Faculty of Science

School of Anatomy, Physiology and Human Biology

Student Research Projects for Honours, Masters and PhD Studies 2013
The School's research areas include:

- Cell Biology
- Evolutionary Ecology
- Ion Channels in Heart Muscle
- Functional anatomy
- Sleep Science – Sleep Disorders
- Education
- Respiratory Physiology
- Skeletal Muscle Physiology
- Comparative Physiology of Adaptation
- Art in Science
- The Auditory Laboratory
- Neuroscience
- Impact of obesity on maternal adaptation to pregnancy and placental function
- Developmental origins of health and disease
- The genetic consequences of isolation in Kimberley, Pilbara and Abrolhos islands
- Creating virtual environments and educational animations for e-learning
- Growing Muscles
- Aging Muscles
- Dystrophic Muscles
- Exercised Muscles
- Attitudes to release of information in open-identity donor programs
- The influence of age and reproductive status on stress perception and responsivity
- Ecology
- The Importance of Vitamin D in pregnancy
- Geometry of placental vascular networks and implication for nutrient transport
- The role of kisspeptin in energy expenditure in the mouse
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 is available in the following discipline:
- Anatomy and Human Biology
- Physiology
- Neuroscience (by arrangement)
- Biomedical (by arrangement)

General information about Honours in Anatomy, Physiology and Human Biology can be found at http://www.aphb.uwa.edu.au/courses/honours.

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.

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.

Each year some suggested projects are posted on our honours website at 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>
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<th>Tasks</th>
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INFORMATION FOR POSTGRADUATE APPLICANTS

Graduate Diploma in Science

This one year degree is essentially the same as honours and is designed for students who are ineligible for honours at UWA.

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/
## Staff Research Interests

### Cell Biology

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<tr>
<td>Project outline</td>
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<td>Professor Dharmarajan’s group researches the role of apoptosis and its signalling molecules in cancer. Specifically projects examine the role of secreted frizzled related protein-4 (sFRP4) and its associated wnt signalling pathways in:</td>
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<tr>
<td>- Breast cancer</td>
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<tr>
<td>- Ovarian cancer</td>
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<tr>
<td>- Mesothelioma</td>
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<td>- Skin differentiation/melanoma</td>
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<td>- Prostate cancer</td>
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<td>- Angiogenesis</td>
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<td>- Cancer Stem cells</td>
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</table>

Project is suitable for

Honours, Masters, PhD

Supervisor

W/Prof Arun Dharmarajan

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 molecular biology, biochemistry, good writing and computing skills.
**Cell Biology**

**Anti-viral immunity and host genetics**

Project outline

Host Genetic Determinants of Spontaneous Hepatitis C Clearance: influence of immune response genes on infection outcome.

How does the interaction between host and virus influence Hepatitis C virus and HIV infection outcome and disease progression?

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.
Cell Biology

Cancer Epigenetics; Epigenetics of aging; engineering cells using designer DNA-binding proteins.

Project outline
- Molecular mechanisms of tumorigenesis and tumor progression
- Molecular cancer therapeutics, protein engineering for cancer
- Cancer Epigenetics
- Epigenetics of Aging

My laboratory is interested in Epigenetics. Epigenetic modifications occur at DNA level (DNA methylation) and in histones, proteins that associated with the DNA in chromatin. We are focused on the mapping of epigenetic modifications in the genome of diseased cells versus normal cells (for example cancer cells relative to normal tissue). Second, we wish to promote sequence-specific changes in the epigenome of the diseased cell to ultimately correct the phenotypic alteration in the diseased state. To this aim, our lab has characterized and engineered "custom-made" DNA binding proteins linked to a variety of epigenetic enzymes for the purpose of cell engineering and cancer therapeutics.

Project is suitable for

Honours, Masters, PhD

Supervisor
A/Prof Pilar Blancafort

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.
Evolutionary Ecology

The School of Anatomy, Physiology and Human Biology offers a diverse range of student research topics.

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
- 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
- Environmental uncertainty and reproductive strategies in Australian fauna. Database development and statistical analyses of patterns of ecology and life history traits across species
- 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 both 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 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
Associate 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.
Functional anatomy

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 2013:

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; cardiovascular function and sleep disorders.

Project is suitable for Honours, Masters, PhD

Supervisor
W/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.
Education

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.
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 depends 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. Currently 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 isolate pig airways. 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.

Project 2 Respiratory pattern in airway disease

Over the last decade a surprising finding in asthma research is that breathing is a bronchodilator in healthy subjects but not in asthmatics or COPD (chronic obstructive pulmonary disease) patients. In a healthy person taking a deep breath greatly reduces bronchoconstriction and relaxes airway smooth muscle. However few studies have examined pattern of breathing differences between healthy and diseased subjects. This project aims to measure the frequency and pattern of spontaneous deep breath (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.

