the activity of copper chelation therapies in-vivo, and their effect on the tumor microenvironment.

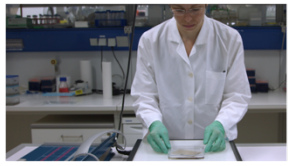
As these copper-binders are clinically approved for use in other diseases, they are novel drugs that can be repurposed to improve immunotherapies for patients with mesothelioma

Principal supervisor:	Kofi Stevens
Other supervisors:	Jonathan Chee Andrew Crowe Delia Nelson
Contact details for further information:	Jonathan.chee@uwa.edu.au
Closing date for applications:	
Start & finish date of project:	
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Institute for Respiratory Health
Desired background of applicants:	Interest in immunology and cancer biology
Additional funding/scholarship provided:	
Other benefits:	Travel to UNSW for collaborative work
Extra Comments:	





Research opportunity:	Honours	X	Masters	X	PhD	
Project title:	Characterising the physical characteristics of immune-fibroblast cell interaction within the fibrotic lung					

Short project description & main objectives:

Idiopathic pulmonary fibrosis (IPF) is an aggressive interstitial lung disease with no cure and a mean survival of three years from diagnosis. The drugs pirfenidone and nintedanib have improved the quality of life for a small proportion of patients with IPF but has had little effect on survival. Thus, the need to identify new treatment remains. Our laboratory and others have shown that the immune environment, and in particular B cells play an important role in fibrosis. We have shown B cell accumulation at sites of fibrosis, i.e. within the fibrotic foci, discrete sites of lung injury, repair, and fibrogenesis. The cell-cell and cell-matrix interaction within fibrotic foci are not well understood but it is clear that these interactions are important in defining cell function. Current *in vivo* and *in vitro* lab-based models of fibrosis while useful, are not able to recapitulate the complexity of IPF in humans. In this study we will characterise the human lung fibrotic foci. We will using immunohistochemistry and image analysis to develop a 3D model of the IPF fibrotic foci and measure the spatial characteristics of cells and matrix within it. This analysis will be performed on upto 12 foci and these data will be used in future studies to develop a biological model of the human fibrotic lung for future *in silico* drug testing analysis.

The project will involve the following activities.

- Preparation tissues for immunohistochemistry
- 3D Image analysis and quantification

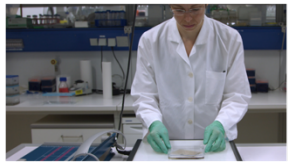
This project will be conducted in the Institute for Respiratory Health Laboratories, which are located within the Perkins North research builiding in Nedlands.

Principal supervisor:	A/Prof Cecilia Prêle
Other supervisors:	Prof Bruce Gardiner A/Prof Steven Mutsaers
Contact details for further information:	cecilia.prele@murdoch.edu.au
Closing date for applications:	30 June
Start & finish date of project:	1 yr
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Tissue Repair Group, Institute for Respiratory Health
Desired background of applicants:	Biomedical Science, Laboratory Medicine, Maths
Additional funding/scholarship provided:	Yes – Consumable budget available
Other benefits:	
Extra Comments:	





Research opportunity:	Honours	X	Masters	X	PhD	X
Project title:	Fornesic Hair Proteomics- Using genetically variant peptides to identify individuals					

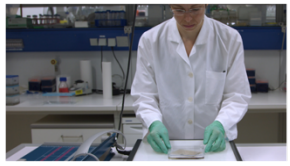
Short project description & main objectives:
GVPs have been shown to compliment forensic DNA as a method of identifying an individual from hair shafts found at crime scenes as these are often limited in nuclear DNA. This project is a multi-million dollar collaboration with WA forensic agencies (WA Police, ChemCentre and PathWest) to develop a GVP assay for australian use. It can be hons/masters but prospective students must be willing to continue the project into a PhD. A PhD Scholarship will be included in the project with potential for additional top up depending on the candidate. More about the concept can be found here- https://link.springer.com/article/10.1007/s00414-023-02955-w

Principal supervisor:	Brendan Chapman
Other supervisors:	ChemCentre, PathWest
Contact details for further information:	Brendan.chapman@murdoch.edu.au
Closing date for applications:	30 June
Start & finish date of project:	4yrs
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Forensic Analysis: High Resolution Trace DNAS Lab (Chapman)
Desired background of applicants:	Molecualr Biology/FBT/Other relevant
Additional funding/scholarship provided:	Yes- PhD scholarship +/- top up
Other benefits:	Industry exposure and almost certain employment upon completion of PhD
Extra Comments:	





Research opportunity:	Honours	X	Masters	X	PhD	X
Project title:	The role of checkpoint molecules in lung fibrosis					

Short project description & main objectives:

Idiopathic pulmonary fibrosis (IPF) is an aggressive interstitial lung disease with no cure and a mean survival of three years from diagnosis. The drugs Pirfenidone and Nintedanib have improved the quality of life for a small proportion of patients with IPF but has had little effect on survival. Our group has pioneered studies identifying the Programmed Death-1 (PD-1) and its ligand (PD-L1) as key drivers of fibrosis. We have also shown the importance of the transcription factor STAT3 in PD-1/PD-L1-induced fibrosis but how they interact is unclear. PD-1 and PD-L1 inhibitors have revolutionised cancer immunotherapy with most successful treatments using combinations of PD-1/PD-L1 inhibitors with inhibitors of growth factor and cytokine signalling. In this study we will use human IPF and control cells and a mouse lung fibrosis model to examine 1. How PD-1/PD-L1 interact with STAT3 to drive fibrosis and 2. Determine if pirfenidone or nintedanib (inhibitors of growth factor and cytokine signalling) combined with PD-1/PD-L1 inhibitors will be more effective in reducing lung fibrosis than pirfenidone and nintedanib alone.

The project will involve the following activities.

