Faculty of Science

School of Anatomy, Physiology and Human Biology

Student Research Projects for Honours, Masters and PhD Studies 2014
# Student Research Project Ideas

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Tips for Choosing an Honours/Masters dissertation 
Supervisor and Topic

Supervision
The role of the supervisor is to advise, guide and provide constructive feedback to the student through the processes of choosing a realistic topic, designing a project, doing the research and interpreting the findings and writing the dissertation.

Things to do before deciding on a supervisor:
• Talk with a few prospective supervisors about their research interests and prospective topics, as well as their styles of supervision and what they expect of their students; and
• Talk with your prospective supervisors' current and former Honours and postgraduate students about their experiences.

Select a supervisor whom you expect will maintain a supportive supervisory relationship with you throughout your Honours year; meet with you regularly (at least fortnightly) to discuss your project; and provide on-going clear, constructive and timely feedback on all aspects of your work.

Things to discuss and negotiate with your supervisor very early in the program:
• The regularity, timing and format of your meetings;
• The type and level of assistance that you would like, and your supervisor is prepared to give, with respect to choosing a topic and setting goals; finding appropriate literature; collecting the data and information; analysing and interpreting your findings; planning the dissertation; and writing and reviewing the dissertation.
Choosing a Topic

Before deciding on a topic, it is usually a good idea to first identify one or more prospective supervisors according to the criteria above. Then, in consultation with your prospective supervisor/s, identify some possible topics and projects according to the following criteria:

• Choose an area that is sufficiently interesting to you to maintain your enthusiasm for a year-long project;
• Choose a topic in which you can identify questions to be answered or gaps to be filled in the current knowledge; and
• Find a project that is realistic for you to complete within the time allocated for your research and dissertation.

The tips above have been excerpted from the document “Preparing for Honours – Hints and Tips” from the following UWA Student Services website: http://www.studentservices.uwa.edu.au/ss/learning/online_services/honours_hub
INFORMATION FOR HONOURS APPLICANTS

In an Honours year, the learning emphasis is on completing an original research project. Projects are guided by academic staff who are internationally recognised in their specific fields of research. Students acquire the specialized skills required to complete their particular research project, and also develop generic research skills such as analytical and problem-solving abilities, and a variety of communication skills. These are not only vital for future success in research but stand graduates in good stead whatever career they may subsequently pursue. Throughout the year, students also work in close collaboration with a like-minded peer group and professional university staff.

Honours are available in the following discipline:
- Anatomy and Human Biology
- Physiology
- Neuroscience (by arrangement)
- Biomedical (by arrangement)


Students can apply for a prestigious Dr Margaret Loman-Hall Honours Scholarships to support their studies. Further information is available at [http://www.aphb.uwa.edu.au/students/scholarships](http://www.aphb.uwa.edu.au/students/scholarships).

Entry to Honours requires at least a 65% average in 24 points of level 3 units that are relevant to the honours discipline you wish to study. Enrolment must be full time but students may enter the course in February or July.

As a starting point, applicants should talk to potential supervisors. Research areas and associated staff can be found at [http://www.aphb.uwa.edu.au/research](http://www.aphb.uwa.edu.au/research).

Each year some suggested projects are posted on our honours website at [http://www.aphb.uwa.edu.au/research/student-projects](http://www.aphb.uwa.edu.au/research/student-projects). If students wish to nominate and pursue topics of their own devising, they can discuss this with a supervisor.

In addition you may want to contact the School’s Honours Convenors, Associate Professor Gavin Pinniger for Physiology Honours and Associate Professor Silvana Gaudieri for Anatomy and Human Biology Honours. Neuroscience and Biomedical Science may also be accommodated.

Other useful websites include the School’s home page (http://www.aphb.uwa.edu.au/) and the Faculty’s honours page (http://www.science.uwa.edu.au/courses/honours).
## OVERVIEW OF ANATOMY AND HUMAN BIOLOGY HONOURS UNITS

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<thead>
<tr>
<th>Unit</th>
<th>Unit name</th>
<th>Tasks</th>
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<th>% of Unit</th>
<th>% of Final Grade</th>
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<td>Viva</td>
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## OVERVIEW OF PHYSIOLOGY HONOURS UNITS

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<td></td>
<td>Assignment - Newspaper Article</td>
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<td>10%</td>
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<td>Project Plan</td>
<td>Week 4</td>
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<td>80%</td>
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<td>Supervisors Assessment</td>
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<td>5%</td>
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<td><strong>Total</strong></td>
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INFORMATION FOR POSTGRADUATE APPLICANTS

Masters by Coursework and Dissertation

The school offers two courses:
Master of Anatomical Sciences
Master of Human Biology-

Both include a research dissertation similar to Honours and students will find this information useful to organise a supervisor and a project. Most students are sufficiently well prepared by these courses to proceed to a PhD, but it is not an automatic progression.

Masters by Research and Doctor of Philosophy (PhD)

These degrees are entirely research, and candidates have the opportunity to undertake larger, more complex projects. The Masters is two years full time or equivalent, and the PhD is usually 3 to 4 years. Candidates require previous research experience, usually an honours degree or Masters dissertation, but experience as a research assistant may be sufficient.

Candidates do not necessarily need to undertake their research in the same field as their previous study, so approach potential supervisors whose work interests.
http://www.science.uwa.edu.au/courses/postgrad/research

There are research student scholarships for both domestic and international students and candidates are encouraged to apply, however they are quite competitive. There are two rounds of offers each year. http://www.scholarships.uwa.edu.au/
Host and Viral Determinants of Hepatitis C infection outcome: influence of immune response genes on infection outcome.

Project outline

How does the interaction between the host and virus influence Hepatitis C virus infection outcome and disease progression? What are the genetic and immunological signatures of an effective host immune response against Hepatitis C virus (HCV)? These questions will be addressed utilising samples from ell-characterised local and international cohorts. Samples will be assayed using next-generation sequencing technologies and cellular immunology tests in a state of the art laboratory that houses robotic systems for high-throughout automation. The study outcomes will hopefully be used to inform vaccine design and future immune-therapy.

Project is suitable for

Honours, Masters, PhD

Supervisor

A/Prof Silvana Gaudieri

Essential qualifications

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
Physical MicroCT studies of vascularisation

(With Shane Maloney)

Project outline

a) Taking advantage of the new high resolution scanner in CMCA in QEII we have been investigating the structure of the sheep rete, a complex network of capillaries below the brain used to cool the sheep’s brain under water stress. We wish to see how the efficiency of this structure varies between sheep and between sheep strains to identify the best heat adapted sheep, suitable for the Australian climate

b) Blood supply of the nasal cavities, this is one of the last areas of human anatomy yet to be understood. Nose bleeds are a common, and usually innocuous, occurrence. However, as nasal vessels are embedded in the nasal conchae they may be unable to contract after damage and exanguination has occurred following epistaxis. This area is notoriously difficult to dissect. This project would involve injection of iodine into the facial and maxillary arteries followed by use of the microCT to produce high resolution angiograms of the nasal vasculature.

Project is suitable for

Honours, Master, PhD

Supervisor

Prof Stuart Bunt

Essential qualifications

For Honours: Some second and/or third year units in human anatomy and physiology
For Masters or PhD: Anatomy and physiology background
Evolutionary Ecology

The projects, which all have the same set of conditions, are:

- Intergenerational relationships in terms of help provided to adult offspring by mothers and fathers
- Family composition effects on development and reproductive strategies (survey work in Australia or work in Timor-Leste).
- Database development and statistical analyses of patterns of ecology and life history traits across species
- Behavioural studies of captive mammals (especially primates) at the Perth Zoo
- Behavioural studies of sex differences in humans
- For HIGHLY MOTIVATED students there is potential to undertake field studies of family well-being in East Timor involving questions of family structure, ecology, activity and child growth. Some language study before commencing will be required.
- If you have another idea in the area of evolutionary ecology, talk to me about it; I am open to new and interesting questions.

Suitable for: Honours, masters, PhD

Supervisor

- Asst/Prof Debra Judge

Essential qualifications

- For honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.
- For masters or PhD: An appropriate honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience

- Knowledge of basic statistical analyses is helpful but can be learned during the project
Ion Channels in Heart Muscle

Currently, cardiovascular disease accounts for 41% of all deaths in Australia. This is a staggering proportion when compared with the 22% from all cancers and 4% from road deaths. A number of the deaths in the cardiovascular group are due to arrhythmia or disturbances in the electrical activity in the heart.

The normal electrical activity in the heart is controlled by the movement of ions through specialised channels in the membranes of cardiac cells. The autonomic nervous system plays an essential role in regulating cardiac function and many of its effects are mediated via sympathetic neurotransmitters that regulate the activity of these ion channels.

Certain pathophysiological conditions contribute to arrhythmias such as hypoxia and oxidative stress. Under these conditions there is a reduction in blood flow to the muscle in the heart resulting in a reduction in available oxygen and reactive oxygen species production. This is then followed by an increase in generation of reactive oxygen species. There is increased sympathetic drive and the heart has a greater vulnerability to sudden cardiac death. Understanding how cardiac ion channels are regulated under these conditions is crucial to understanding the ionic mechanisms involved in the triggering of ischemic arrhythmias. In addition an increase in reactive oxygen species can contribute to the development of cardiac hypertrophy (enlarged heart) and cardiac failure. We have good evidence that an early mechanism involves increased calcium influx through the L-type calcium channel.