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 is continuous partial contraction can make isolated bronchi asthma like in their response to bronchoconstrictors. This project will use isolate pig bronchi and explant culture.
Project 4 Airway Structure in Disease

During lung 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

Project 5 Airway Explants

Cell culture is an extremely useful technique but limited for studying whole tissues like an airway. The tissue explant technique is an adaptation of tissue culture to larger structure like an intact blood vessel of airway segment. 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” does prolonged exposure to high intraluminal pressure change airway contractility and does a normal breathing pattern inhibit pathological changes in airway structure. This project would involve developing a method to explant sheep bronchi under conditions were the luminal pressure can be controlled.

Supervisor

Dr Peter McFawn | Dr Peter Noble

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.
Skeletal Muscle Physiology

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 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 anesthesia and surgery, non-recovery anesthesia and microdissection of whole muscle and single muscle fibres, cell- culture and calcium imaging. We have several multi-disciplinary collaborations with local researches and are particularly interested in: i) the molecular processes underlying exercise-induced muscle damage; ii) the effectiveness of anti-oxidant and anti-inflammatory treatments in reducing injury related muscle weakness; iii) gene therapy treatments for Duchenne muscular dystrophy, and iv) the impact of exposure to clinically relevant treatments on diaphragm dysfunction in pre-term infants. 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 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 unraveling 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 2 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 antioxidant 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.

Project 3 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 (School of Women’s and Infants’ Health)

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.

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.
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 text books 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 is 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 Undernutrition and the defense 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 Can we use Vibration to Enhance Cooling from Hyperthermia?**

Industrial workers habitually exposed to hand vibration (such as jackhammer operators) often develop a condition called “whitefinger” where vasoconstriction of the hands is exaggerated. It turns out that there is a range of frequencies where vasoconstriction is exaggerated, but another where it is inhibited. When a hyperthermic human places their arms in cold water, it feels good, but not much heat is transferred to the water because the cold stimulus causes skin vasoconstriction. If we can determine the optimum vibration stimulus for inhibition of vasoconstriction to a cold stimulus during hyperthermia, we would have an ideal method for treating hyperthermia. Laser Doppler flowmetry will be used to measure skin blood flow, and thermocouples to measure skin temperature, of the arm and hand while the arm is vibrated at various frequencies. Initially the flow and temperature responses in euthermia will be investigated to determine the optimum frequency (frequencies?) for vasomotor effects in the skin. Then the study will turn to effects in hyperthermia and with cold stimuli applied to the skin. A more efficient, non-pharmacological method of cooling will be useful in any endeavour where hyperthermia impacts on health or performance, such as competitive sport, military activities, or outdoor events. There is potential to test also the effect of ultrasound on the same responses.
**Project 6. 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 7. 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.
Art in Science

The School of Anatomy, Physiology and Human Biology offers a diverse range of student research topics.

**Art and 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.
The Auditory Laboratory

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.

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 frequently suffer from tinnitus. Many such patients who receive a cochlear implant to restore some hearing function, report that the implant reduces the severity of their tinnitus. The mechanism by which this effect occurs is unknown. The 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 cochlea in these animals to test whether it restores the spontaneous activity to normal levels.

Project 2: Translation of an animal behavioural test for tinnitus to human tinnitus sufferers.

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 is suitable for
Honours, Masters, PhD

Supervisor
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.
**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.

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
**Impact of obesity on maternal adaptation to pregnancy and placental function**

**Project outline**

Our major interests centre on the adverse effects of maternal obesity on the success of pregnancy. This includes effects on maternal adaptations (e.g. metabolic function), placental function, and fetal growth and development. Our models of obesity during pregnancy include consumption of a “cafeteria diet” (pies, biscuits, hot dogs etc) and excess consumption of high fructose corn syrup (HFCS), a sweetener used in soft drinks and other junk foods.</p> <p>

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.

**Project is suitable for**

- Honours, Masters

**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.
**Developmental origins of health and disease**

**Project outline**

Our major interests centre on the role of glucocorticoids and dietary omega-3 fatty acids on pregnancy. This includes their effects on placental function, fetal growth and programming the phenotype of adult offspring.

Studies under this project title focus on the effects of excess fetal glucocorticoid exposure during pregnancy on the adult phenotype, particularly in relation to programming of the metabolic syndrome. The interactive effects of variations in postnatal diet, particularly in relation to possible protective effects of dietary fish oil, are the current focus in 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 is suitable for**

Honours, Masters

**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 as they will be developed under the supervision of Associate Professor Karen Haines (UWA), Dr Peter Morse (UWA) at WASP (Western Australian Super Computer) facility at UWA.

