



**Faculty of Health Sciences & Medicine**

**Bachelor of Health Sciences  
Honours Program**

**Information Booklet**

**2021 Intake**

## **Introduction**

The Bachelor of Health Sciences Honours program is a 90CP supervised, one-year program of independent research and study, culminating in the production of a research thesis and presentation of a research seminar. Students undertake a program of course-work and research in which they conceptualise, plan, organise, undertake and report on an independent research project, whilst being supervised by a member of academic staff, often within a research group or team.

The Honours Program is offered as an add-on to the following degree programs at Bond:

- Bachelor of Biomedical Science
- Bachelor of Exercise & Sports Science
- Bachelor of Health Sciences

The program is a three-semester course of study which has an intake in January each year.

## **Aims of the Honours Degree**

The Bachelor of Health Sciences Honours program is designed primarily to provide graduates with skills in research. An Honours degree is an essential prerequisite for entry into postgraduate research, typically Master of Science by Research and PhD (Doctor of Philosophy) programs. Completion of an Honours year will also help graduates gain employment in their discipline, and there are diverse opportunities available, not only as research assistants, but also in hospitals, allied health, education, government, the pharmaceutical industry, scientific editing and others. Honours graduates are highly valued by employers, since they have demonstrated skills in written and oral communication, critical thinking and interpretation and project management.

The Honours program within the Faculty of Health Sciences & Medicine aims to help graduates develop skills in:

- planning and conducting research
- written and oral professional / scientific communication
- writing ethics and grant applications
- information retrieval and organisation
- project management

## **Structure of the Program**

The Honours program consists of 90 credit points, comprising both coursework and research components scheduled as follows:

<b>SEM 1</b>	HLSC41-140: Research Analysis & Communication (15CP) HLSC41-141: Research Preparation & Design (15CP)
<b>SEM 2</b>	HLSC44-140: Honours Thesis A (15CP) HLSC44-141: Honours Thesis B (15CP)
<b>SEM 3</b>	HLSC44-142: Honours Thesis C (30CP)

### **COURSEWORK COMPONENTS**

#### **HLSC41-141: Research Preparation and Design (15CP)**

This subject is designed to provide the framework and skills necessary for Honours students to successfully commence a research project in the Health Sciences. Students will work closely with the Honours convenor and individual project supervisors to develop their research topic, formulate their aims and hypotheses and consider the significance of the project. Workshops will enable students to search for, retrieve, interpret and begin to critically evaluate the relevant literature in their field. Research ethics processes will be discussed and debated, and students will be assisted to complete ethics applications where appropriate for their study. Students will also review various research design strategies and identify appropriate methods for conducting their project and analysing their expected data. Finally, students will be supported to prepare a detailed research proposal to the Faculty.

*Assessment includes: Literature Review (60%) & Project Proposal (40%)*

#### **HLSC41-140: Research Analysis and Communication (15CP)**

The successful conduct of research requires advanced abilities in analysis and interpretation of data, critical thinking and written and oral presentation. This subject will complement the subject 'Research Preparation & Design', and help students to develop these skills. A thorough coverage of mathematical and statistical procedures will be provided, to support both the project design and data analysis aspects of the research project. Parametric and non-parametric statistical methods will be examined, including t-tests, analysis of variance (ANOVA), correlation and regression. Interactive workshops will help develop students' skills in a variety of communication formats, including the writing of discipline-specific journal articles, short abstracts and funding proposals. Students will also participate in regular presentation sessions.

*Assessment includes: Journal Club Presentation (15%), Statistics Assignment (35%) & Research Proposal Seminar (50%)*

## **RESEARCH / DISSERTATION COMPONENTS**

### **HLSC44-140: Honours Thesis A (15CP)**

*Assessment includes: 3-minute thesis (3MT) presentation (15%), Journal Club (15%)  
Standard and Extended Abstracts (70%)*

### **HLSC44-141: Honours Thesis B (15CP)**

*Assessment includes: Research Skills and Engagement mark (supervisor mark) (40%),  
Poster Presentation (60%)*

### **HLSC44-142: Honours Thesis C (30CP)**

This subject is the culmination of the research project and has two major final assessable components of the Honours candidature. Candidates will be required to prepare a full thesis (80% of the assessment weighting) and deliver a final research seminar (20%) in which the research project and associated results will be presented and defended. These assessments will be evaluated for the thoroughness of the literature review, the validity and reliability of the data collected, as well as the subsequent analysis, interpretation, presentation and discussion of the results. The final thesis will be assessed both internally and externally to the Faculty.

*Assessment includes: Final Honours Thesis (80%), Final Seminar Presentation (20%).*

## **Application for admission**

The program is available to students who have completed a relevant Bachelor's degree. An application for admission to the Honours program, and all relevant supporting documentation, must be submitted online to Bond University at <https://apply.bond.edu.au/>.