The laboratory uses molecular biology techniques for expression and purification of ion channel protein and biochemical techniques for assay of generation of reactive oxygen species and cell viability. The method that will be used to study membrane currents is the patch-clamp technique. This technique is an extremely powerful method for studying the electrophysiological properties of biological membranes and its contribution to the advancement of research was justly recognised with the awarding of the Nobel Prize in Physiology or Medicine in 1991 to its developers Erwin Neher and Bert Sakmann. The technique can be used to study ion channels either at a whole-cell level or at the level of a single channel. In addition, since the intracellular composition of the cell can be controlled, this can be exploited to determine any second messengers involved. Patch-clamp technique is also used in the laboratory in conjunction with fluorescent dyes to record changes in intracellular calcium, reactive oxygen species generation and mitochondrial function.

**Project 1** How does the L-type calcium channel regulate mitochondrial function in pathology where actin filaments are disrupted?
(Collaboration with Professor Nigel Laing, WAIMR, Prof Christine Seidman, Harvard University and Prof Chris Semsarian, Sydney University)

Mitochondrial respiration is abnormal in hearts where actin or cytoskeletal proteins are disrupted and it is not understood why. This project follows from data generated by previous students in the lab. We have evidence that the L-type calcium channel can regulate mitochondrial function via the actin cytoskeleton. The project involves the use of patch clamp technique to study L-type calcium channel currents in mouse myocytes isolated from hearts of mice with disease involving disruption in cytoskeletal proteins and fluorescent detection of changes in mitochondrial membrane potential, NADH and superoxide production after activation of the channel. Alterations in expression of proteins in mdx mouse hearts that co-immunoprecipitate with the channel (assessed by Mass Spec) will be identified using immunoblot analysis.
Project 2 How does oxidative stress alter the sensitivity of the L-type calcium channel to isoproterenol? What effect does this have on the action potential? (Collaboration with Professor Yoram Rudy, University of Washington, St Louis, Missouri, USA)

This question seeks to understand how arrhythmias occur during ischemia/reperfusion in the heart (after a heart attack). Isoproterenol is a beta- adrenergic agonist (and mimics the effects of catecholamines such as adrenaline in the heart). This project will use patch clamp technique to study the effect of oxidative stress and isoproterenol on L-type calcium channel currents in addition to K and Na channel currents and record changes in action potentials. Information gained from patch-clamp studies are incorporated into the Rudy-Luo model. Changes in action potential configuration are modeled and the relative risk of arrhythmia is determined.

Supervisor

Professor Livia Hool

Essential qualifications

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Art in Science (SymbioticA)

Project outline

1. Art and science
2. Biological Arts (also known as bioart)
3. Cultural studies in Art & the Life Sciences

Project is suitable for

Masters, PhD

Supervisor

Dr Ionat Zurr

Essential qualifications

For Masters: BSc or BA. Applicants will be assessed on a case-by-case basis
For PhD: An appropriate Honours or Masters degree in Arts or Science or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
Morphometrics and Finite Element Analysis

1. Morphometrics.
   Functional anatomy research involves understanding the meaning of shape variation in biology. The reason for the variation might be function, phylogeny/inheritance, environment, disease or just something that changes shape over time (like during growth or locomotion). The biological object is frequently a bone, but can be soft tissues (like faces, or feet!). Data can be collected from bone collections, or CT scans, photographs or living people. The questions that can be asked using these techniques have relevance to anatomy, biomechanics, development, evolution, forensics, medicine, physical anthropology, and palaeontology. The data collected can traditional linear measurements or 3D landmark data that is used in modern Geometric Morphometric analysis.

2. Finite element analysis.
   Functional anatomy can also be explored using computer modelling of stress and strain in bones under different conditions. These methods have been used to test hypotheses about how muscles may sometimes act to reduce bending stress (and thus reduce the risk of bone breakage). This method can also be used to test hypotheses about why bones have particular shapes. For example why is the human femur curved? There must be some advantage to this curvature.

Examples of two projects that could be done in 2014:

1. The skulls in the Anatomy and Human Biology teaching collection are thought to have all come from South Asia. Data has already been collected on cranial collections from other parts of the world. This honours project could digitise the School's crania collection and analyse their variation in relation to known samples.

2. How does the 3rd trochanter work to relieve bending stress in the femur. Armadillos and their fossil relatives have a 3rd trochanter. The muscles that attach to the 3rd trochanter have been shown to relieve bending stress. But would it work as well if the trochanter was bigger or smaller, or more proximal or distal? This question could be explored using femoral models and finite elements analysis.

There are numerous other projects that could be negotiated. The possibilities are as wide as your imagination.

Supervisor       Assoc/Prof. Nick Milne

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
Obstructive sleep apnoea is a common condition, affecting as many as 2-4% of middle-aged adults, and is accompanied by heavy snoring. It is characterised by repetitive partial or complete collapse of the upper airway (throat) during sleep. These episodes, which can occur hundreds of times during a single night, are accompanied by a momentary fall in blood oxygen levels, an increase in blood pressure and arousal. These disruptions result in excessive daytime tiredness and lethargy.

Sleep researchers at the School of Anatomy, Physiology & Human Biology (UWA) and the West Australian Sleep Disorders Research Institute (Sir Charles Gairdner Hospital) have an active interest in understanding factors that predispose individuals to obstructive sleep apnoea. Large numbers of patients are seen at the hospital clinic each year, most of whom are suitable for participation in research studies. Hospital-based projects are available in waking and/or sleeping individuals with and without sleep disorders.

A major NHMRC-funded project is currently being undertaken at the School’s new Centre for Sleep Science, located on the UWA campus near the School of Anatomy, Physiology & Human Biology. The study is funding full overnight sleep studies on 1,500 healthy 23 years olds who are participants in the WA Raine Study Cohort. The purpose of the study is to determine the prevalence of sleep disorders in young adults, and define the factors that lead to sleep disorders in this age group. The extensive, unique data being collected as part of this study is also available for research projects. Competitive Raine Foundation PhD scholarship top-up awards are available.

Other active areas of research in which projects are potentially available include: stroke and sleep disorders; gastroesophageal reflux and sleep disorders; craniofacial structure and sleep disorders; sleep and neurocognitive function; sleep and athletic performance; and cardiovascular function and sleep disorders.

Project is suitable for Honours, Masters, PhD

Supervisor
Prof Peter Eastwood

Other supervisors
Dr Jennifer Walsh, UWA and Sir Charles Gairdner Hospital
Dr Kelly Shepherd, UWA and Sir Charles Gairdner Hospital
Clinical Professor David Hillman, Sir Charles Gairdner Hospital
Dr Nigel McArdle, Sir Charles Gairdner Hospital

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
**Physical properties of nervous tissue**

**Project outline**

Working with Karol Miller’s large research group in Mechanical engineering we are looking at various physical aspects of brain structure such as its elasticity, fluid permeability, and resistance to compression. These measurements are then used to model brain deformation in surgery and disease. Accurate modelling of brain movement during, for example, robotic guided surgery is necessary to ensure that electrodes or excisions are accurately placed in tumours or selected brain nuclei. Knowledge of the interface between the skull and brain define the edge effects of brain distortion in impact injuries. We are also interested in fluid flow through brain tissue as this can effect properties such as rigidity in the enclosed skull and responses to distortion of the brain ventricles by space filling lesions such as tumours and blood clots. The research will involve experimenting on sheep and human brain tissue, applying stresses and strains in finely calibrated apparatus to obtain the required parameters. For fluid flow we wish to investigate mass flow using gold nano particles followed by electron microscopy to study microflow in brain tissue.

Project is suitable for

- Honours, Master, PhD

**Supervisor**

Prof Stuart Bunt

**Essential qualifications**

- For Honours: ANHB2217 preferred (other neuro units may suffice).
- For Masters or PhD: A background in biology with some neuroanatomy/neuroscience

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**Respiratory Physiology**

The respiratory group in APHB has had a long-standing interest in the control and function of conducting bronchi. The trachea, bronchi and other airways conduct air into and out of the lung. During an asthma attack contraction of airway smooth muscle (ASM) narrows the conducting bronchi and obstructs airflow. Airway obstruction also occurs in several other respiratory disease including Chronic Obstructive Pulmonary Disease (COPD), chronic bronchitis and emphysema. The focus of our research has been in understanding the detailed mechanisms involved in the control of airway diameter and airway obstruction.

**Project 1** Airway wall isotropy: is a push the same as a pull?

Airway narrowing, bronchoconstriction, is a key feature of several respiratory diseases
including asthma. Our developing understanding of bronchoconstriction now suggest that narrowing is dependent on the interactions of airways smooth muscle contraction with the loads placed on the airway and the modulating actions of breathing movements such as deep breaths. Current models of airway function assume that the airway is isotropic and behaves the same way to forces pulling on the outside as to a pressure in the lumen pushing from the inside. This project aims to directly test that assumption using Anatomical Optical Coherence Tomography (aOCT) in airways isolated from pig lungs. These experiment use state of the art imaging techniques being developed at UWA's school of electronic and electrical engineering to map the inside of individual bronchi with LASER probes. The question is how does the lumen move in response to an inflation by positive pressure in the lumen compared to negative pressure on the serosal surface and what change does that produce during airway contraction and in simulated breathing movements. This project uses isolated lung tissue from pigs.

Supervisor

Assoc Lecturer Peter McFawn
Asst/Prof Peter Noble

Project 2 Respiratory pattern in airway disease

Over the last decade a surprising finding in respiratory research is that breathing protects against airway obstruction in healthy subjects but not in subjects with asthma or COPD (chronic obstructive pulmonary disease). In a healthy person taking a deep breath greatly reduces bronchoconstriction and relaxes airway smooth muscle. Few studies have examined the pattern of breathing and how this differs between healthy subjects and those with respiratory disease. This project aims to measure the frequency and pattern of spontaneous deep breaths (i.e. sighs) in healthy subjects and patients with respiratory disease such as asthma. A collaborative project involving APHB at UWA and Respiratory Medicine at QEII that will use respiratory monitors to measure normal breathing pattern in human volunteers.