- Preparation of cells and tissues for immunocyto/histochemistry
- Preparation of cells for RNA isolation and real time PCR
- Preparation of cells for protein isolation and western blot analysis
- Cell function assays
- Animal models

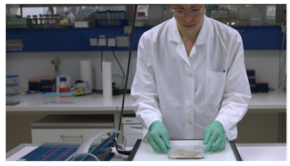
This project will be conducted in the Institute for Respiartory Health Laboratories, which are located within the Perkins North research builiding in Nedland and the Auditory Neuroscience Laboratory at UWA.

Principal supervisor:	A/Prof Steven Mutsaers
Other supervisors:	A/Prof Cecilia Prêle
Contact details for further information:	cecilia.prele@murdoch.edu.au or steven.mutsaers@uwa.edu.au
Closing date for applications:	30 June
Start & finish date of project:	1-4yrs (depending whether Hons, MSc or PhD)
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Tissue Repair Group, Institute for Respiratory Health
Desired background of applicants:	Biomedical Science, Laboratory Medicine, Neuroscience
Additional funding/scholarship provided:	Yes – Consumable budget available PhD students will have to apply for a PhD scholarship. PhD students also have the opportunity external PhD top up Scholarships.
Other benefits:	
Extra Comments:	**This project is suitable for Hons and Masters or can be extended for PhD**





Research opportunity:	Honours	X	Masters	X	PhD	X
Project title:	Modelling and regulating extracellular matrix deposition in the inner ear					

Short project description & main objectives:

Fibrosis in the inner ear can occur following surgery and as a complication of infection. Local tissue responses to cochlear implants can result in the formation of a fibrotic barrier between the electrode and the target neurons, causing loss of residual hearing and function of the implant. In patients with meningitis, cochlear fibrosis and subsequent ossification profoundly limits the capacity for cochlear implantation, which can also adversely affect hearing outcomes.

In this study we will examine the efficacy of anti-fibrotic drugs in regulating extracellular matrix protein deposition by inner ear fibroblasts. Dose response curves will be performed and the effect of drug treatment of TGFB-induced, SMAD, MAPK and PI3K pathway activation will be confirmed by western blot. The effects of drug treatment on inner ear fibroblast cell proliferation, differentiation and ECM protein deposition by inner ear fibroblasts confirmed using *in vitro* assays.

The project will involve the following activities.

- Preparation of cells and tissues for immunocyto/histochemistry
- Preparation of cells for RNA isolation and real time PCR
- Preparation of cells for protein isolation and western blot analysis
- Cell function assays
- Confocal laser scanning microscopy
- Analysis and interpretation of data generated using image analysis techniques

This project will be conducted in the Institute for Respiartory Health Laboratories, which are located within the Perkins North research builiding in Nedland and the Auditory Neuroscience Laboratory at UWA.

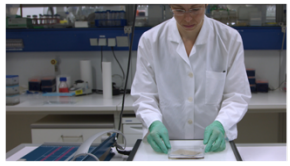
Please note that several potential projects exist within this broad programme of research and we welcome all enquires.

Principal supervisor:	A/Prof Cecilia Prêle
Other supervisors:	A/Prof Wilhelmina Mulders Dr Tylah Miles
Contact details for further information:	cecilia.prele@murdoch.edu.au
Closing date for applications:	30 June
Start & finish date of project:	1-4yrs (depending whether Hons, MSc or PhD)
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Tissue Repair Group, Institute for Respiratory Health
Desired background of applicants:	Biomedical Science, Laboratory Medicine, Neuroscience
Additional funding/scholarship provided:	Yes – Consumable budget available PhD students will have to apply for a PhD scholarship. PhD students also have the opportunity external PhD top up Scholarships.
Other benefits:	
Extra Comments:	





Murdoch University

Research opportunity:	Honours	X	Masters	X	PhD	X
Project title:	Investigating transcriptomic changes in the inner ear following cochlear implantation in an animal model					

Short project description & main objectives:

Cochlear implants are the gold standard treatment for profound hearing loss and are the most successful sensory prosthesis, however there is considerable variation in outcomes for patients. One of the factors that may contribute to this variability is the development of fibrosis in the cochlea caused by the insertion of the implant. In this project we will investigate the potential of a novel anti-fibrotic drug as a treatment using *in vitro* cell culture techniques and an *in vivo* animal model of cochlear-implant induced fibrosis.

In this study, and in order to identify novel targets for the treatment of cochlear-implant induced fibrosis we will compare the transcriptomic profiles of cochlea following implantation (fibrotic tissue) to control unplanted cochlea. Using gene ontology analysis we will identify the cellular processes and signalling pathways that are altered following implant surgery. This will allow us to identify suitable target drugs that will be screened for their suitability in the inner ear cells using *in vitro* assays.

The project will involve the following activities.

- Preparation of cochleae tissues for RNA for RNAseq analysis
- Analysis and interpretation of data generated using advanced analytical techniques
- High throughput cell-based assays to test candidate therapeutic drugs
- Immunocytochemical analysis of cell cultures using Cell Insight and confocal laser scanning microscopy
- Cellular assays to determine drug toxicity
- Analysis and interpretation of data generated using image analysis techniques

This project will be conducted in the Institute for Respiartory Health Laboratories, which are located within the Perkins North research builiding in Nedlands and the Auditory Neuroscience Laboratory at UWA.

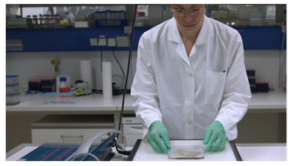
Principal supervisor:	A/Prof Cecilia Prêle
Other supervisors:	Dr Tylah Miles A/Prof Wilhelmina Mulders
Contact details for further information:	cecilia.prele@murdoch.edu.au
Closing date for applications:	30 June
Start & finish date of project:	1-4yrs (depending whether Hons, MSc or PhD)
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Tissue Repair Group, Institute for Respiratory Health
Desired background of applicants:	Biomedical Science, Laboratory Medicine, Neuroscience
Additional funding/scholarship provided:	Yes – Consumable budget available PhD students will have to apply for a PhD scholarship. PhD students also have the opportunity external PhD top up Scholarships.
Other benefits:	

Extra Comments:	**This project is suitable for Hons and Masters or can be extended for PhD**





Murdoch University

Research opportunity:	Honours	X	Masters	X	PhD	
Project title:	Investigating the role of the cystine/glutamate transporter SLC7A11 in Idiopathic pulmonary fibrosis.					