**Applications open on 14<sup>th</sup> September 2020 (Monday Week 1 of semester 203)**

**Applications close on 21st October 2020 (Wednesday Week 6 of semester 203)**

## **Selection**

The candidate's application for admission to the Honours program is considered by the Honours Program Convenors, in consultation with proposed/potential supervisors and the Heads of Program. In evaluating an application for admission to the Honours program the following will be considered:

1. The undergraduate record of the applicant, and the completion (or expected completion) of a relevant Bachelor's degree. Admission into the Honours Program requires an overall GPA of 2.0 (credit) out of 4 (equivalent to 5.0 out of 7). Eligibility for partial tuition-fee waiver scholarships, if available (see 'Fees & Scholarships'), requires a minimum GPA of 2.5 (on a 4- point scale) or 5.5 (on a 7-point scale).
2. Candidates must have completed at least 60 credit points of study related to the general area of the proposed Honours research project in the last three semesters of their Bachelor's degree.
3. Candidates must have been awarded (or expected to be awarded) a Bachelor's degree that is related to the proposed Honours research project within the previous three years.
4. A candidate whose GPA is below that required for admission into the Honours program may apply to the Dean of the Faculty for special consideration.

### **Approval of dissertation topic and supervision**

All Honours projects/dissertation topics and Supervisor(s) are approved by the Faculty prior to being offered to students.

#### **NEXT STEPS:**

- 1. Discuss advertised projects with potential supervisors prior to the application deadline.**
  
- 2. A student/supervisor agreement must be signed by both parties and submitted by e-mail to the Honours Convener by the application deadline (camcderm@bond.edu.au).**
  
- 3. Submit application for the Bachelor of Health Sciences (Honours) program by Wednesday 21<sup>st</sup> October 2020 at <https://apply.bond.edu.au/>**
  - Applicants who do not have the agreement of the project supervisors will NOT be considered.**

#### **NOTE REGARDING SCHOLARSHIPS:**

- All applicants will automatically be considered for a partial tuition-fee-waiver scholarship (you do not have to make any selections on the online application regarding scholarships)**

## **Fees & Scholarships**

A limited number of partial tuition-waiver scholarships may be available, to a maximum of 50%. Award of a scholarship, and the percentage fee waiver that a student receives is the decision of the University and all students will not necessarily receive equal scholarship amounts. Students will be charged the standard tuition fee minus their percentage of Scholarship awarded. Note that applications received after the closing date may not be considered for a scholarship.

### **Fees for the School of Health Sciences Honours Program 2021: \$35,010**

#### **Honours Convenors:**

Associate Prof. Catherine McDermott

[camcderm@bond.edu.au](mailto:camcderm@bond.edu.au)

## **FEE-HELP**

Fee-help may be used to off-set the costs of the fees associated with the Honours program. FEE- HELP is an interest-free loan scheme administered by the Australian Taxation Office and available to Australian citizens and those holding a permanent humanitarian visa to help pay tuition fees. For more details of the loans available visit: [www.goingtouni.gov.au](http://www.goingtouni.gov.au).

## **Grades Awarded**

The degree with Honours is awarded in the following classes:

Honours Class I (85-100%)

Honours Class IIA (75-84%)

Honours Class IIB (65-74%)

Honours Class III (50-64%)

## **Study Load & enrolment status**

The HSM Honours program comprises 90CP over three semesters. Each semester has an enrolment of 30CP.

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## **HONOURS RESEARCH PROJECTS AVAILABLE FOR 2021**

E-mail contacts are provided for the principal supervisor for each project. You should contact the supervisor for the projects you are most interested in to discuss in detail.

## 1. Project Title:

# A role for TRP channels in kidney stone treatment

## Supervisors:

Iris Lim, Donna Sellers, Russ Chess-Williams

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## Project Summary:

### Background

Kidney stones cause excruciating pain while passing down the urinary tract, especially through the ureter, a hollow tube made up of smooth muscle cell wall. Ureteral smooth muscle contraction causes constriction, resulting in pressure increase, and is suggested to be the cause of pain when passing kidney stones (Canda et al., 2007). Pharmacological treatment for passing kidney stones is most preferred by patients, as it is non-invasive compared to other treatments like surgery. However, the most widely used drug for passing kidney stones, tamsulosin, has been associated with adverse effects and its efficacy is in question (Meltzer et al., 2018). Current research efforts are directed towards alternative pathways to reduce ureteral smooth muscle contraction. The mechanisms by which ion channels regulate ureteral smooth muscle function have not been completely elucidated. Previous studies have shown that transient receptor potential (TRP) channels are expressed in the bladder detrusor smooth muscle and play a critical role in the regulation of contractility (Smith et al., 2013). While several members of the TRP superfamily have been identified in the ureter, these channels show expression in the urothelium or sensory neuron and has not been studied in the smooth muscle (Shabir et al., 2013).