Supervisors

Peter Noble
Peter McFawn

Project 3 Force adaptation

Over the last decade work with isolated airway smooth muscle (ASM) has shown that ASM has a plastic length- tension curve, that is given time the muscle will adapt to make its current length the optimum operating length. Two recent reports in the literature suggest a similar phenomenon can happen to muscle force production, where ASM is left partially contracted for some time the maximum force that can be generated is increased. This project will attempt to prove the phenomena of force adaptation and test whether continuous partial contraction can cause an asthma-like phenotype. This project will use bronchi al segments from large animal species (sheep and pigs) and also involve translational experiments on human airway tissue.

Supervisor

Assoc Lecturer Peter McFawn
Asst/Prof Peter Noble

Project 4 Airway Structure in Disease

In airway diseases such as asthma and chronic obstructive pulmonary, disease remodelling of the airway wall occurs. That is, the wall becomes thicker with more muscle and more
connective tissue. But does the greater thickness of muscle mean more contractile filaments in the muscle or is it mostly “empty space”? The aim of this project is to use immunohistochemistry to assess the actin and myosin in the smooth muscle cells. Airway and lung tissue samples from asthmatic, COPD and control patients will be used to determine if the increased muscle mass also means more contractile filaments. This project would run as a collaboration involving APHB at UWA and Respiratory Medicine at QEII

Supervisor

Assoc Lecturer Peter McFawn
Asst/Prof Peter Noble

Project 5 Novel Airway Explants

Cell culture is an extremely useful technique but limited for studying integrated organ function like a bronchus. The tissue explant technique is an adaptation of tissue culture to larger structures like an intact blood vessel or airway tube. Explanting allows prolonged incubation of an isolated tissue under highly controlled conditions that is not possible in vivo or in classical organ bath methods. Our question is how do changes in the mechanical and chemical environment of the lung produce airway wall structural changes? Can incubation of tissues with cytokines present in asthma make an airway “asthmatic” or does prolonged exposure to high intraluminal pressure change airway contractility? This project would involve developing a method to explant bronchi from large animal species (pigs and sheep) under conditions were the luminal pressure can be controlled.

Supervisor

Assoc Lecturer Peter McFawn
Asst/Prof Peter Noble

Project 6 Variable breathing and airway function

Our laboratory has previously shown that simulated breathing movements in isolated bronchial tubes prevents airway collapse. It is theorised that a loss of the beneficial effects of breathing is a precursor to airway obstruction in asthma. However, while our prior studies have modelled breathing as a fixed sinusoidal rhythm, breathing is irregular in nature comprising both small and large breaths at a variable rate. There is now increasing evidence to suggest that this natural irregularity of breathing promotes normal airway function but this has yet to be tested. The present project will for the first time determine how a variable breathing rhythm impacts airway function and how this may be disrupted in disease leading to poor airway function. Techniques will include a newly developed and custom-designed organ bath system that provides a comprehensive assessment of mechanical airway wall properties and simulation of different human breathing rhythms.

Supervisors

Peter Noble
Peter McFawn

Project 7 A contemporary mouse model of lung disease

A new paradigm in respiratory disease is that structural and physiological abnormalities may arise independent of inflammatory pathways. We have established a mouse model that overexpresses transforming growth factor alpha (TGFalpha), producing lung remodeling particularly when the Early growth response 1 (Egr-1) gene is ‘knocked out’. Importantly, these changes are mediated in the absence of inflammation. We are interested in the functional and structural consequences of TGFalpha induced respiratory disease including airway remodeling and smooth muscle contractility, lung stiffening and diaphragmatic function. The data generated is relevant to asthma, chronic obstructive pulmonary disease,
pulmonary fibrosis and other respiratory disorders. While the project makes use of a sophisticated transgenic and knock out mouse model, our focus is on lung physiology and is suitable for any student interested in airway-structure function relationships. Techniques include, in vivo assessment in mechanically ventilated and anaesthetised mice, organ bath experiments on isolated mouse trachea, bronchi or diaphragm muscle, and stereological assessment of tissue ("stereology" – the unbiased assessment of structure).

Supervisors
Peter Noble
Peter McFawn
Gavin Pinniger
Alan James

Project 8 A contemporary mouse model of lung disease

A new paradigm in respiratory disease is that structural and physiological abnormalities may arise independent of inflammatory pathways. We have established a mouse model that overexpresses transforming growth factor alpha (TGFalpha), producing lung remodeling particularly when the Early growth response 1 (Egr-1) gene is ‘knocked out’. Importantly, these changes are mediated in the absence of inflammation. We are interested in the functional and structural consequences of TGFalpha induced respiratory disease including airway remodeling and smooth muscle contractility, lung stiffening and diaphragmatic function. The data generated is relevant to asthma, chronic obstructive pulmonary disease, pulmonary fibrosis and other respiratory disorders. While the project makes use of a sophisticated transgenic and knock out mouse model, our focus is on lung physiology and is suitable for any student interested in airway-structure function relationships. Techniques include, in vivo assessment in mechanically ventilated and anaesthetised mice, organ bath experiments on isolated mouse trachea, bronchi or diaphragm muscle, and stereological assessment of tissue (“stereology” – the unbiased assessment of structure).

Supervisors
Peter Noble
Peter McFawn
Gavin Pinniger
Alan James

Essential qualifications
For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
New methods of teaching in Anatomy and Physiology

Project outline

The nature of university teaching is changing radically. Increasing numbers of students, casualization of the teaching staff, development of new technology and software, social media, changes in student behaviour and expectations all provide new challenges and opportunities. In UWA a radical overhaul of courses reflects some of these changes. A few prestigious US universities now provide free online access to their lectures.

This project would involve the study of current teaching methods and the new student intake. Investigation of new technology, its usefulness and its impact on education (from mobile phones to Ipads, “clickers” 3D TV, virtual worlds, animations, plastination etc. etc.) It could involve the analysis of examination results for statistical correlations with examination methods, the development of new teaching material and the adaptation and assessment of new teaching methods in human anatomy.

Project is suitable for

Honours, Masters, PhD

Supervisor

Prof Stuart Bunt

Essential qualifications

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
Project 1. Developing novel interference peptides for the treatment of chemoresistant tumors

A severe limitation for the development of effective cancer drugs is resistance to chemotherapy and other treatments. Tumor cells initially respond to treatment but later develop resistance, which leads to tumor relapse and development of metastasis (the cells spread from the primary tumor to the other sites, such as bone, brain and lung). Many transcription factors are responsible for activating resistance pathways in cancer cells. Our lab is particularly interested in finding novel ways to inhibit oncogenic transcription factors which induce cancer initiation, resistance and disease spread. This project aims to develop novel peptides, which are able to inactivate these transcription factors in cancer cells. The project involves learning cancer cell biology, molecular biology and molecular therapeutics for cancer.

Project 2. Targeting the cancer epigenome with novel engineered DNA-binding proteins

Area of interest: cancer epigenetics

The cancer genome has the capacity to express genes, named oncogenes, which are responsible for tumor initiation, progression and resistance. This “abnormal” expression of cancer drivers is ultimately due to changes in the way that the DNA is packed in the nucleus with histones and associated chromatin, commonly referred as epigenetic processes. Epigenetic mechanisms, such as DNA and histone methylation influence the way that genes are expressed in the cell. Abnormal DNA methylation, for example, is associated with expression of many cancer drivers and with cancer development. This project involves the construction of artificial DNA binding proteins able to modify the epigenetic code of cancer cells to render these cells “normal-like” and more sensitive to chemotherapy. The project involves learning cancer cell biology, molecular biology and molecular therapeutics for cancer.

Project 3. Discovery of novel cancer drivers in breast cancer

Areas of interest: cancer biology, cancer epigenetics, clinical oncology

Our laboratory is interested in discovering novel genes involved in breast cancer development and progression. We collaborate with clinicians and pathologists at UWA medical school and have access to a large number of breast cancer tissues (tissue microarrays) with available and extensive clinical information, for example grade and stage of the tumor, resistance to chemotherapy, and subtype of breast cancer. This project involves the detection by immunohistochemistry and immunofluorescence of TMAs to discover novel cancer drivers involved in chemo-resistance in breast cancer. We will also study whether in the cancer tissues the abnormal expression of the cancer driver is associated with a change in the epigenetic status of the DNA, by mapping the epigenetic marks such as DNA and histone methylation. This project aims to discover novel targets that can be used as biomarkers for resistance to chemotherapy.

Project is suitable for

Honours, Masters, PhD

Supervisor

A/Prof Pilar Blancofort
Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science, cell biology and basic molecular biology emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological, cellular and basic molecular biology science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable Skills/Experience

Knowledge of statistics, cell biology, basic biochemistry and cell biology

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**Neonatal Physiology and Biology**

**Vitamin A and Retinoic Acid and Non-Invasive Ventilation to Prevent Diaphragm Atrophy and Apoptosis after Mechanical Ventilation in Preterm Lambs**

Project Outline:
Premature babies often need a machine (mechanical ventilator) to help them breathe after they are born, but it can be hard to wean them from the ventilator so that they can breathe on their own. Although most research has focused on the lungs as the cause for their breathing problems, the breathing muscle (the diaphragm) may also be damaged after preterm birth. This study will tell us how breathing machines damage the immature diaphragm and if more gentle (non-invasive) ventilation or Vitamin A and retinoic acid may prevent this damage. The study will be laboratory based, working on frozen diaphragm samples obtained from lambs on respiratory support for at least 3 days after premature birth.