Short project description & main objectives:

Idiopathic pulmonary fibrosis (IPF) is an aggressive interstitial lung disease with no cure and a mean survival of three years from diagnosis. The drugs Pirfenidone and Nintedanib have improved the quality of life for a small proportion of patients with IPF but has had little effect on survival. Thus, the need to identify new treatment remains. Our laboratory has shown that IPF fibroblasts from the base of the lung are transcriptionally different to the fibrobast cells isolated from the lung apex. Specifically, we observed altered expression of genes associated with glutamine and cystine transporters. Importantly, this pathway has been identified as a potential cell survival mechanism which may contribute to the accumulation of collagen producing fibroblasts in the fibrotic lung. In this study we will determine the role of the cystine/glutamate transporter SLC7A11 in IPF. We will use sulfasalazine to determine these transporters are a suitable target for therapy. We will determine their effect on fibroblast cell function *in vitro.*

The project will involve the following activities.

- Preparation of cells and tissues for immunocyto/histochemistry
- Preparation of cells for RNA isolation and real time PCR
- Preparation of cells for protein isolation and western blot analysis
- Cell function assays

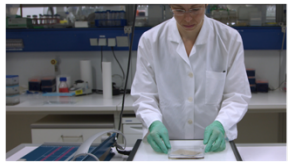
This project will be conducted in the Institute for Respiratory Health Laboratories, which are located within the Perkins North research builiding in Nedland and the Auditory Neuroscience Laboratory at UWA.

Principal supervisor:	A/Prof Cecilia Prêle
Other supervisors:	Dr Tylah Miles A/Prof Steven Mutsaers
Contact details for further information:	cecilia.prele@murdoch.edu.au or tylah.miles@resphealth.uwa.edu.au
Closing date for applications:	30 June
Start & finish date of project:	1 yr
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Tissue Repair Group, Institute for Respiratory Health
Desired background of applicants:	Biomedical Science, Laboratory Medicine, Neuroscience
Additional funding/scholarship provided:	Yes – Consumable budget available
Other benefits:	
Extra Comments:	





Murdoch University

Research opportunity:	Honours	X	Masters	X	PhD	X
Project title:	Characterisation of free-floating mesothelial cells and their mechanisms for avoiding apoptosis					

Short project description & main objectives:

Little is known about the mechanisms regulating repair of the cells (mesothelial cells) lining the body cavities and internal organs. Mesothelial cells are unique as although they are principally adherent cells, they survive in a free-floating state in serosal fluid. The only other adherent cell type that does not undergo apoptosis when removed from their basement membrane are malignant cells. Upon serosal injury the number of free-floating mesothelial cells increase. These cells participate in the healing process by several mechanisms but one mechanism is landing on the wound surface from the serosal fluid that surrounds the mesothelial cells, dividing and repopulating the injured area. Little is known about these cells and what mechanisms they use to remain viable. This study will test the **hypothesis that free-floating mesothelial cells have increased expression of cell survival genes and decreased expression of apoptosis genes when compared with adherent mesothelial cells.**

More specifically, this study aims to:

1. Isolate and characterise the free-floating mesothelial cell population in serosal fluid before and after injury.
2. Examine the profile of known apoptosis and cell survival genes in free-floating compared with adherent mesothelial cells.

The project will involve the following activities.

- Preparation of cells and tissues for immunocyto/histochemistry
- Preparation of cells for RNA isolation and real time PCR
- Preparation of cells for protein isolation and western blot analysis
- Cell function assays
- Animal models of serosal injury and repair

This project will be conducted in the Institute for Respiratory Health Laboratories, which are located within the Perkins North research builiding in Nedlands and the Auditory Neuroscience Laboratory at UWA.

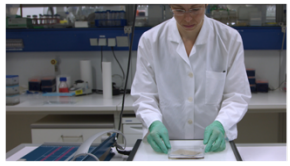
Principal supervisor:	A/Prof Steven Mutsaers
Other supervisors:	A/Prof Cecilia Prêle
Contact details for further information:	cecilia.prele@murdoch.edu.au or steven.mutsaers@uwa.edu.au
Closing date for applications:	30 June
Start & finish date of project:	1 yr
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Tissue Repair Group, Institute for Respiratory Health
Desired background of applicants:	Biomedical Science, Laboratory Medicine, Neuroscience
Additional funding/scholarship provided:	Yes – Consumable budget available

	PhD students will have to apply for a PhD scholarship. PhD students also have the opportunity external PhD top up Scholarships.
Other benefits:	
Extra Comments:	





Murdoch University

Research opportunity:	Honours	X	Masters		PhD	X
Project title:	Genetic engineering and gene editing of bacteria and archaea					

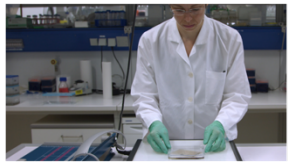
Short project description & main objectives:
We have a variety of projects available that are aimed at genetically modifying microorganisms to create sustainable futures. Areas of research include: designing vectors for conditional expression of genes, modifying existing biochemical pathways to obtain high value biomolecules, random and targeted inactivation of bacterial genes required for infection or survival in a eukaryotic host. We are also happy to help you with designing your own project if you have one in mind. You can expect to learn skills in the following techniques: microbiology, bioinformatics, cloning, design of plasmid vector delivery systems, CRISPR-Cas gene editing, genome sequencing and assembly, metagenomics.

Principal supervisor:	Dr Wayne Reeve
Other supervisors:	Dr Ravi Tiwari, Dr Julie Ardley
Contact details for further information:	W.Reeve@murdoch.edu.au R.Tiwari@murdoch.edu.au J.Ardley@murdoch.edu.au
Closing date for applications:	
Start & finish date of project:	
Available part-time?	Yes
Available to international students?	Yes

If applicable:

Research centre/group:	
Desired background of applicants:	Genetic Engineering, Molecular Microbiology
Additional funding/scholarship provided:	
Other benefits:	
Extra Comments:	





Research opportunity:	Honours	x	Masters		PhD	
Project title:	How does cholesterol lowering drugs affect immune cell function?					