### Aims of the project

This project will investigate the role of TRP channels on agonists-induced contractile response in the isolated porcine ureter.

### Methods to be used/skills to be developed by the student

This study will utilise several techniques to investigate the role of TRP channels in the porcine ureter. Students will develop skills in:

- Isolated tissue dissection
- Functional pharmacology, which will be performed to study smooth muscle contraction and relaxation using organ bath experiments
- Pharmacological and physiological data analysis

### Significance and Expected Outcomes for student

- Identification of the pharmacological function of TRP channels in ureteral contraction
- Student outcomes include the opportunity to present research findings at a national urology symposium and local health and medical research conference, and to publish one or more abstracts and a manuscript.

### References

- CANDA, A. E., TURNA, B., CINAR, G. M. & NAZLI, O. 2007. Physiology and pharmacology of the human ureter: basis for current and future treatments. *Urol Int*, 78, 289-98.
- MELTZER, A. C., BURROWS, P. K., WOLFSON, A. B., HOLLANDER, J. E., KURZ, M., KIRKALI, Z., KUSEK, J. W., MUFARRIJ, P., JACKMAN, S. V. & BROWN, J. 2018. Effect of Tamsulosin on Passage of Symptomatic Ureteral Stones: A Randomized Clinical Trial. *JAMA Intern Med*, 178, 1051-1057.
- SHABIR, S., CROSS, W., KIRKWOOD, L. A., PEARSON, J. F., APPLEBY, P. A., WALKER, D., EARDLEY, I. & SOUTHGATE, J. 2013. Functional expression of purinergic P2 receptors and transient receptor potential channels by the human urothelium. *Am J Physiol Renal Physiol*, 305, F396-406.
- SMITH, A. C., HRISTOV, K. L., CHENG, Q., XIN, W., PARAJULI, S. P., EARLEY, S., MALYSZ, J. & PETKOV, G. V. 2013. Novel role for the transient potential receptor melastatin 4 channel in guinea pig detrusor smooth muscle physiology. *Am J Physiol Cell Physiol*, 304, C467-77.

## Email contact:

[ilim@bond.edu.au](mailto:ilim@bond.edu.au)

## 2. Project Title:

### Does gender affect ureteral contractility?

#### Supervisors:

Iris Lim, Donna Sellers, Russ Chess-Williams

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#### Project Summary:

##### Background to the project

The incidence of kidney stones is steadily increasing, currently affecting at least 10% of the population. Studies have shown that males are twice as likely to present clinically with kidney stones compared to females (Nojaba and Guzman, 2020). While there are potential environmental factors (for instance, increased dehydration in males than females) that might contribute to this, it is also likely that the ureteral smooth muscle in males and females have differing pharmacological and physiological profiles. Previous studies have shown that contractile characteristics of other structures of the urinary tract like the bladder can differ between gender (Liang and Leung, 2012). These differences in ureteral contraction have not been investigated and could potentially elucidate the differences in number of clinical presentation of kidney stones between males and females.

##### Aims of the project

This project will investigate the contractility of the isolated ureter in male vs female young pigs, which have been shown to have similar pharmacology to human ureters (Lim et al., 2020).

##### Methods to be used/skills to be developed by the student

This study will utilise several techniques to investigate differences in porcine ureteral contractility between gender. Students will develop skills in:

- Tissue dissection
- Functional pharmacology, which will be performed to study smooth muscle contraction and relaxation using organ bath experiments
- Pharmacological and physiological data analysis

##### Significance and expected outcomes of the project and for the student

- Identification of differences in contractile response of the ureter to various agonists including (not limited to) phenylephrine and 5-HT in different parts of the ureter including the proximal, mid and distal ureter.
- Student outcomes include the opportunity to present research findings at a national urology symposium and/or local health and medical research conference, and to publish one or more abstracts and a manuscript.

##### References

- LIANG, W. & LEUNG, P. C. 2012. Variations in carbachol- and ATP-induced contractions of the rat detrusor: effects of gender, mucosa and contractile direction. *Int Urol Nephrol*, 44, 1641-8.
- LIM, I., CHESS-WILLIAMS, R. & SELLERS, D. 2020. A porcine model of ureteral contractile activity: Influences of age, tissue orientation, region, urothelium, COX and NO. *J Pharmacol Toxicol Methods*, 102, 106661.
- NOJABA, L. & GUZMAN, N. 2020. Nephrolithiasis. *StatPearls*. Treasure Island (FL).

#### Email contact:

[ilim@bond.edu.au](mailto:ilim@bond.edu.au)

### 3. Project Title:

## Stress and diabetic bladder dysfunction

### Supervisors:

Donna Sellers, Catherine McDermott Russ Chess-Williams

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### Project Summary:

#### Background to the project

Bladder dysfunction such as overactive bladder, bladder pain syndrome and interstitial cystitis are common in the general population. A body of clinical evidence exists linking bladder disorders with stress, anxiety and depression, including witness trauma and post-traumatic stress disorder. Stress appears to greatly influence the development of bladder symptoms, or worsens symptom severity. In spite of this, there is very little research on the precise changes and underlying mechanisms. These studies will identify local mechanisms underlying changes in bladder function in models of stress and diabetic bladder dysfunction.