Project is suitable for
Honours

Supervisor
Professor Jane Pillow

Additional Supervisors
Research Assistant Professor Yong Song
Assistant Professor Gavin Pinniger

Essential qualifications

**For Honours:** An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience
Basic understanding of molecular and cell biology
Neonatal Physiology and Biology

Postnatal Steroids and Antenatal Chorioamnionitis in the Ventilated Preterm Lamb: Between the Scylla and the Charybdis of Inflammation and Apoptosis

Project Outline

Mechanical ventilation induces a local inflammatory response that prolongs the need for mechanical support and increases the risk of systemic infection and inflammation: Duration of mechanical ventilation is an independent risk factor for the development of bronchopulmonary dysplasia (BPD), a chronic lung disease that is present in over 40% of extremely preterm infants born at less than 28 weeks gestation. Bronchopulmonary dysplasia and the duration of mechanical ventilation are independent predictors of adverse neurodevelopmental outcomes. Although postnatal corticosteroids are an independent risk factor for adverse neurodevelopmental outcomes, delays in initiating postnatal steroid treatment potentially may also put infants at risk for adverse outcomes due to ongoing respiratory and neurodevelopmental impacts of mechanical ventilation, and the necessity for protracted or repeated corticosteroid treatment to successfully wean infants to breathing on their own. There is a growing awareness that patient disease profile may modify the risk of adverse neurodevelopmental outcomes after postnatal steroids. Inflammation of the placental membranes (chorioamnionitis) is present in up to 70% of preterm births. The fetus exposed to inflammation is at greater risk of ventilation related brain injury and development of chronic lung disease. It is unknown how postnatal steroids modulate these risks. This project offers multiple PhD student opportunities investigating the impact of mechanical ventilation and steroids on the major organs of interest (brain, heart & lungs), or other organ systems including the airways, immune system, gastrointestinal system and kidneys amongst others. Projects may have a functional physiology (in vivo and/or in vitro), or more laboratory (molecular & cell biology) focus depending on the interests of the student.

Students will be able to access additional training opportunities through the NHMRC Centre for Research Excellence in Improving the Immediate & Longer-Term Outcomes of Preterm Infants (2013-8). Project availability is dependent on NHMRC Project Grant Funding outcomes in October 2013.

Project is suitable for
Honours, Masters, PhD

Supervisor
Professor Jane Pillow
(Additional supervisors will be involved depending on the student interests.)

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience
Preparedness to work with large animals
Project outline

Unlike humans and other mammals, fish can regenerate their spinal cords. This gives us the ability to examine what may happen when the mammalian researchers eventually get good spinal cord regeneration in mammals. Will the new axons make appropriate connections, will they get lost in scar tissue?

This experiment would involve severing the spinal cord of fish while they are anaesthetized, allowing the cord to regenerate, then labelling sub sets of axons with fibre tracers to examine where the regenerated axons have grown. The spinal cords would then be examined.

Project is suitable for

Honours, Master, PhD

Supervisor

Prof Stuart Bunt

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
The Brain Bioengineering and Imagining

Project outline

I have been working for some time with Karol Miller’s group in Engineering. This group is interested in modelling the deformation and movement of the brain in injury and during surgery. To do this modelling they need to know various parameters about the brain, e.g. how compressible it is, how fast liquid can travel through brain tissue, how elastic it is etc. etc. Surprisingly many of these basic brain structural parameters are not known with any certainty.

This research would involve constructing apparatus, sometimes with the help of engineers to test and measure these parameters in post mortem brain tissue, usually from sheep. We are also interested in imaging the brain and comparing the results from MRI/CT/ultrasound etc. to theoretical modelling results. The engineers are good at constructing models of brain deformation but know little anatomy so will need your help in comparing the results.

Project is suitable for

- Honours, Master, PhD

Supervisor

Prof Stuart Bunt

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Neonatal Physiology and Biology

Separating the adverse neurodevelopmental consequences of mechanical ventilation and postnatal steroids in preterm lambs

Project Outline

The administration of postnatal glucocorticoids to accelerate weaning from mechanical ventilation and to either prevent or rescue infants with severe BPD from impending respiratory failure remains highly contentious in contemporary neonatal practice. Dexamethasone is the most widely used glucocorticoid in the postnatal period. Used in high and prolonged doses in the 1980’s, dexamethasone use has diminished in recent years due to reports of adverse neurodevelopmental and other outcomes. However, without dexamethasone, some infants require protracted periods of mechanical ventilation, which is also independently associated with adverse long-term neurodevelopmental and respiratory outcomes. Whilst most doctors now prescribe a low steroid dose and there are no reports of adverse neurological outcomes after low dose
steroids, there remains a reluctance to use steroids until late in the clinical course, when significant damage has been inflicted on the heart and lungs, and possibly also the brain.

Using an extended ventilation preterm lamb model in a neonatal intensive care setting, this project will identify the independent risks of postnatal glucocorticoids and mechanical ventilation for adverse cardiorespiratory and neurodevelopmental long-term outcomes, thereby identifying the cost:benefit of dexamethasone in the presence/absence of mechanical ventilation. Further, the long-term outcomes associated with different contemporary dosing schedules, and hydrocortisone as an alternative glucocorticoid therapy, will be determined. These data will be vital to clinicians as they inform parents about long-term outcome when low-dose glucocorticoid therapy is used as a lifesaving rescue treatment, or to promote more rapid weaning from mechanical ventilation.

This project offers multiple PhD student opportunities investigating the impact of mechanical ventilation and steroids on the major organs of interest (brain, heart & lungs), or other organ systems including the airways, immune system, gastrointestinal system and kidneys amongst others. Projects may have a functional physiology (in vivo and/or in vitro), or more laboratory (molecular & cell biology) focus depending on the interests of the student.

Students will be able to access additional training opportunities through the NHMRC Centre for Research Excellence in Improving the Immediate & Longer-Term Outcomes of Preterm Infants (2013-8). Project availability is dependent on NHMRC Project Grant Funding outcomes in October 2013.

Project is suitable for
Masters, PhD

Supervisor
Professor Jane Pillow
(Additional supervisors will be involved depending on the student interests.)

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience
Preparedness to work with large animals
Geometry of placental vascular networks and implication for nutrient transport

Project outline

This project presents an exciting opportunity to develop a novel technique at UWA. It will involve developing resin casts of blood vessels within the rodent placenta (which has a complex, tree-like network of blood vessels), so that we can then obtain 3D images of placental vasculature. This will enable us to assess the geometry of the placenta and gain an appreciation for how the mathematics of this geometry links with nutrient transport. This approach will then be applied to rodent placentas where we know nutrient transport is impaired and the geometry of these placentas will be compared to control samples. This will provide novel insight into how placental vessel branching impacts on placental function.

Project is suitable for Honours

Supervisor

Asst/Prof Caitlin Wyrwoll

Other Supervisors

Dr Charles Price

Essential qualifications

Willingness to work with rodents
Skeletal muscles serve numerous functions that are essential for life. Not only do they provide the power required for movement and locomotion, but they also have vital roles in respiration, thermoregulation and metabolism. Not surprisingly, the loss of muscle mass and/or muscle function can be life threatening. Skeletal muscles of pre-term babies, elderly people and of people suffering from muscle diseases such as the debilitating Duchenne muscular dystrophy (DMD) are highly vulnerable to injury and are inherently weaker than healthy muscle. The goal of our research group is to understand the mechanisms of muscle damage and contractile dysfunction associated with ageing and disease and to evaluate potential therapeutic treatments to alleviate the severity of symptoms and improve the quality of life of these individuals.

Using a range of experimental models from in vitro single cell recordings to in vivo experiments on whole animals we investigate the molecular processes regulating muscle contraction and the mechanisms of contractile dysfunction from a cellular and systems approach. Students will be exposed to experimental techniques including recovery anaesthesia and surgery, microdissection of whole muscle and single muscle fibres, cell-culture and calcium imaging. We have several multi-disciplinary collaborations with local and international researchers and are particularly interested in:

i) The impact of exposure to clinically relevant treatments on diaphragm dysfunction in pre-term infants;

ii) The molecular processes underlying exercise-induced muscle damage;

iii) The effectiveness of anti-oxidant and anti-inflammatory treatments in reducing injury related muscle weakness; and

iv) Gene therapy treatments for Duchenne muscular dystrophy.

Specific details of these projects are listed below. Although the majority of this work is based on widely accepted and well established animal models of muscle disorders, there is also the possibility of projects working on skeletal muscle function in humans as well.

**Project 1** Effects of clinically relevant in utero and postnatal exposures on diaphragm function in an ovine model of pre-term infants
With Dr Tony Bakker & Prof Jane Pillow

A functional diaphragm is critically important to successful establishment of unsupported spontaneous breathing. The incidence of respiratory failure is higher in preterm babies than at any other time of life and the functional immaturity of the preterm diaphragm is likely to contribute to this respiratory failure. The preterm baby needs to generate sufficient inspiratory force to overcome the mechanical disadvantages imposed by a highly compliant chest wall, low levels of endogenous surfactant and noncompliant, structurally immature lungs. Therefore, the integrity of the diaphragm at delivery may critically influence the resilience of the infant to developing respiratory failure after birth. Optimising in utero diaphragm development and the structure and function of the diaphragm at birth is essential to ensure a healthy start to life for these extremely vulnerable babies. We aim to determine the effect of common, clinically relevant antenatal exposures (inflammation, glucocorticoids) and the timing of these insults on the metabolic, functional and structural phenotype of the fetal and newborn diaphragm.