Short project description & main objectives:

The immune system plays an important role in fighting cancer. Cancer immunotherapy is a promising treatment for an asbestos induced cancer, mesothelioma. However, not all treated patients benefit from immunotherapy. Retrospective studies implicate that usage of cholesterol lowering drugs (statins) is linked with immunotherapy benefit for patients with mesothelioma. This project will investigate how statins affect the anti-tumour immune response.

We discovered that regulatory immune (T) cells in mesothelioma tumours resistant to immunotherapy increased cholesterol metabolism genes. As cholesterol metabolism is important for regulatory T cell function, our study aims to test how commonly used statins in the clinic changes regulatory T cell functions such as proliferation, differentiation and cytokine secretion in vitro. Techniques include flow cytometry, immunoassays and cell culture. If successful, it will provide rationale to test statins in combination with immunotherapy in murine models of cancer.

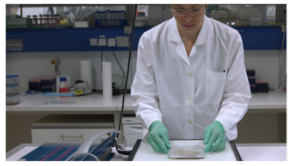
References: Eur J Cancer. 2021 Feb;144:41-48. doi: 10.1016/j.ejca.2020.10.031

Principal supervisor:	Jonathan Chee
Other supervisors:	
Contact details for further information:	Jonathan.chee@uwa.edu.au
Closing date for applications:	
Start & finish date of project:	
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Institute for Respiratory Health
Desired background of applicants:	Interest in immunology and cancer biology
Additional funding/scholarship provided:	
Other benefits:	
Extra Comments:	





Research opportunity:	Honours	X	Masters		PhD	
Project title:	Optimising a micronic blood collection protocol for the detection of sepsis					

Short project description & main objectives:

Neonatal sepsis is a leading cause of death and disability among infants, particularly those born premature. Approximately 25% of infants born very preterm develop sepsis during their stay in the neonatal intensive care unit. Rapid and accurate diagnosis of neonatal sepsis is critical for minimising adverse outcomes. However, research for improving sepsis diagnosis is hindered by small blood samples and the infeasibility of processing samples in a short timeframe.

We are developing a micronic blood collection protocol to measure sepsis protein biomarkers. We can measure sepsis protein biomarkers in plasma, but plasma collection requires immediate processing, which impractical in sepsis studies. We would like to explore the possibility of measuring sepsis protein biomarkers in our micronic blood collection platform, which only requires 2-3 drops of blood.

This project has three main aims:

1. **To optimise protein extraction form our micronic blood collection protocol.**
2. **Establish the equivalence of protein concentration between the optimised mirconic blood collection compared to plasma, the gold standard protocol**
3. **Establish the sensitivity of the protein concentration between the optimised mirconic blood collection compared to plasma, the gold standard protocol**

This project will involve project design, basic molecular techniques, including protein extraction and measurement on the Luminex® platform, and data analysis.

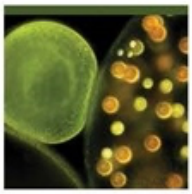
This project will be conducted in a laboratories at Murdch University. Patient samples will sourced from healthy adult volunteers (approved by the human ethics committee of Murdoch University)

Principal supervisor:	Dr Andrew Currie
Other supervisors:	Dr Julie Hibbert Clin Professor Tobias Strunk
Contact details for further information:	Dr Andrew Currie a.currie@murdoch.edu.au
Closing date for applications:	July 2023
Start & finish date of project:	S2 2023 – S1 2024
Available part-time?	No
Available to international students?	Yes

If applicable:

Research centre/group:	Centre for molecular medicine and innovative therapeutics/Sepsis group
Desired background of applicants:	Molecular assays
Additional funding/scholarship provided:	NA
Other benefits:	
Extra Comments:	



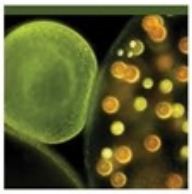



Murdoch UNIVERSITY

Research opportunity:	**Honours**		**Masters**		**PhD**		
Project title:	Are cyclases that contain SAM domains critical for rhizobia-legume signalling in symbioses?						
Short project description & main objectives:	*Description:* The legume-rhizobia symbiosis is vital for introducing fixed nitrogen into sustainable farming systems. There are currently few studies into the molecular signalling that is crucial to the establishment of fully effective N_2-fixation in the symbiosis. As part of a large collaboration project (Reeve et al 2015), a number of novel plant interaction protein families from the genomes of 110 rhizobia have now been identified (Seshadri *et al*., 2015). One such identified interaction protein domain is the sterile alpha motif (SAM domain) discovered in rhizobial adenylate/diguanylate cyclases important in signal transduction. The SAM domain is critical for developmental processes in diverse eukarya but its role in microbial symbioses has yet to be explored. *Honours project objectives:* 1) Bioinformatically characterise the adenylate-diguanylate cyclases (with emphasis on those with a SAM domain) 2) Inactivate a SAM domain-containing cyclase protein in selected microsymbionts 3) Perform glasshouse trials to identify any effects on nodulation, nitrogen fixation and host specificity						
Keywords:	Signal transduction, symbiosis, nitrogen fixation						
Principal supervisor:	A/Professor Wayne Reeve						
Other supervisors:	Dr Julie Ardley Dr Ravi Tiwari						
Contact details for further information:	W.Reeve@murdoch.edu.au						
Closing date for applications:	Ongoing						
Start & finish date of project:	S1 or S2						
Available part-time?	Yes						
Available to international students?	Yes						

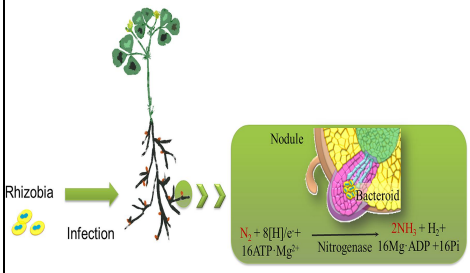
Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	
Extra Comments:	**Reeve** et al (2015). *Standards in Genomic Sciences* 10: 14. **Seshadri** et al (2015). *Scientific Reports* 5: 16825.