#### Aims of the project

To determine whether stress exacerbates diabetic bladder dysfunction, specifically bladder muscle and nerve function.

#### Methods to be used/skills to be developed by the student

This study will investigate the changes in bladder function in mice with diabetes following a period of exposure to stress and anxiety. The model of stress to be used will be environmental stress (water avoidance).

The study will utilise several techniques and students will develop skills in:

- Small rodent (mice) handling and treatments
- Tissue dissection
- Behavioural and voiding studies
- Functional pharmacology using isolated whole bladder preparations
- Pharmacological and physiological data analysis
- Participation in regular lab group meetings

#### Significance and expected outcomes of the project and for the student

Approximately 40% of patients with bladder dysfunction have poor treatment outcomes from the currently available treatments. In spite of strong clinical associations, and reports of increased bladder symptom severity with stress, there has been very little attention given to the mechanisms underlying bladder dysfunction induced by stress and anxiety. The identification the mechanisms involved in stress-induced changes in bladder function will increase our understanding of the role of stress and anxiety on the lower urinary tract. This knowledge is essential if new therapies are to be developed to manage these disorders.

Students outcomes include the opportunity to present research findings at a national pharmacology symposium and to publish one or more abstracts plus a manuscript.

### Email contact:

dsellers@bond.edu.au

#### **4. Project Title:**

**The effects of age on contractile activity of the urinary bladder.**

#### **Supervisors:**

**Christian Moro, Russ Chess-Williams**

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#### **Project Summary:**

##### **Background to the project**

Although combination treatments are becoming the more common first-line pharmacotherapy for overactive bladder, a large proportion of patients discontinue their regimes due to side effects and lower-than-expected treatment benefits. Interestingly, patients over the age of 60 are more likely to persist with pharmacological management of their bladder dysfunction, compared to younger patients, but the underlying reasons for this have yet to be understood. Although lifestyle changes may influence compliance to medications, there is also the possibility that ageing influences the receptor activity or prevalence within urothelial and detrusor tissues, and it may be this mechanism which is affecting patient responses to prescribed medications.

##### **Aims of the project**

This project aims to investigate the influence of ageing on bladder contractile responses to adrenergic and other candidate receptors on the urinary bladder detrusor and urothelium tissue layers.

##### **Methods to be used/skills to be developed by the student**

Functional organ bath experiments will be performed utilising selective pharmacological agonists and antagonists. A comparison will be made between the contractile activity, and the responses to agonists, on isolated samples of urothelium and detrusors from differently aged porcine samples.

##### **Significance and expected outcomes of the project and for the student**

This exciting project will provide some understanding into the effects of ageing on contractile activity of the urinary bladder and provide a student with a solid grounding in physiological and pharmacological research.

#### **Email contact:**

**cmoro@bond.edu.au**

## 5. Project Title:

### Investigating the effects of stress hormones on urothelial mediator release

## Supervisors:

Catherine McDermott, Donna Sellers, Katie Powell

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## Project Summary:

### Background to the project

A body of clinical evidence exists linking the development of bladder disorders with stress, anxiety and depression, including witness trauma and post-traumatic stress disorder. Stress appears to greatly influence the development of bladder symptoms or worsens symptom severity. In recent years the inner lining of the bladder, known as the urothelium, has been identified as an important regulator of bladder activity. Once thought of as a simple barrier between the urine and underlying tissues, this layer is now known to be involved in both sensory and contractile mechanisms regulating bladder activity. During bladder filling, stretch of urothelial cells elicits the release of several factors including ATP, ACh, PGE<sub>2</sub>, NO and an unidentified factor that inhibits the underlying smooth muscle contraction. Alterations in release of these chemical mediators is associated with bladder dysfunction.

### Aims of the project

The overall aim of the proposed study is to identify if urothelial signalling mechanisms are altered by exposure to stress hormones.

### Methods to be used/skills to be developed by the student

We will use an established urothelial cell culture model to determine the effects of stress hormones on the urothelium. Cells will be treated with a range of concentrations of cortisol and adrenaline for 1-7 days and changes in release of ATP, Ach, NO and PGE<sub>2</sub> assessed. Release of inflammatory mediators will also be investigated.