**Project 2** Molecular mechanism of stretch-induced force enhancement
With Dr Tony Bakker

Experiments on isolated muscle preparations have shown that stretch of an active muscle causes a transient increase in force arising from the strain of both contractile (crossbridges) and non-contractile (structural) components of the sarcomere. The relative contributions of these components can be determined from their force-velocity characteristics and by the use of specific myosin inhibitors (Pinniger et al., J Physiol, 2006). Structural proteins such as titin, act to stabilize the sarcomere allowing the transmission of force within and between muscle fibres and disruption to these proteins is associated with the development of exercise-induced muscle damage. Although the contribution of the structural proteins (titin) to stretch-induced force enhancement is unknown, there is evidence that titin stiffness increases upon activation in a calcium-dependent manner. This study aims to determine the contribution of titin filaments to stretch-induced force enhancement. Experiments will be performed on single skinned muscle fibres to determine the calcium sensitivity of stretch-induced force enhancement. This research is focused on unravelling the complex molecular mechanisms of tension development during active muscle lengthening. The outcomes of this research will provide valuable insight into the mechanisms of exercise induced muscle damage and help to identify key features of the adaptation process brought about by repeated exposure to eccentric exercise.

Project 3 The role of inflammation and reactive oxygen species in skeletal muscle weakness in Duchenne Muscular Dystrophy (DMD)
With Dr Peter Arthur (Biochemistry) and Prof Miranda Grounds

Due to the absence of functional dystrophin protein, the skeletal muscles of DMD patients are inherently weaker and highly susceptible to muscle damage. Localized muscle damage and membrane lesions allow the infiltration of extracellular calcium and key inflammatory cytokines such as tumor necrosis factor (TNF) which stimulate the increased production of reactive oxygen species (ROS). The accumulation of these reactive molecules can lead to degradation of cellular constituents that can lead to cell death (myofibre necrosis). Excessive ROS production can also contribute to muscle weakness by reversible modification of protein function. We have recently shown that blockade of TNF activity (using cV1q, a mouse specific TNF antibody) results in a striking reduction of myofibre necrosis and muscle weakness in dystrophic mdx mice. If inflammation is a stimulus for ROS production, then anti¬oxidant treatment may also reduce the severity of muscle damage and weakness in dystrophic muscle. This project will investigate the hypothesis that the inherent weakness in dystrophic muscle is caused by protein thiol oxidation which can be attenuated by the antioxidant NAC. Experiments will be carried out on normal healthy mice and dystrophic, mdx mice using a combination of in vivo eccentric muscle testing as well as isolated, intact muscle fibre experiments.

Suitable for: Honours, masters, PhD

Supervisor:  Associate Lecturer Gavin Pinniger

Essential qualifications

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
**The role of kisspeptin in energy expenditure in the mouse**

**Project outline**

Recent data from our laboratory demonstrate no effect of central kisspeptin treatment on accumulative food intake. Despite this, neuroanatomical links have been established between kisspeptin cells and appetite regulating neurons expressing neuropeptide Y (NPY) and Pro-opiomelanocortin (POMC). Moreover, kisspeptin results in the activation of NPY cells in the hypothalamus. Electrophysiological data also suggests kisspeptin regulates the activity of NPY, and also POMC neurons. Taken together, these data strongly suggest kisspeptin has effects on energy expenditure.

Experiments will be conducted to measure the effect of kisspeptin and the absence of kisspeptin signalling in mice on energy Expenditure. GPR54 (Kiss1r) knock-out mice or their wild-type littermates will be challenged with a high fat diet for 12 weeks. Mice will then be tested on indices of energy balance including:

- Measurement of whole body energy metabolism (using metabolic cages for indirect calorimetry)
- Assessment of whole body glucose metabolism (using intraperitoneal glucose and insulin tolerance tests)
- Assessment of body composition (Using dual energy X-ray absorptiometry DEXA)
- Assessment of neuropeptide systems involved in energy metabolism (using in situ hybridisation).

Results from these experiments will shed light on the known link between the reproductive system and metabolism and will, potentially, offer novel therapeutic alternatives for the treatment of obesity and related metabolic disorders.

**Project is suitable for**

Honours, Masters, PhD

**Supervisor**

Dr Jeremy Smith

**Essential qualifications**

None

**Desirable skills/experience**

A background in molecular biology is desirable but not essential.
Comparative Physiology of Adaptation

Our group is interested in the physiological mechanisms whereby animal species (including humans) adapt to environmental stressors. We focus mainly on thermal and osmotic stress, but exercise, inanition (starvation), and infection are also studied. Most experimental work is on systems level adaptations, but organ level adaptations are also studied. Our long-term aim is to identify specific adaptations that allow animals to survive and reproduce in challenging environments, and to identify how “homeostasis” handles the trade-offs when simultaneous challenges are presented to an organism, (such as combined thermal and osmotic stress, or combined inanition [starvation] and infection stress). Prospective Honours students with a background in General Systems Physiology, Exercise Physiology, Applied Animal Physiology, or Comparative Physiology are encouraged to apply. Depending on the project chosen a background in Cell Physiology could be an advantage.

Students will be exposed to a range of approaches and techniques including (in non-human animals) recovery anesthesia and surgery, implantation of physiological recording equipment, blood sampling for hormone measurement, and husbandry techniques for various species. In human research we use state of the art equipment to record physiological parameters in ambulatory subjects, including core and skin temperature transmitters, ambulatory blood pressure recording equipment, laser Doppler skin blood flow techniques, and infra-red thermography for surface temperature measurement.

**Project 1** Is a Large Brown Fat Depot Protective Against Diet Induced Weight Gain?
(With Prof Phil Withers, Animal Biology)

The recent discovery of functional brown fat deposits in adult humans is rewriting the textbooks on energetic balance and cold adaptation in humans. Brown fat is a specialised adipose store that is endowed with mitochondria, and expresses uncoupling protein 1, resulting in oxidation without phosphorylation of ATP and the production of heat. It was thought that while human infants possess appreciable quantities of brown fat, it was lost in infancy. In rodents, overfeeding is thought to result in the stimulation of metabolism, and brown fat is implicated in that response. It was also known that cold adaptation in rodents increases brown fat tissue stores. In this project we will test if cold adaptation from infancy results in i) hypertrophy of brown fat stores, ii) increased heat increment of feeding, iii) protection from obesity when presented with a ‘cafeteria diet’. Techniques used will include temperature loggers implanted under general anaesthesia and the measurement of metabolic rate using indirect calorimetry, placing animals in a chamber and measuring oxygen consumption and carbon dioxide production. This project ran in 2012 where we exposed the mice to 30°C during cafeteria feeding. We would like to repeat the project exposing the mice to 22°C during cafeteria feeding.

**Project 2** Under nutrition and the defence of body temperature in the cold
The normal response of mammals to cold exposure involves peripheral vasoconstriction and an increase in metabolism. The former reduces heat loss from the skin while the latter increases heat production, helping to defend core body temperature. It is becoming clear that short term changes in energy (food) intake are detected by the body and that these signals have consequences for energy demanding activities like inflammation and reproduction. We would like to test whether these short-term signals also influence the energy demands for heat production during cold exposure. Human subjects will be exposed to cold while core and skin temperatures, as well as metabolic rate and skin blood flow are measured. Each subject will be exposed to the same cold stimulus twice, once while well fed and once after a period of reduced energy intake. The physiological responses will be compared.
Project 3 Does extracranial cooling really reduce brain temperature independently of arterial blood temperature?

It has become established in the last few years that cooling the brain reduces the long term effects of brain trauma such as stroke or ischemia. But the easiest way to cool the brain is to cool the body, and cooling the body creates problems of its own and can make the situation worse. The ideal treatment would be a means to cool the brain but leave the body at its usual temperature. That may sound easy but there is evidence that the main determinant of brain temperature is the temperature of the arterial blood reaching it. Despite this, many groups continue to test ‘extracranial selective brain cooling’ as a means to reduce brain temperature. We will use a rabbit model to look at brain – blood temperature coupling in several situations: during hypo- and hyper-capnia (which alter brain blood flow), and with ice packs applied to the cranium and a heater applied to the body. The data generated will provide good evidence for or against the possibility of brain – blood uncoupling. Techniques used will include an acute anesthetized rabbit preparation (like PHYL3350) with thermocouple measurement of temperatures. Students will be required to have done PHYL3350 and to have been an active participant in the techniques performed in the rabbit labs.

Project 4 Basal metabolic rate in mammals - How much does metabolism fall during anaesthesia?

(With Prof. Phil Withers and Dr Sean Tomlinson, Animal Biology)

The measurement of basal metabolic rate requires that an animal be rested, post-absorptive, awake, and within its thermoneutral zone. Measurements are made with an animal in a respirometry chamber (which measures metabolic rate by indirect calorimetry, the measurement of oxygen consumption and carbon dioxide production) and are usually made during the quiet-phase of the animal’s circadian cycle. These measurements are often confounded by animal movement and restlessness. Recent analyses indicate that the average small mammal has to remain in a chamber for 8 hours before a reliable estimate of BMR can be made. Some researchers have taken to lightly anesthetising animals before they place them into the metabolism chamber, which removes the confounding effect of animal restlessness. But to date no one has compared the awake BMR of small mammals to the anesthetised MR. During this project we will make measure both the awake BMR and the anesthetised MR of the same individuals, using mice and some other small mammals.

Project 5. A Role for Prostaglandins in the Vasodilator Skin Blood Flow Response to Heat Exposure and Exercise?