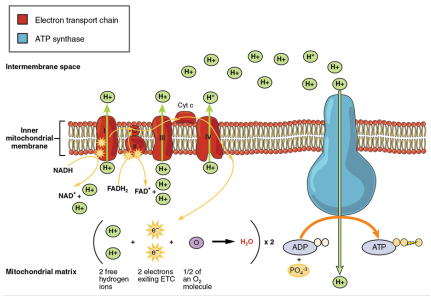


Murdoch UNIVERSITY

Research opportunity:	**Honours**		**Masters**		**PhD**		
Project title:	Which genes are required for nitrogen fixation in *Burkholderia*?						





Electron transport chain genes of *Burkholderia*?

Description:

The legume-rhizobia symbiosis is vital for introducing fixed nitrogen into sustainable farming systems. Both alpha and beta proteobacterial strains are capable of symbiotic N_2-fixation. There are currently few studies that have investigated which genes are required for N_2-fixation in beta-rhizobial strains of *Burkholderia* and how these genes are regulated. As part of a large collaboration project, the genomes of 110 rhizobia including several species of *Burkholderia* have been sequenced (Reeve et al., 2015; Seshadri *et al*., 2015).

Burkholderia are unusual in that they:

1) They are able to fix nitrogen *ex planta*
2) They lack the electron transport chain *cbb3* cytochrome proteins FixNOQP that are essential for N_2-fixation in all other studied alpha and beta-rhizobia.
3) They lack the FixGHIS proteins required for the formation of the high-affinity *cbb3*-type cytochrome that is essential for N_2-fixation in all other studied alpha and beta-rhizobia.
4) Lack the nitrogen fixation regulatory protein FixK that activates the expression of *fixNOQP*.

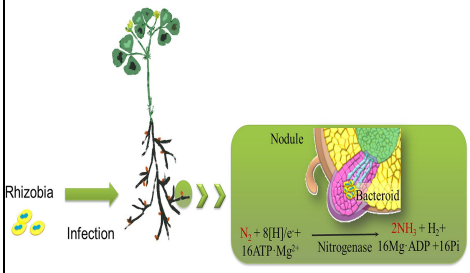
Honours project objectives:

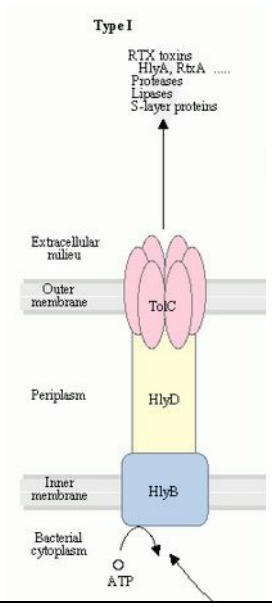
1) Bioinformatically characterise the nitrogen fixation genes in symbiotic *Burkholderia* strains
2) Inactivate identified genes using a site directed approach
3) Identify essential N_2-fixation genes using random mintransposon mutagenesis.
4) Perform glasshouse trials to identify any effects on nodulation, nitrogen fixation and host specificity

Keywords:	Beta-rhizobia, symbiosis, nitrogen fixation
Principal supervisor:	A/Professor Wayne Reeve
Other supervisors:	Dr Julie Ardley
Contact details for further information:	W.Reeve@murdoch.edu.au
Closing date for applications:	Ongoing
Start & finish date of project:	S1 or S2
Available part-time?	Yes
Available to international students?	Yes

Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	
Extra Comments:	**Reeve** *et al* (2015). *Standards in Genomic Sciences* **10**: 14. **Seshadri** *et al* (2015). *Scientific Reports* **5**: 16825.

Research opportunity:	Honours		Masters		PhD	
Project title:	Are RTX genes are required for symbiosis with *Microvirga*?					





Description:

The legume-rhizobia symbiosis is vital for introducing fixed nitrogen into sustainable farming systems. Both alpha and beta proteobacterial strains are capable of symbiotic N_2-fixation. Current models only describe the process of Root Hair Curl infection of legumes. There are currently few studies that have investigated the alternative process of epidermal infection as observed with lupins and some other South African legumes. As part of a large collaboration project, genomes of 110 rhizobia including several species of *Microvirga* that epidermally infect legumes have been sequenced (Reeve et al, 2015; Seshadri *et al*, 2015).

Microvirga are unusual in that they:

1) Possess more genes (36) encoding RTX toxins and related Ca2+-binding proteins than any other studied root nodule bacterium.
2) RTX proteins are secreted through the Type I Secretion System.
3) The RTX genes have been implicated in infection and virulence but their role in symbiosis has not been investigated thoroughly.

Objectives:

1) Bioinformatically characterise the RTX genes in symbiotic *Microvirga* strains
2) Inactivate identified genes using a site directed approach
3) Identify essential symbiotic genes using random mintransposon mutagenesis.
4) Perform glasshouse trials to identify any effects on nodulation, nitrogen fixation and host specificity

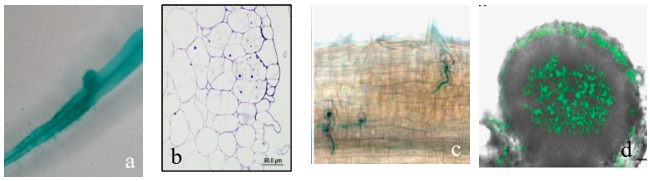
Keywords:	Epidermal infection, symbiosis, nitrogen fixation
Principal supervisor:	A/Professor Wayne Reeve
Other supervisors:	Dr Julie Ardley
Contact details for further information:	W.Reeve@murdoch.edu.au
Closing date for applications:	Ongoing
Start & finish date of project:	S1 or S2
Available part-time?	Yes
Available to international students?	Yes

Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	Yes ($2500)
Extra Comments:	**Reeve** *et al* (2015). *Standards in Genomic Sciences* **10**: 14. **Seshadri** *et al* (2015). *Scientific Reports* **5**: 16825.