- Cell culture
- ELISA (PGE<sub>2</sub>, Inflammatory cytokines)
- Fluorescence (ACh, NO) and luminescence (ATP) assays
- Live cell microscopy (NO)

### Significance and Expected Outcomes for student

Evidence of incontinence in adults following psychological stress is in itself not enough, as currently no mechanistic data exists to inform whether current treatments would be useful in this population. In spite of strong clinical associations, and reports of increased bladder symptom severity with stress, there has been very little attention given to the mechanisms underlying bladder dysfunction induced by stress and anxiety. It may be via very different mechanisms to those targeted by current incontinence treatments, where mechanisms are linked to ageing. This study will enhance our understanding of the direct effects of stress on the urothelium and the urothelial signalling mechanisms affected by exposure to stress hormones.

Students outcomes include the opportunity to present research findings at a national pharmacology symposium and local health and medical research conference, and to publish one or more abstracts plus a manuscript.

## Email contact:

camcderm@bond.edu.au

## 6. Project Title:

### **Diabetic bladder dysfunction and bladder sensory nerves**

#### Supervisors:

**Donna Sellers, Catherine McDermott, Russ Chess-Williams**

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#### Project Summary:

##### **Background to the project**

Lower urinary tract complications are amongst the most common and costly complications of diabetes mellitus, and have been estimated to affect up to 87% of patients with diabetes, a rate greater than that of the widely known, and more widely researched complications, neuropathy and nephropathy. In particular, approximately 50% of patients diagnosed with diabetes are affected by diabetic bladder dysfunction, a condition characterized by a wide range of clinical symptoms, from problems with storage through to voiding symptoms.

The pathogenesis of diabetic bladder dysfunction is not yet clearly understood. Whilst sensory pathways from the bladder are well known to influence normal bladder activity, they may be adversely affected in diabetes mellitus leading/contributing to bladder dysfunction.

##### **Aims of the project**

To identify the effect of diabetes on bladder sensory nerve activity

##### **Methods to be used/skills to be developed by the student**

This study will investigate the changes in bladder sensory nerve function in mice with experimental diabetes, induced by the pancreatic cytotoxin streptozotocin.

The study will utilise several techniques and students will develop skills in:

- Small rodent (mice) handling and treatments
- Tissue dissection
- Behavioural and voiding studies
- Sensory nerve recording from mouse bladders in vitro
- Spike 2 analysis of nerve activity in individual nerve fibres
- Pharmacological and physiological data analysis
- Participation in regular lab group meetings

##### **Significance and expected outcomes of the project and for the student**

The identification of changes in sensory nerve activity will help to elucidate the pathogenesis of diabetic bladder dysfunction. This information is crucial to the aid future development therapies to help manage and treat diabetic bladder dysfunction.

Students will have the opportunity to present research findings at a national pharmacology symposium, to publish one or more abstracts and a peer-reviewed manuscript.

#### Email contact:

**dsellers@bond.edu.au**

## 7. Project Title:

### **Can some alpha-adrenoceptor antagonists prevent metastasis in prostate cancer**

#### Supervisors:

**Katie Powell and Russ Chess-Williams**

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#### Project Summary:

##### **Background to the project**

Prostate cancer initially starts as a malignant growth that can be treated with drugs to reduce testosterone levels. If the cancer continues to develop it becomes androgen-independent, spreads to other regions of the body (metastasizes) and currently there are no treatments that are effective long term. In a previous study we have shown that some alpha1-adrenoceptor antagonists (prazosin, doxazosin) but not others (tamsulosin) that are used to treat hypertension and benign prostatic hyperplasia have actions that can kill cancer cells. Our laboratory and others have shown that prazosin is cytotoxic to cancer cells, stimulating apoptosis and cell death. It is also reported to have other actions such as inhibiting angiogenesis (which inhibits tumour growth) and reducing metastasis in mice. Thus these drugs may have many beneficial effects when used to treat cancer.

##### **Aims of the project**

The aims of the project are to

- Determine the relative potencies of prazosin, doxazosin, alfuzosin and tamsulosin as inhibitors of cell motility using human prostate cancer cell lines.
- Determine the relative potencies of these drugs as inhibitors of cell adhesion using human prostate cancer cell lines.

##### **Methods to be used/skills to be developed by the student**

- Cell culture of human prostate cancer cell lines, LNCap (androgen dependent) and PC-3 (androgen-independent).
- Acute and chronic treatment of cultured cells.
- Measurement of cell motility using migration assays.
- Assessment of cell adherence using adhesion assays.

##### **Significance and expected outcomes of the project and for the student**

There are currently no effective treatments for androgen-independent prostate cancer, while treatments for early stage prostate cancer have severe side effects. There is a need for new treatments. This study will examine a group of drugs with a different unique mechanism of action that is currently not understood. We are currently examining these drugs in patients undergoing radiotherapy for prostate cancer, but they are likely to work directly on cancer cells and this project will identify two possible mechanisms (inhibited migration and adhesion, which would result in reduced metastasis).

For the student, outcomes include developing experience in widely used cell culture techniques, gaining knowledge of carcinogenesis, presentation of results at the national urogenital conference and publication of a paper in a pharmacology/urology journal.