(With Prof Brian Dawson, Human Movement and Exercise Science)

When humans are placed in situations where enhanced heat loss is required to maintain thermal balance, skin blood flow increases. An elevation in skin blood flow is achieved by reduction of vascular resistance in the skin. It is clear that central thermal input is important and leads to a reduction in vasoconstrictor tone and activation of a vasodilator system. For many years it was thought that the vasodilator system was mediated by Nitric Oxide, but subsequent study in humans has offered little support for NO mediation. The system seems to involve sympathetic cholinergic nerves, but the mediator is not Acetyl Choline. Attention has thus turned to Non-Adrenergic-Non-Cholinergic (NANC) mediators released from these nerves. In skeletal muscle prostaglandins and histamine have been implicated in ACh induced vasodilation, and so an involvement of these mediators in skin blood flow is possible. The project will involve exposing subjects to high ambient temperature (37°C) and light exercise, while core body temperature, skin blood flow, and skin temperatures are measured. Blood pressure and heart rate will also be recorded. Three experiments will be performed in random order 1) Control, 2) prostaglandin blockade, 3) histamine blockade. The results will have implications for sport and general medicine, because drugs that inhibit prostaglandins and histamine are freely available and they may be important in the etiology of heat illness.
Project 6. Cardiac work and the structure of the heart  
(With Prof Roger Seymour, University of Adelaide)

This project concerns the physiological and anatomical constraints that affect the vertebrate cardiovascular system. Body size is known to relate non-linearly to several characters of animals (e.g. metabolic rate, heart size, blood pressure, flow rate, and mitochondrial density), but no one knows why. Non-linear relationships can be analysed using allometric analysis, and we will adopt that approach by measuring heart work (cardiac output and blood pressure) and relating it to metabolic rate in anesthetized animals, and to the structure of the heart (volume can be taken up by contractile proteins, mitochondria, sarcoplasm, or blood vessels creating a trade off in space). Eventually we will do this for several species (rabbit, sheep, kangaroo, alpaca) but one species will be sufficient for one project.

Project is suitable for Honours, Masters, PhD

Supervisor  
Prof Shane Maloney

Essential qualifications

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
Deafness and other hearing disorders such as tinnitus are among the most common forms of sensory impairment with profound consequences for the individual and society. Normal hearing depends on the proper function of the many components of the inner ear and the brain pathways to which it is connected. Our laboratory seeks an integrated understanding of the normal operation of this sense organ and its associated neural pathways and to describe the mechanisms underlying various hearing pathologies.

**Project 1:** Mechanism of the therapeutic effect of cochlear implant stimulation on tinnitus. With E/Prof Don Robertson

Tinnitus, or ringing in the ears, is a phantom auditory sensation arising from abnormal electrical activity that develops in the brain as a consequence of hearing loss. Profoundly deaf individuals who receive a cochlear implant to restore some hearing function, report that the implant can reduce the severity of their tinnitus. The mechanism by which this effect occurs is unknown. This project will use an animal model of tinnitus in which we measure abnormal levels of spontaneous neural activity in the brain. Electrical stimulation will be delivered to the deafened and normal hearing cochlea in these animals to investigate the mechanisms by which this reduces the abnormal central activity.

**Project 2:** Translation of an animal behavioural test for tinnitus to human tinnitus sufferers. With E/Prof Geoffrey Hammond

Providing objective evidence in animals for the presence of a phantom auditory sensation such as tinnitus requires special behavioural testing strategies. A test known as the gap suppression test has been developed to evaluate tinnitus in animal models. This test measures the reduction caused by a preceding short gap in continuous background noise of the response to a startling acoustic stimulus. If animals experience tinnitus, the gap is less apparent and the resulting reduction in the startle response is less. The advantage of this test is that it is mediated by brainstem circuits and does not require conscious participation or training. This project will test whether human tinnitus sufferers exhibit a similar reduction in the gap suppression of brainstem reflexes. The eye blink reflex will be used in place of a startle response and the effects of a preceding noise gap in normal individuals and in tinnitus sufferers will be compared.

**Project 3:** Effects of repetitive transcranial magnetic stimulation on abnormal neural activity measured in an animal model for tinnitus. With A/Prof Jenny Rodger

Tinnitus, or ringing in the ears, is a phantom auditory sensation arising from abnormal electrical activity that develops in the brain as a consequence of hearing loss. Repetitive transcranial magnetic stimulation (rTMS) can reduce tinnitus perception in human patients, with more sustained effects after longer duration regimes. In the project we will use an animal model of tinnitus in which we measure increased levels of spontaneous neural activity in the midbrain. We will investigate the effects of different stimulation regimes of rTMS on the abnormal central activity.

Project is suitable for

Honours, Masters, PhD

Supervisor

Assoc/Prof Helmy Mulders
Essential qualifications

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

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**Ecology and Evolution**

Project outline

Project on primate socioecology in China, Rwanda and Cambodia.

Project is suitable for PhD

Supervisor

Cyril C. Grueter

Essential qualifications

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

For All:
Knowledge of statistical methods and Skills/Experience preferably also ArcGIS; candidate needs to be willing to work in a different cultural environment; candidate also needs to be physically fit
**Neuroscience**

Cell and tissue transplantation, gene therapy and the repair of central nervous tissue damaged after injury

**Project outline**

The research by the neuroscience groups in Anatomy, Physiology and Human Biology has a particular emphasis on cell and tissue transplantation, gene therapy and the repair of central nervous tissue damaged after injury. Ways are being tested for preventing nerve cells from dying after injury and promoting the regenerative growth of damaged axons. The specificity of axon/target cell reconnection after injury is of particular interest. The potential for replacing compromised cells with new healthy cells, including stem cells, is also under investigation. Studies are mostly carried out in the visual system and in the spinal cord. Studies on visual system development are also a major interest of the Harvey lab.

**Project is suitable for**

Honours, Masters, PhD

**Supervisor**

Assoc/Prof. Stuart Hodgetts

**Other supervisors**

W/Prof Alan Harvey

**Essential qualifications**

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

**Desirable skills/experience**

Neuroscience emphasis. Cellular and Molecular Biology would be helpful
Identifying Novel Signalling Pathway Governing Premature Diaphragm Weakness

Project outline

The diaphragm is the major muscle of the respiratory pump hence a functional diaphragm is fundamental to respiratory well-being. Studies over the last decade have shown that in adults, severe inflammation causes diaphragm dysfunction. Recently we have established that chorioamnionitis (inflammation of the placental and fetal membranes) has negative impact on preterm diaphragm function and the deleterious effect is likely to differ during critical stages of development occurring prenatally. The Wnt signalling cascade is a key regulator of cell proliferation, polarity and differentiation, and our pilot data has demonstrated that such novel pathway plays a significant role in regulating preterm diaphragm weakness in response to in utero inflammation. We have collected a number of samples of diaphragm tissue from naive lambs delivered prematurely, as well as lambs exposed to chorioamnionitis after either one or repeated intra-amniotic injections of lipopolysaccharide (LPS – an endotoxin). The project is designed to comprehensively examine how Wnt signalling integrates protein metabolism into protein degradation process, leading to muscle weakness.

Project is suitable for Honours

Supervisor

Assistant Research Professor Yong Song

Other Supervisors

Professor Jane Pillow

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable Skills/Experience

Basic Understanding of molecular and cell biology
Overview:

The major interests of our group centre on the importance of circadian biology in relation to placental function, maternal adaptation to pregnancy, and developmental programming. Current studies are focussed on the impact of maternal obesity, omega-3 fatty acids and glucocorticoid excess on pregnancy outcome (from the perspective of both the mother and the developing fetus).

Project 1: Adverse of obesity on maternal adaptation to pregnancy and placental function: omega-3 fatty acids help?

This project explores the adverse effects of maternal obesity on pregnancy outcome. This includes effects on maternal adaptations (e.g. circadian biology), placental function, and fetal growth and development. Our model of obesity involves provision of a ‘Western diet’ to rats before and during pregnancy (e.g. junk food such as pies, biscuits etc).

Obesity is a state of systemic inflammation and this may adversely impact on the mother’s adaptation to pregnancy as well as placental function. Placental inflammation may drive local oxidative stress, which is thought to play a key role in several pregnancy disorders such as miscarriage, intrauterine growth retardation and preeclampsia. This project is designed to investigate possible disturbances in the circadian biology of the mother, placenta and fetus induced by obesity, and the potential for omega-3 fatty acid supplementation to alleviate these disturbances.

Project 2: Developmental origins of health and disease (DOHAD)

Studies in relation to DOHAD focus on the effects of fetal glucocorticoid excess on the adult phenotype, particularly in relation to programming of adult-onset diseases such as hypertension, diabetes and obesity. The capacity of postnatal diets to either exacerbate (e.g. by a high fat diet) or rescue (e.g. dietary fish oil) adverse outcomes is an important focus of this work.

Tissue banks have been collected from a large scale glucocorticoid programming study and these are available for analysis. Tissues including heart, kidney and adrenal gland have been collected from control and programmed offspring raised on standard, high fat or high fat/high omega-3 diets at 6 months of age. They have been collected at four time points across a 24 hour period, enabling circadian profiling of gene expression and tissue function to be layered into the analysis.

Project 3: Circadian rhythms in the spiny mouse placenta

(Chief Supervisor Dr Peter Mark, with W/Prof Brendan Waddell and Dr Hayley Dickinson, Monash University)

Circadian biology underpins all major metabolic processes to appropriately align physiology of the organism with behaviour. Altricial (immature at birth) organisms, such as the rat and mouse, have minimal circadian variation in placental function, possibly to supply the fetus with constant nutrition during the the relatively brief period of fetal growth. Precocial (relatively mature at birth) organisms are often born with metabolic rhythmicity (e.g. liver function) which may be driven by exposure to
peaks and troughs in substrate supply from the placenta.

This project aims to determine whether placentas from the precocial spiny mouse exhibit distinct circadian rhythmicity in their function in association with fetal liver rhythmicity. Samples will be collected from pregnant spiny mice in collaboration with Dr Hayley Dickinson, The Ritchie Centre, Monash University, Victoria, and placental expression of clock genes and nutrient transporters will be determined at various stages throughout gestation to determine the timing of onset for placental rhythmicity.