Research opportunity:	Honours		Masters		PhD	
Project title:	Transposon mutagenesis of the novel pink pigmented Microvirga microsymbiont to identify genes essential for symbiotic profiency with the Crotalariod legume Lotononis					

Short project description & main objectives:

Biological nitrogen fixation (BNF) is second only to photosynthesis as the most important biochemical process on earth and plays a vital role in sustainable agriculture practices. Establishment of a legume-rhizobia symbiosis requires the coordination of two processes: bacterial infection of the host plant and nodule organogenesis (Madsen *et al.*, 2010). Two mechanisms of rhizobial infection have evolved in legumes: the intracellular method where bacteria enter the plant via root-hair curling, or intercellular infection via cracks in the epidermis or between epidermal cells. Recent work on the South African legume *Lotononis* indicates that infection by novel pink-pigmented rhizobia belonging to the genus *Microvirga* (Yates *et al.*, 2007)is intercellular.



a) *L. bainesii* nodule initial; b) *L. bainesii* nodule organogenesis; c) visualisation of root hair infection in *Lotus japonicus* with *lacZ*-marked rhizobia d) visualisation of eGFP-marked rhizobia in *L. japonicus* nodule. Images in c) and d) are from Madsen *et al.* (2010)

A Tn*5*-based delivery vector (pVM1) has been designed for the purpose of generating rhizobial insertion mutants. Features of the mTn5-VM cassette that aid rapid screening of insertion mutants include: promoterless reporter genes *lacZ* and *gusA* for colorimetric screening and interchangeable, promoterless, fluorescent reporter genes *mCitrine*, *mCherry*, *mTFP1* and *T-sapphire* (Melino *et al.*, 2010). In this project, pVM1 will be used to generate insertion mutants of the *Microvirga* rhizobia. Mutants will be screened for their symbiotic abilities - those that are able to nodulate and fix nitrogen will be used to visualise the infection process; those that cannot will be screened for genes important to the symbiosis.

Principal supervisor:	A/Professor Wayne Reeve
Other supervisors:	Dr Julie Ardley Dr Ravi Tiwari
Contact details for further information:	W.Reeve@murdoch.edu.au
Closing date for applications:	Ongoing
Start & finish date of project:	S1 or S2
Available part-time?	Yes
Available to international students?	Yes

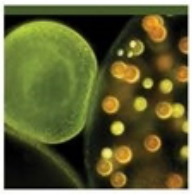
If applicable:

Research centre/group:	
Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	
Other benefits:	
Extra Comments:	**Reeve** et al (2015). *Standards in Genomic Sciences* 10: 14. **Seshadri** et al (2015). *Scientific Reports* 5: 16825.

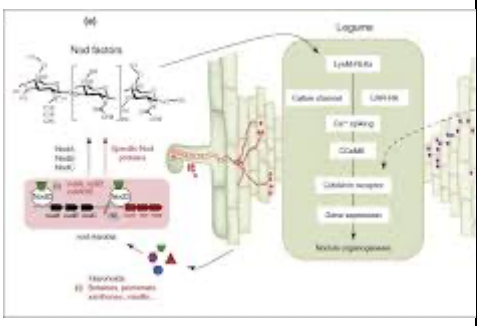
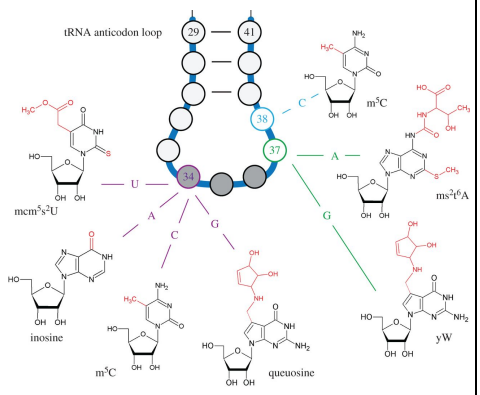
Research opportunity:	**Honours**		**Masters**		**PhD**		
Project title:	Is the MnM pathway essential for free-living or the symbiotic lifestyle of root nodule bacteria?						
Short project description & main objectives:	The legume-rhizobia symbiosis is vital for introducing fixed nitrogen into sustainable farming systems. Understanding the free-living or symbiotic lifestyles is essential to maximise sustainable nitrogen fixation. A diverse range of rhizobial genomes have now been sequenced as the result of a collaboration established by A/Professor Wayne Reeve and international collaborators (Reeve et al., 2015; Seshadri *et al*., 2015). One recent discovery was the identification of a tRNA modification pathways required for the modification of the U34 position in the tRNA anti-codon with methylaminomethyl (mnm^5), carboxymethylaminoethyl ($cmnm^5$) or aminomethyl (nm^5) groups. The pathway also produces s^2 thiolated derivatives of these tRNAs. Such modifications (Tuort et al, 2016) influence codon recognition (Armengod et al, 2015), stop codon read-through and translation fidelity. This pathway has been shown to be essential for acid-resistance, biofilm formation and virulence (Shippy et al, 2015). Its role in rhizobia has not yet been revealed. *Honours project objectives:* 1) Bioinformatically characterise the mnm genes in the rhizobia. 2) Inactivate the identified genes using a site directed approach in a NHR and a BHR strain 3) Phenotype the mutants in the free-living stage. 4) Perform glasshouse trials to identify any effects on nodulation, nitrogen fixation and host specificity 5) Perform complementation studies 6) Provide a model for the role of the pathway in rhizobia						
Keywords:	Free-living survival, host infection, symbiosis, nitrogen fixation						
Principal supervisor:	A/Professor Wayne Reeve						
Other supervisors:	Dr Julie Ardley, Dr Ravi Tiwari						
Contact details for further information:	W.Reeve@murdoch.edu.au						
Closing date for applications:	Ongoing						
Start & finish date of project:	S1 or S2						
Available part-time?	Yes						
Available to international students?	Yes						

Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	
Extra Comments:	**Armengod** *et al* (2015) *RNA Biology* 11:12, 1495=1507 **Reeve** *et al* (2015). *Standards in Genomic Sciences* **10**: 14. **Seshadri** *et al* (2015). *Scientific Reports* **5**: 16825. **Shippy** *et al* (2015). *Microbial Pathogenesis* 89 **Tuorto** et al (2016). Open Biol. 6: 160287.