#### Email contact:

**kapowell@bond.edu.au**

## 8. Project Title:

### **Alpha-adrenoceptor antagonists: A potential bladder cancer treatment**

#### Supervisors:

**Catherine McDermott and Russ Chess-Williams**

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#### Project Summary:

##### **Background to the project**

Bladder cancer is an important disease in Australia with about 2500 new cases diagnosed each year. Treatment often involves instillation of cytotoxic or immunological agents directly into the bladder. However, tumour recurrence occurs in up to 80% of patients and local side-effects are common which greatly affects quality of life and ability to tolerate and continue treatment. Thus, there is a desperate need for more effective and tolerable therapies for bladder cancer. Some  $\alpha$ 1-adrenoceptor antagonists exert anti-tumour actions at high concentrations. Their potential use for other cancer types is limited due to the side effects that would occur with systemic treatment at high doses. However, for bladder cancer local administration of the antagonist directly into the bladder lumen would allow higher doses to be administered without any systemic adverse effects.

##### **Aims of the project**

- To investigate the effects of alpha1-adrenoceptor antagonists on human bladder cancer cells and pig bladder tissues and compare with drugs currently used as therapy for bladder cancer.

##### **Methods to be used/skills to be developed by the student**

- Cell culture – bladder cancer (RT4 and T24) and non-cancer (UROtsa) urothelial cell lines
- Cell proliferation and apoptosis assays.
- Porcine tissue drug incubations and contraction studies

##### **Significance and expected outcomes of the project and for the student**

- Identify drugs most potent on bladder cancers and examine potential drug effects on bladder function.
- Knowledge and experience of cancer research developed in a team environment.
- Skills developed in cell culture and physiological recordings.
- Presentation of data at scientific meetings, publication of at least one full research article.

#### Email contact:

**camcderm@bond.edu.au**

## 9. Project Title:

### Effects of intravesical mitomycin c treatment on bladder afferent nerve activity

#### Supervisors:

Russ Chess-Williams, Donna Sellers and Catherine McDermott

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#### Project Summary:

##### Background to the project

About 2500 new cases of bladder cancer are diagnosed in Australia each year. Treatment often involves surgical removal of the tumour and then instillation of cytotoxic drugs such as mitomycin c (MMC) directly into the bladder to kill off any remaining cancer cells. However, after this treatment significant local side effects can occur such as bladder inflammation, pain on urination and also urinary urgency and frequency. To explain these side effects we have previously studied the effects of MMC on various aspects of bladder function such as muscle and urothelial function. However, another important aspect of bladder function is the afferent (sensory) nervous system and this has never been investigated after MMC treatment. We have facilities to record afferent nerve activity during bladder filling and obtain data for low threshold (normal physiological filling) and high threshold (pain) afferent fibres. ATP and acetylcholine release from the urothelium during bladder filling also influences nerve activity and will also be assessed.

##### Aims of the project

To investigate the effects of intravesical treatment with MMC on bladder low and high threshold afferent nerve fibres.

##### Methods to be used/skills to be developed by the student

- Fine dissection under the microscope
- Electrophysiological recordings of afferent activity
- ATP and Ach assays
- Analysis of single nerve fibre activity

##### Significance and expected outcomes of the project and for the student

- Identify changes in afferent nerve activity that explain the side effects observed in patients following MMC treatment.
- Develop skills in electrophysiological recording.
- Presentation of data at scientific meetings, publication of at least one full research article.

#### Email contact:

[rchesswi@bond.edu.au](mailto:rchesswi@bond.edu.au)

## 10. Project Title:

### **Lubricin: A novel intravesical treatment for bladder pain/dysfunction?**

#### Supervisors:

**Donna Sellers, Catherine McDermott and Russ Chess-Williams**

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#### Project Summary:

##### **Background to the project**

Lubricin is a natural lubricant produced in the body, a biologic sticky Teflon®, currently in clinical trials for dry mouth and dry eye, with exciting potential for treating bladder dysfunction such as interstitial cystitis/bladder pain syndrome (IC/BPS). This chronic debilitating pain disorder affects more than eight million women worldwide. Its cause and pathophysiology are poorly understood, although there is a strong link with stress. There is currently no long-term effective treatment, with some patients even undergoing surgical removal of their bladder as a last resort to relieve the pain.

##### **Aims of the project**

This large project aims to determine the effect of intravesical (direct installation into the bladder) therapy with lubricin in bladder dysfunction, and to compare it against the currently used clinical therapy.

##### **Methods to be used/skills to be developed by the student**

The effects of lubricin treatment on local mechanisms controlling bladder function will be determined using a range of approaches (sensory nerve recording techniques, measurements of pain and voiding behaviours, whole bladder muscle compliance and contractility, urothelial mechanisms and ATP/Ach release assays). As such we are able to offer more than one student an Honours project.