Project is suitable for

Honours, Masters, PhD

Chief supervisor

W/Prof Brendan Waddell

Other supervisors

Dr Peter Mark

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
The genetic consequences of isolation in Kimberley, Pilbara and Abrolhos islands

Project outline

Many vertebrates occur on the numerous offshore islands of Western Australia. These islands have been separated from the mainland for up to 12,000 years. Isolated populations are at high risk of extinction due to specialized adaptations and loss of genetic variability, which limit a population’s ability to evolve in response to environmental change. Apart from isolation, there are concerns about the impact of grazing, tourism, fire and the mining industry, all of which have an inimical effect on population size and distribution. Examining the genetic diversity of vertebrates using mtDNA and microsatellite markers provides an insight into the population structure and the effects and risks of adverse impacts. Of course this study has significance for human evolution - early human populations were also very fragmented and experienced ecological change so in observing the impact of fragmentation on other vertebrates we may be able to clarify this and other impacts on our own history.

Project is suitable for

Honours

Supervisor

W/Prof Linc Schmitt

Other supervisors

Dr R A How, WA Museum

Essential qualifications

For Honours: BSc or BA in Biological Science, Psychology or Anthropology from an approved institution with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience

Some basic laboratory skills and a knowledge of genetics.
Creating virtual environments and educational animations for e-learning

Project outline

These projects are suitable for students interested in entering a career in science communication and/or science education. They focus on creating virtual environments and educational animations for image intensive disciplines – coupled with modern pedagogy. An understanding of the histology of the human body would be useful – but not essential. No previous computing knowledge/skills is needed.

Book publishers must use images selectively as publishing in these disciplines becomes unacceptably expensive as more colour plates are used. In the e-learning environment, the full power of digital images is employed and the “picture is worth a thousand words” truism used to full effect to create more appealing and compelling learning environments students now demand.

I have developed an award winning learning system for image intensive disciplines that facilitates learning preferences of students consistent with their more intensive use of computers and the internet. I have demonstrated that creating virtual environments and animations and integrating explanatory content in the learning system provides extremely powerful learning tools that have a major impact on qualities of learning outcomes achieved by students accessing e-learning.

Based on this initial success there is an opportunity to create biological structures that can be studied within virtual environments whereby we are able to generate computer aided visualisation of microscopic structures in 3 dimensions with accompanying explanatory sound features and animations to simulate functions of structures presented. Research into the consequent educational values of these innovations then can be initiated.

Project is suitable for Honours

Supervisor
Prof Geoffrey T. Meyer

Essential qualifications
For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience
An understanding of histology, but not essential.
Growing Muscles

Project outline

Myotubes (multinucleated skeletal muscle cells) are widely used as a convenient model that approximates to a muscle fibre in vivo, yet emerging data indicate that many properties of such immature cells are NOT equivalent to that of a mature, adult myofibre (discussed in Grounds & Shavlakadze, 2011). There are also likely to also be important differences between myotubes in culture and even young growing myofibres in vivo, since myofibres (both growing and mature) are innervated, in marked contrast with myotubes in culture. For example, we have shown that only GROWING muscle cells (myotubes, growing muscles and also regenerating muscles) show a signalling response to increased IGF-1 (Shavlakadze et al, 2010a,b). Several projects are proposed to investigate difference related to these growing and mature cell types.

1. Isolated Myofibres as a model for growth factor responses
2. Imaging sarcolemma properties of growing and adult myofibres
3. The mystery of central myonuclei in regenerated mouse muscles

Project is suitable for

Honours, PhD

Chief supervisor

Prof Miranda Grounds

Other supervisors

Dr Thea Shavlakadze

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
Aging Muscles

Project outline

Background. Skeletal muscles constitute approximately 40% of the mass of the human body and are essential for all aspects of movement such as breathing, eating, posture, walking and reflexes as well as heat generation and metabolism. A loss of muscle mass, known as atrophy or wasting, has major consequences for strength and muscle function. Muscle wasting can result from disuse (e.g. bed rest or space travel), injury, starvation, diseases such as cancer, sepsis, neuromuscular disorders, and also ageing. Different factors contribute to muscle wasting in the various conditions. The progressive loss of muscle mass associated with ageing is known as sarcopenia and is the focus of this research. Between the ages of 50 and 80 years in humans, muscle mass is reduced by about one-third; this is a major contributing factor to increased falls and fractures, with impaired physical function (frailty) resulting in dependency and sometimes death. Development of new targeted interventions to reduce sarcopenia and frailty would have a major impact on reducing health system costs, as well as improving the quality of life for the growing population of older individuals. In order to develop appropriate interventions to reduce muscle-wasting we need to understand the key factors responsible for sarcopenia. This is the focus of our current research; e.g Shavlakadze & Grounds (2003). Our research includes student projects on the role of denervation in sarcopenia; the role of protein degradation in sarcopenia; analyses of mitochondrial function and/or epigenetics in sarcopenia; molecular analyses and biomarkers of ageing muscles in mice and humans.

- See also recent papers 2010-2013 on http://school.anhb.uwa.edu.au/personalpages/grounds/

Project is suitable for
Honours, PhD

Chief supervisor
Prof Miranda Grounds

Other supervisors
Dr Thea Shavlakadze

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.
For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
A major focus of our research is developing therapies for muscular dystrophies, using mouse models. Much work is related to Duchenne Muscular Dystrophy (DMD) using the mdx mouse (e.g. Project #1 below), but more recently we have been investigating dysferlinopathies using dysferlin-deficient A/J mice (Project #2). This research is of central interest to various parent groups and other international groups e.g. TreatNMD e.g. http://www.treat-nmd.eu/ and http://www.parentprojectmd.org/site/PageServer?pagename=nws_index

1. Potential drug treatment for DMD: using OTC to target oxidative stress in mdx mice. This project would be done in close collaborations with Dr Jessica Terrill and Dr Peter Arthur (Biochemistry, UWA) who are experts on these studies on dystrophic mdx mice and on oxidative stress.

2. Dysferlinopathy: understanding oxidative stress and adipogenesis in dysferlin-deficient mice. Several experiments are planned to pursue this new research and these are still evolving and can be discussed.

Project is suitable for
Honours, PhD

Chief supervisor
Prof Miranda Grounds

Other supervisors
Dr Jessica Terrill and Hannah Crabb

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
Optimising methods for human sperm cryopreservation

Project outline

Cryopreservation of human semen is commonly used for storage of sperm for patients undergoing chemotherapy or vasectomy, quarantining of donor sperm and for fertility treatments when the male partner cannot be physically present. However, exposure to sub-zero temperatures and re-warming results in the loss of structural integrity and functional capabilities of at least 50% of the sperm; survival rates of men with low sperm counts appear further compromised. This project explores different approaches to freezing human semen including use of antioxidant supplementation of cryomedia and vitrification and examines the impact on indices of sperm quality (count, motility, generation of reactive oxygen species, oxidative DNA damage).

Project is suitable for

Honours

Supervisor

Dr Kathy Sanders

Dr Peter Burton, Concept Fertility Centre, King Edward Memorial Hospital

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience

Background in reproductive biology, physiology, cell biology or related areas; some experience with microscopy and basic laboratory techniques e.g. pipette handling and preparing solutions is desirable.
Skeletal muscle function can be severely compromised by injury and disease, leading to loss of mobility and decreased quality of life. In the case of inherited muscle wasting diseases such as the muscular dystrophies, damage to respiratory muscles (diaphragm) can lead to death of patients in their early twenties. Injuries have a direct impact on skeletal muscle function due to acute damage to the muscle structure. However, it is now apparent that the inflammatory response involved in the healing process can also have deleterious effects on muscle performance. This is due to the release from inflammatory cells of inflammatory mediators such as cytokines, which alter skeletal muscle contractile output and protein turnover through increases in intracellular levels of reactive oxygen species, Ca2+, phospholipase A2 and other factors. Many muscle diseases (e.g. muscular dystrophies) have a significant inflammatory component, and many non-muscle diseases such as cancer and chronic heart failure lead to loss of muscle performance due to the effects on muscle of increased circulating inflammatory cytokine levels. In this laboratory, we are interested in determining the role of inflammation in skeletal muscle damage after injury or disease, and uncovering novel strategies to inhibit these pathways in order to provide therapies for affected patients.

**Project 1:** The Role of Protease-Activated Receptors (PARs) in Muscle Injury  
With Dr Gavin Pinniger

In skeletal muscle, inflammation results from muscle injury. This inflammation is thought to contribute to the skeletal muscle weakness seen in these conditions, although it is unclear how this occurs. PARs are a newly identified family of G protein-coupled receptors that are activated by serine proteases such as thrombin and tryptase. PARs have been shown to mediate an extensive range of cellular activities, particularly during inflammation. In this laboratory, preliminary results in isolated skeletal muscle cells indicate that PAR-1 activation results in a large (=50%) decrease in sarcoplasmic reticulum Ca2+ release, which should induce significant muscle weakness. Therefore, PARs could act as an important link between inflammation and muscle weakness. Aim of Study: To investigate the mechanism responsible for effects of PAR-activation on skeletal muscle Ca2+ signalling under normal and conditions and conditions where PAR-expression is increased. Understanding the mechanism responsible for the PAR-mediated effect on skeletal muscle function could lead to strategies to inhibit this pathway in humans. Therefore, the results of this study could have important ramifications for the treatment of sports injuries, and diseases where inflammation and skeletal muscle weakness are associated. These include the muscle weakness associated with muscular dystrophy, cancer, chronic heart failure, chronic obstructive pulmonary disease and repetitive strain injury.