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
\textbf{Prof Geoffrey T. Meyer}

Essential qualifications
\textbf{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 and oxidative stress in sarcopenia; possible altered regenerative response to muscle damage; major microarray and molecular analyses of ageing muscles; cellular analyses of neuromuscular junctions, nerves and motoneurones; and blood cells analyses of ageing mice.


1. Enhancing regeneration of damaged muscles in OLD mice
2. Stem cell capacity of aged muscles after repeated injury
3. Molecular and cellular analyses of aged 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.
Dystrophic Muscles

Project outline

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, but more recently we have been investigating dysferlinopathies using dysferlin-deficient A/J and SJL/J mice: this work is of central interest to various parent groups and TreatNMD e.g. Parent Project Muscular Dystrophy and Jain Foundation and TreatNMD. Our recent research relates to drug interventions to blockade TNF or target oxidative stress, plus dietary interventions based on deep metabolic analyses (many papers in preparation + see recent papers below). Projects related to all of these aspects are possible and only a few are indicated. Recent papers:


1. Potential drug treatment for DMD: using OTC to target oxidative stress in mdx mice.
2. Can a high protein diet reduce the severity of dystropathology in mdx mice?
3. Dysferlinopathy: understanding oxidative stress and adipogenesis in dysferlin-deficient mice

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.
Exercised Muscles

This project would be done in close collaborations with Dr Peter Arthur (Biochemistry, UWA) who is an expert on oxidative stress and his research with exercise forms the basis for this project.

Project outline

1. Exercise and muscle adaptation, measured by increased protein thiol oxidation and altered signalling. Regular exercise helps maintain healthy muscle. The beneficial effects of exercise are proposed to arise from stimulating signal transduction pathways to promote a variety of positive effects, including increased protein synthesis (leading to increased muscle mass). Oxidative stress during, and after, exercise is proposed to enhance the action of these signal transduction pathways. If this hypothesis is correct, then consuming antioxidants may be undesirable if it blocks the benefits of exercise. This hypothesis will be tested in an exercising rat model in the presence and absence of an antioxidant. Additional or future experiments can apply these observations to various regimes of exercised mice, using our many models of normal, dystrophic and aged mice.

Project is suitable for

Honours, PhD

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.
Historically sperm donation and conception have remained secretive. The donor was anonymous and only limited, non-identifying information (e.g. hair and eye colour, education and interests) was made available to recipients. Few donor-conceived children were told of the manner of their conception. Oocyte recipients were also unlikely to disclose to their offspring despite being more likely to know their donor (for example, a friend or relative).

However, social attitudes to the use of donor gametes/embryos have changed. Accordingly an increasing number of countries/states (Sweden, Netherlands, UK, States of Victoria and Western Australia) have legislated for open-identity donor systems where children born of gamete or embryo donation can access identifying information about their donor on reaching maturity.

This project addresses issues surrounding the release of identifying information in a donor gamete/embryo program from the perspectives of the donor, the recipient and the offspring. Some questions include:

- What factors motivate individuals to donate gametes/embryos in an open-identity system?
- Is the extent and availability of biographical information about the donor important in recipients’ decisions to (or not to) disclose?
- How do donor-conceived offspring perceive their donor, and what information about the donor do they desire?

Project is suitable for

Honours

Supervisor

Dr Kathy Sanders

Dr Peter Burton and Ms Iolanda Rodino, 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

Some background in any of the following areas useful but not essential: Reproductive biology, Psychology, Marketing, Health Science
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 out weigh 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.
Ecology

Project outline

Project on intergroup relationships and/or social cohesion in wild mountain gorillas in the Virunga Volcanoes in Rwanda.

Project is suitable for PhD, Research Masters

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.

Ecology

Project outline

Primate behavioral ecology research, e.g.

- Questions related to alloparental care in mountain gorillas (using Karisoke long-term database)
- Comparative study on ornamentation and social organization in primates (using literature data)
- Comparative study on aspects of socioecological model of primate female relationships (using literature data)

Project is suitable for Masters/ Dissertation Masters

Supervisor

Cyril C. Grueter

Desirable Skills/Experience

Basic knowledge of statistics (especially regression analyses) would be desirable; for comparative studies, knowledge of phylogenetic methods would be helpful, but can be learned.
The Importance of Vitamin D in pregnancy

Project outline

Vitamin D is critical for optimal health, and it's becoming increasingly apparent that many people are deficient for Vitamin D. Vitamin D deficiency during pregnancy is of particular concern as it has implications for maternal health, neonate health and subsequent adult health of the offspring. This project will look at the significance of Vitamin D deficiency in pregnancy using a rodent model. Placental and fetal development will be assessed as well as maternal care and offspring behaviour in later life.

Project is suitable for Honours
Supervisor Asst/Prof Caitlin Wyrwoll

Essential qualifications
Willingness to work with rodents

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
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

Jeremy Smith

Essential qualifications

None

Desirable skills/experience

A background in molecular biology is desirable but not essential.