This study will use a mouse model of bladder dysfunction and utilise several techniques. Students will develop skills in:

- Small rodent (mice) handling and treatments
- Tissue dissection
- Behavioural and voiding studies
- Sensory nerve recording or bladder compliance/contractility recordings from mouse bladders in vitro
- Pharmacological and physiological data analysis or urothelial ATP/Ach assays
- Participation in regular lab group meetings

##### **Significance and expected outcomes of the project and for the student**

Characterizing the actions of lubricin on the key mechanisms involved in local control of bladder function will provide essential and novel pre-clinical information, that will support this agent as an innovative new treatment for patients.

Students will have the opportunity to present research findings at a national pharmacology symposium, to publish one or more abstracts and a peer-reviewed manuscript.

#### Email contact:

**dsellers@bond.edu.au**

## 11. Project Title:

### Effects of hypoxia on contractile bladder responses and urothelial mediator release

#### Supervisors:

Catherine McDermott and Donna Sellers

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#### Project Summary:

##### Background to the project

Research suggests that alterations in blood flow to the urinary bladder and the resultant hypoxia may contribute to development of lower urinary tract dysfunction. Normal bladder function relies on efferent systems that control the bladder muscle during filling and voiding. In addition, the urothelium which lines the bladder lumen plays an important signalling role, releasing chemical mediators (including ATP and acetylcholine) which regulate normal bladder function. Changes in contractile bladder response and the release of urothelial mediators is reported in bladder disease, however effects of hypoxia on the bladder muscle and urothelium are not fully understood.

##### Aims of the project

1. To investigate the effects of hypoxia on isolated whole bladder responses.
2. To investigate the changes in release of urothelial mediators (including ATP and Ach) in a urothelial cell culture model of hypoxia

##### Methods to be used/skills to be developed by the student

- Small rodent (mice) handling and treatments
- Tissue dissection
- Functional pharmacology using isolated whole bladder preparations
- Cell culture of human urothelial cell line (RT4)
- Pharmacological and physiological data analysis
- Fluorescence (Ach, NO) and luminescence (ATP) assays

##### Significance and expected outcomes of the project and for the student

The identification of mechanisms involved in hypoxia induced bladder dysfunction will improve our understanding of hypoxia in the lower urinary tract and is essential to aiding management of these disorders.

Students outcomes include the opportunity to present research findings at a national pharmacology symposium and to publish one or more abstracts plus a manuscript.

#### Email contact:

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## **12. Project Title:**

**Design and synthesis of selective Poly(ADP-ribose)polymerase member 14 (PARP14) macrodomain inhibitors to potentially inhibit the metabolism of glucose in cancerous cells**

## **Supervisors:**

**Stephan Levonis and Stephanie Schweiker**

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## **Project Summary:**

### **Background:**

Recent literature has highlighted that we can potentially 'starve' cancer cells to death by inhibiting PARP14 and the Warburg effect. This could be achieved by designing a small molecule that selectively targets and inhibits PARP14 over other PARP enzymes. Selectivity of PARP14 may be achieved by optimising interactions with Tyr1620, a residue outside of the conserved catalytic domain. By targeting metabolism of cancer cells, normal healthy cells will be unaffected and locally-invasive and metastatic prostate cancers will be reduced.

### **Project aims:**

- I. Synthesis of the library of small molecules.
- II. Evaluate the small molecule's ability to selectively inhibit PARP14 over other PARPs using in vitro assays.

### **Skills to be developed by the student:**

- Design of Macrodomain inhibitors
- Synthesis and purification of macrodomain PARP14 inhibitors
- Inhibition studies

### **Significance and expected outcomes of the project and for the student:**

This project will add to the understanding of macrodomain inhibition and potentially lead the way to designing selective PARP14 inhibitors.

## **Email contact:**

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### 13. Project Title:

## Synthesis of HaloTag

### Supervisors:

**Stephan Levonis, Stephanie Schweiker (Bond University) and Ganesh Vasan and Madhuvanathi Kannan (Yale University)**

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### Project Summary:

#### Background to the project

HaloTag is a small organic molecule that can link coelenterazine analogues in situ to NLuc. NLuc is a novel bioluminescent platform and when excited by a red shift coelenterazine analogue in situ the fluorescence can be detected non-invasively using a small detector (less than 2 grams). The development of quick, easy, and non-invasive method for observing brain activity would serve as a platform to further develop our understanding of neuronal activity.

#### Aims of the project

This project aims to synthesise HaloTag using a multistep synthesis for bioluminescence studies

#### Methods to be used/skills to be developed by the student

- Multistep synthesis and purification of HaloTag
- Bioluminescence studies

#### Significance and expected outcomes of the project and for the student

This project is in collaboration with Dr Ganesh Vasan and Dr Madhuvanathi Kannan (Yale University, USA) on their work in detection of neuronal activity.