**Project 2:** Investigating the mechanisms responsible for the high rate of respiratory failure in premature babies, using an animal model.  
With Dr Gavin Pinniger and Prof Jane Pillow, School of Women's and Infants' Health.

Premature babies have immature lungs and have a greater incidence of respiratory failure than full term babies, and they often require mechanical ventilation. The diaphragm is the major skeletal muscle driving respiration, and the high incidence of respiratory failure in premature neonates may be, at least in part, due to exposure to in utero factors that alter diaphragm function. These include treatment with glucocorticoids (to increase lung maturity and surfactant production). In adult skeletal muscle, glucocorticoid exposure can activate muscle wasting pathways, through stimulation of nuclear factor-K13, ultimately leading to loss of muscle mass. In this study the successful applicant will investigate whether glucocorticoids play a role in the compromised diaphragm function in premature babies. Aims of the study
1. The student will use the neonatal rat diaphragm model to investigate whether glucocorticoid (betamethasone) exposure cause a loss of skeletal muscle function in the neonatal diaphragm.

2. The student will evaluate the ability of the nuclear factor-K13 inhibitors, ibuprofen and resveratrol to prevent the effects of betamethasone exposure on loss of diaphragm function.

The results of this study could lead to important new treatments to decrease the incidence of respiratory failure in preterm infants, and increase their rate of maturation and functional development.

**Project 3:** The role of reactive oxygen species (free radicals) on skeletal muscle fatigue.

With Dr Gavin Pinniger & Assoc. Prof Peter Arthur

Muscle fatigue is an important factor limiting sporting performance in athletes. It also plays an important role in the increasing immobility of the elderly, and the resulting loss of quality of life. There are a number of different types of fatigue, and each type may act by differing cellular mechanisms, and be important during different types of physical activity. Reactive oxygen species are highly reactive particles that are generated during contractile activity, and skeletal muscle fatigue is due in part to the effects of reactive oxygen species on the contractile machinery. In this study, we will examine the role of reactive oxygen species in different types of skeletal muscle fatigue, and examine the ability of antioxidants to reverse the effects of fatigue.

**Aim of Study:** To investigate the role of reactive oxygen species on ‘acute’ and ‘low frequency’ skeletal muscle fatigue, and the ability of antioxidants to reverse these processes. In this study, muscles from mice will be exposed to differing types of fatigue and the drop in force measured. The effects of reactive oxygen species on reactive thiol groups located on the contractile proteins will also be measured. The same protocol will be repeated in the presence of antioxidants such as dithiothreitol. The results of this study could lead to treatments to increase mobility of the elderly and patients with skeletal muscle diseases.

**Project is suitable for**

Honours, Masters, PhD

**Supervisor**

Assoc/Prof Tony Bakker

**Essential qualifications**

For Honours: An appropriate undergraduate degree with a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major, from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.
**The influence of age and reproductive status on stress perception and responsivity**

Project outline

There is a growing body of evidence supporting an association between higher levels of stress and reproductive failure. However, the association is weaker in women of advanced reproductive age (>35 years) compared with younger women. This is consistent with the reproductive suppression model which posits reproduction should not be suppressed when the costs of delay in terms of lost reproductive opportunities outweigh the benefits of suppression. But what are the mechanisms? This project will examine the influence of age and different reproductive states (for example, nulliparous, multiparous) on women's perception of stress and their physiological reactivity to a variety of stressors.

Project is suitable for

Honours, Masters, PhD

Supervisor

Dr Kathy Sanders

Essential qualifications

For Honours: An appropriate undergraduate degree with a biological science emphasis, and a minimum weighted average of 65% in the level 3 subjects that comprise the relevant major from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An appropriate Honours degree with a biological science emphasis or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience

Knowledge of statistics, second and third year Anatomy and Human Biology Reproductive Biology units or equivalent, background in psychology.
Forensic Anatomy

Have we got the scale right in fighting crime?

Project outline

Crime investigation relies on good science to make good decisions. The underpinning benchmarks of good science is good measurement with known outcomes. In the science of bite marks it is important that the rulers used are precise and the images taken are reproducible at to make measurements. This project will expand on some pilot work our team has done examining the quality of the rulers (international standards) used in forensic examination of bite marks (and other things). Get your teeth into some crime fighting outcomes! Our team includes about 25 postgraduate students and more than 100 collaborators across the globe (ircohe.net). One of the leaders of this project is currently with the Forensic Science team in Tasmania and we have collaborators across Australia. We have published on topics associated with this in the world’s literature for about 5 years and will support your efforts – we are a fun team!

Project is suitable for
Honours.

Supervisor(s)
Winthrop Professor Marc Tennant, Professor Estie Kruger and Dr Mithun Rajshekar
International Research Collaborative – Oral Health and Equity

Essential qualifications
For Honours: An undergraduate degree a minimum weighted average of about 65% in the level 3 subjects from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience
A passion for understanding and addressing issues of justice. A little bit of basic computer skills. Ready to have a fun learning experience.
**Using a Virtual World for Teaching**

**APHB In Second Life**

**Project outline**

I have a small grant to construct a virtual copy of the school of Anatomy, Physiology and Human Biology in the 3D world Second Life.

This is an experimental space in which to investigate the use of a 3D environment for the teaching of anatomy – which is all about 3D structures and the appreciation of 3D relationships.

The project would involve constructing 3D objects using cameras and software to import into the virtual environment and working out how these could be used in science and preclinical education.

**Project is suitable for**

- Honours, Masters

**Supervisor**

- Prof Stuart Bunt

**Essential qualifications**

For Honours: Some second and/or third year units in human anatomy and physiology

For Masters: A biomedical/education background
International Communities

Where are Health specialists in Sri Lanka?

Sri Lanka is a developing country about the size of Tasmania with the population of Australia with the history of 30 years long internal conflict which ended up recently. Accessibility and affordability to quality health care is a serious issue among poor people in Sri Lanka compared to their Australian counterpart. This project will extend work already completed and published in the international literature (image to right). It will examine the distribution of specialist dental services and how people can get access to these services. Our team includes about 25 postgraduate students and more than 100 collaborators across the globe (ircohe.net). Our mission is to advance our understanding the issues of marginalised peoples and access to good services. We have published in this area in the world’s literature (15 publications this year alone) for over 15 years and will support your efforts – we are a fun team! An international peer review publication will be expected to come from the research and possible travel to Melbourne may be involved.

Project is suitable for
Honours, Masters, (extension of it will lead to Doctorate level).

Supervisor(s)
Winthrop Professor Marc Tennant, Professor Estie Kruger and Dr Irosha Perera

International Research Collaborative – Oral Health and Equity ircohe.net

Essential qualifications
For Honours: An undergraduate degree a minimum weighted average of about 65% in the level 3 subjects from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience
A passion for addressing issues of health workforce in remote areas. A little bit of basic computer skills.

PERERA I, KRUGER E and TENNANT M. GIS as a Decision Support Tool in Health Informatics: Spatial Analysis of Public Dental Care Services in Sri Lanka Journal of Health Informatics in Developing Countries Vol. 6 No. 1, 2012
Ecology and Evolution

Project One: Primate behavioural ecology research:

- Questions related to alloparental care in mountain gorillas (using Karisoke long-term database)
- Comparative study on aspects of socio-ecological model of primate female relationships (using literature data).
- Observational research on primate behaviour/cognition at the Perth Zoo

Project Two: Human behavioural ecology

Examples
Questionnaire-based and experimental research on social networks, mate choice and fairness in humans

Project is suitable for
Honours/ Masters

Supervisor
Cyril C. Grueter

Desirable Skills/Experience
Basic knowledge of statistics (especially regression analyses) would be desirable.
Marginalised Communities

Project 1: Let make life better for people living in poverty

Many health workers in Australia work in capital cities and in relatively wealthy areas. This leaves much of Australia short of essential services and finds people in poverty suffering. Our team, that includes about 25 postgraduate students and has worked in understanding the issues of remote, rural and Indigenous people access to services. This year will see the graduation of the largest number of dentists (and the largest number from rural Australia) in history. For months now we have been collecting job vacancies in dentistry (by the beginning of 2014 we will have 9 months of data). The aim of the proposed study will be to map vacancies using advanced Geographic Information Systems and to monitor the effect of the newly graduation dentists on these vacancies. This work will lead to an international publication in the peer review literature.

Project 2: Do having grommets link to poor oral health?

Many children suffer from ear infection and need to have grommets to treat the infections. The bacteria involved in these infections are similar to those that cause tooth decay. The proposed study will use Big Data techniques to test the hypothesis that there may be a linkage between these two conditions and that providing a dental surveillance program for patients attending for ear infections may reduce the emergency need for dental care for children and thus reduce health care costs and human suffering. The study will also include some health financing and cost-benefit analysis. Our team includes about 25 postgraduate students and more than 100 collaborators across the globe (ircohe.net). Our mission is to advance our understanding the issues of remote, rural and Indigenous peoples and access to good services. We have published on this in the world’s literature (15 publications this year alone) for over 15 years and will support your efforts – we are a fun team! An international peer review publication will be expected to come from the research and possible travel to Melbourne may be involved.

Project is suitable for
Honours, Masters, (extension of it will lead to Doctorate level).

Supervisor(s)
Winthrop Professor Marc Tennant, Professor Estie Kruger and Professor Kate Dyson
International Research Collaborative – Oral Health and Equity

Essential qualifications
For Honours: An undergraduate degree a minimum weighted average of about 65% in the level 3 subjects from an approved institution. Applicants will be assessed on a case-by-case basis.

For Masters or PhD: An Honours degree or equivalent research experience from an approved institution. Applicants will be assessed on a case-by-case basis.

Desirable skills/experience
A passion for understanding and addressing issues of marginalized communities through better health systems. A little bit of basic computer skills.