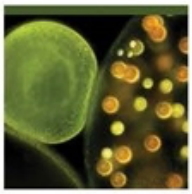



Murdoch UNIVERSITY

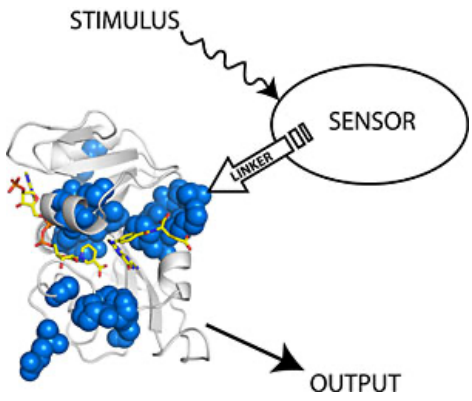
Research opportunity:	**Honours**		**Masters**		**PhD**	
Project title:	Is the Q-pathway essential for free-living or the symbiotic lifestyle of root nodule bacteria?					
 	*Description:* The legume-rhizobia symbiosis is vital for introducing fixed nitrogen into sustainable farming systems. Understanding the free-living or symbiotic lifestyles is essential to maximise sustainable nitrogen fixation. A diverse range of rhizobial genomes have now been sequenced as the result of a collaboration established by A/Professor Wayne Reeve and international collaborators (Reeve et al., 2015; Seshadri *et al.*, 2015). One recent discovery was the identification of a tRNA modification pathways required for the modification of the U34 position in the tRNA anti-codon with queuosine (Q), Such modification influence codon recognition by tRNAs that have a GUN anticodon (tRNAx, tRNAx, tRNAx, & tRNAx) and hence impacts translation fidelity. This pathway has been shown to be essential for stress survival and recently has been implicated as being important in a narrow host range microsymbiont *Ensifer meliloti*. Its role in other symbiotic rhizobia has not yet been revealed. *Honours project objectives:* 1) Bioinformatically characterise the Q-genes in the rhizobia. 2) Inactivate the identified genes using a site directed approach in a NHR and a BHR strain 3) Phenotype the mutants in the free-living stage. 4) Perform glasshouse trials to identify any effects on nodulation, nitrogen fixation and host specificity 5) Perform complementation studies 6) Provide a model for the role of the Q-pathway in rhizobia					
Keywords:	Free-living survival, host infection, symbiosis, nitrogen fixation					
Principal supervisor:	A/Professor Wayne Reeve					
Other supervisors:	Dr Julie Ardley, Dr Ravi Tiwari					
Contact details for further information:	W.Reeve@murdoch.edu.au					
Closing date for applications:	Ongoing					
Start & finish date of project:	S1 or S2					
Available part-time?	Yes					
Available to international students?	Yes					

Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	
Extra Comments:	Reeve *et al*. (2015). *Standards in Genomic Sciences* **10**: 14. Seshadri *et al*. (2015). *Scientific Reports* **5**: 16825. Marchetti *et al*. (2013). *PLOS One* **8**: e56043



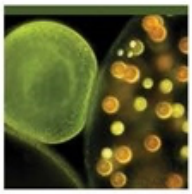



Murdoch UNIVERSITY

Research opportunity:	Honours		Masters		PhD	
Project title:	Linking domain architecture to function: application of input and output modules to regulate gene expression by light					
	*Description:* Regulated gene expression can be immensely useful to trigger or repress the production of desired products in bacterial cell production systems. Light regulated expression can be used to synchronise molecule production at night or during the day depending on the regulation mode. Such a system can be particularly useful to control the expression of target genes to use photosynthesis to reduce the carbon footprint and associated costs of production. A number of light regulated systems (Ohlendorf et al, 2012) have been developed using blue light (Jayaraman et al, 2016) or red light (Avelar et al, 2014). However, a suitable system needs to be developed for use in the cyanobacteria to specifically regulate genes of interest that have been chosen in the Reeve laboratory. *Honours Project Objectives:* 1) Bioinformatically characterise the light sensing domains of proteins available in IMG. 2) Bioinformatically characterise regulatory output domains of proteins available in IMG. 3) Fuse a light sensing domain to an output domain. 4) Clone regulatory regions recognised by the output domain in front of a target gene that needs to be expressed in response to light 5) Identify if regulated expression is leaky or tight					
Keywords:	Protein architecture, light sensing domains, regulatory output domains, gene expression					
Principal supervisor:	A/Professor Wayne Reeve					
Other supervisors:	Dr Julie Ardley, Dr Ravi Tiwari					
Contact details for further information:	W.Reeve@murdoch.edu.au					
Closing date for applications:	Ongoing					
Start & finish date of project:	S1 or S2					
Available part-time?	Yes					
Available to international students?	Yes					

Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	
Extra Comments:	**Avelar et al** 2014 Current Biology. 24:1234–1240 http://dx.doi.org/10.1016/j.cub.2014.04.009 **Ohlendorf et al** 2012. Journal of Molecular Biology. 416: 534-542. doi:10.1016/j.jmb.2012.01.001 **Tabor et al** 2010. Journal of Molecular Biology. doi:10.1016/j.jmb.2010.10.038



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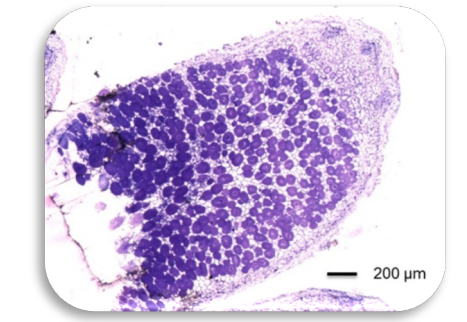
Research opportunity:	**Honours**		**Masters**		**PhD**		
Project title:	Are bacteroids of Australian IRLC clade legumes terminally differentiated?						
Short project description & main objectives:	*Description:* The Inverted Repeat Lacking Clade (IRLC) group of legumes includes many economically important plants such peas, lentils and clover. In symbiosis, many IRLC species impose terminal differentiation on their nitrogen-fixing rhizobial bacteroids, that is, the bacteria lose the capacity to grow and reproduce. Terminal differentiation has been suggested to increase nitrogen-fixation effectiveness. Very few Australian legumes belong to the IRLC. Those that do include species such as the Sturt's Desert Pea (*Swainsona formosa*). Their symbiotic relationships are poorly characterised and none has been tested for terminal differentiation of bacteroids. Studying the symbiotic relationships of Australian IRLC legumes will give us important insights into the evolution of the legume-rhizobia symbiosis and the selective pressures towards increasing nitrogen-fixation effectiveness. In this project, you will investigate the symbioses of Australian IRLC legumes by: 1. Collecting nodules from various Australian native IRLC species 2. Characterising the rhizobia that nodulate these species 3. Assessing the status of the nitrogen-fixing bacteroids 4. Quantifying nitrogen-fixation Techniques you will learn: Germination and propagation of Australian native legumes, glasshouse experiments, PCR techniques, acetylene reduction, statistical analysis, gel electrophoresis, microscopy and microbiology.						
Keywords:	WA native legumes, symbiosis, nitrogen fixation						
Principal supervisor:	A/Professor Wayne Reeve						
Other supervisors:	Dr Julie Ardley Dr Ravi Tiwari						
Contact details for further information:	W.Reeve@murdoch.edu.au						
Closing date for applications:	Ongoing						
Start & finish date of project:	S1 or S2						
Available part-time?	Yes						
Available to international students?	Yes						



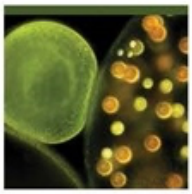
Legume nodule section with blue bacteroid

Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	
Extra Comments:	

Research opportunity:	**Honours**		**Masters**		**PhD**	
Project title:	The use of CRISPR-Cas9 for targeted functional genomics in bacteria					
Short project description & main objectives:	*Description:* The emergence of CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats – Crispr-Associated protein 9) and its derivatives, along with a better understanding of DNA repair systems has significantly expanded genome editing capabilities. In recent years, the CRISPR-Cas system has become an incredible tool in biomedical and molecular sciences, utilised in routine genetic cloning, mass mutagenesis, gene therapy, etc. The reason why the CRISPR-Cas system is so successful is due to its specificity. By using the innate capabilities of the system, wherein a small 'PAM' domain is recognised, and guide RNA used to direct the site of cleavage, nearly any region of dsDNA can be a target for manipulation. With the capacity to precisely target DNA sequences, the CRISPR-Cas9 tool can be used for high throughput functional genomics approach. *Honours project objectives:* 1) Design and construct the CRISPR-Cas vector 2) Design guide RNA for targeting specific genes 3) Use the developed system to mutate a range of genes in a targeted bacterium 4) Phenotype the mutants constructed					
Keywords:	CRISPR-Cas, bacteria, functional genomics					
Principal supervisor:	A/Professor Wayne Reeve					
Other supervisors:	Dr Ravi Tiwari, Julie Ardley					
Contact details for further information:	W.Reeve@murdoch.edu.au					
Closing date for applications:	Ongoing					
Start & finish date of project:	S1 or S2					
Available part-time?	Yes					
Available to international students?	Yes					

Desired background of applicants:	BSc is mandatory for Honours applications
References:	**Safari** et al 2019 CRISPR Cpf1 proteins: structure, function and implications for genome editing. https://doi.org/10.1186/s13578-019-0298-7 **Jacobsen** et al 2020 Characterization of Cas12a nucleases reveals diverse PAM profiles between closely-related orthologs. doi:10.1093/nar/gkaa272



Research opportunity:	**Honours**		**Masters**		**PhD**		
Project title:	Production of microbial biodegradable biopolymers to replace petroleum-derived plastic						
Short project description & main objectives:	*Description:* It is estimated that by 2050, global plastic production will reach over 1,100 million tonnes per annum. Most modern plastic is synthesised from synthetic or semi-synthetic polymers derived from petrochemicals. The extremely high production rates, lack of re-use, low rates of recycling and extremely slow decomposition in the environment has been the cause of plastic pollution. Biodegradable bioplastic polymers are needed to replace the conventional petroleum-based plastics that have caused a decline in our environmental status and increased global greenhouse gas emissions. Polyhydroxyalkanoates (PHAs) are a family of microbially-made polyesters that are 100% biodegradable, thermoplastic, insoluble in water, non-toxic and biocompatible. PHA production platforms to generate the desired bioplastic polymer The outcomes of this project will benefit the development of novel bioplastics with desirable characteristics and optimise the PHA production platform. *Honours project objectives:* 1) Manipulate existing genetic pathways to produce novel polyesters 2) Design gene constructs using synthetic biology approaches to repurpose existing genetic pathways 3) Express the synthetic constructs in different strain backgrounds to identify the most suited production chassis 4) Alter production parameters to optimise bioplastic yield						
Keywords:	Polyesters, bioplastic, bacteria, synthetic biology, microbiology						
Principal supervisor:	A/Professor Wayne Reeve						
Other supervisors:	Dr Ravi Tiwari, Daniel Murphy						
Contact details for further information:	W.Reeve@murdoch.edu.au						
Closing date for applications:	Ongoing						
Start & finish date of project:	S1 or S2						
Available part-time?	Yes						
Available to international students?	Yes						

Desired background of applicants:	BSc is mandatory for Honours applications
Additional funding/scholarship provided:	Yes
Extra Comments:	