### Email contact:

**slevonis@bond.edu.au**

#### **14. Project Title:**

### **Synthesis of red shift coelenterazine analogues for bioluminescence**

#### **Supervisors:**

**Stephan Levonis, Stephanie Schweiker (Bond University) and Ganesh Vasan and Madhuvanathi Kannan (Yale University)**

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#### **Project Summary:**

##### **Background to the project**

There is a need for brighter red-shift coelenterazine analogues in the field of neuronal activity imaging. Red light has been shown to display less scattering than green or blue light and is thus the candidate for cellular bioluminescence studies. In the development of detecting neuronal activity the field is working on chemically engineering brighter red-shift coelenterazines analogues that can be linked to the bioluminescent platform NLuc through a HaloTag link and the systems fluorescence could then be detected with a small, simple and less invasive detector held on the surface.

##### **Aims of the project**

This project aims to design, synthesise, and test a library of coelenterazine analogues for bioluminescence.

##### **Methods to be used/skills to be developed by the student**

- Drug design and computational chemistry
- Synthesis and purification of novel coelenterazine analogues
- Bioluminescence studies

##### **Significance and expected outcomes of the project and for the student**

This project is in collaboration with Dr Ganesh Vasan and Dr Madhuvanathi Kannan (Yale University, USA) on their work in detection of neuronal activity.

#### **Email contact:**

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**15. Project Title:****The influence of iron on immune cell prevalence.****Supervisors:****Christian Moro and Jonathon Tan**

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**Project Summary:****Background to the project**

Iron-deficiency anaemia is a common health problem in university students. This is attributed to a lack of balancing in their dietary intake. Research into the impacts of anaemia usually focuses on the lowered oxygen capacity and haemoglobin in the blood, but there is growing evidence to suggest that the immune system is also impacted by low levels of iron or iron-deficiency anaemia.

**Aims of the project**

This project aims to investigate the influence of iron, haemoglobin and haematocrit on immune cell prevalence in capillary blood samples.

**Methods to be used/skills to be developed by the student**

Capillary blood will be collected from the ear or fingertips of subjects and measurements of haematocrit, haemoglobin and red blood cells recorded. Use of the Flow Cytometer to assess immunological cell prevalence will be employed, with a particular focus on CD3, CD4, CD8, CD16, CD56 markers. Depending on progress, this project may also investigate the levels of iron, and immune cell activity in Semester 3.

**Significance and expected outcomes of the project and for the student**

This exciting project will provide a greater understanding of the current literature into the influence of iron-deficiency anaemia and immune cell prevalence in university students.

**Email contact:****cmoro@bond.edu.au**

## **16. Project Title:**

**Medical Anatomy and Radiography: Bone development and formation throughout growth: a longitudinal study**

## **Supervisors:**

**Christian Moro & Allan Stirling**

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## **Project Summary:**

### **Background to the project**

The rate of bone growth during development varies due to genetics, nutrition, disease, gender and environmental factors, making skeletal maturation and growth rate assessments a difficult part of routine clinical paediatric examinations. Promisingly, there is historically a wealth of radiographic data available from developing juveniles, and modern digitisation techniques and computing power has allowed for more precise measurements and assessments to be completed. As such, there is continued benefit for improving the data available in order to generate accurate determinations of a child's age, stature and developmental status based on skeletal measurements.

### **Aims of the project**

This study aims to investigate an archive of X-Rays taken between 1968 – 1983 on the annual growth rates of children from Pari Village in Papua New Guinea. Morphometric parameters will be measured from X-Rays, including the ossification and growth of the metacarpal, metatarsal, patella, humerus, radius, and ulna bones.

### **Methods to be used/skills to be developed by the student**

The student undertaking this study will scan and measure series of X-rays taken each year on the week of each subject's birthday, from juveniles in Pari Village, Papua New Guinea. Correlations will be made between amongst the students each year and compared with other morphometric analyses of their bone structures as they develop and grow. Factors such as ethnicity, gender, and nutritional habits will also be evaluated for the purpose of this study.

### **Significance and expected outcomes of the project and for the student**

This study is expected to continue prior work completed at bond, to develop a detailed analysis of skeletal maturity in growing skeletons. The growth rate tables and diagrams that expected to be generated from the study might aid radiologists and forensic scientists in the evaluation of child growth patterns. Scientists studying the differences between groups of people living in isolated and those living in a typical mixed community setup would also find the results of the study useful.

## **Email contact:**

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### **17. Project Title:**

**Disruptive technologies in education: The effectiveness of technology enhanced multimodal representations in health sciences.**

### **Supervisors:**

**Christian Moro & Allan Stirling**

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### **Project Summary:**

#### **Background to the project:**

Modern educational techniques are increasingly using technology to enhance student learning experiences. This is particularly important in biomedical and medical education, where 3D models can greatly impact students' understanding of the human body and its structure. Research has shown that manipulation of a 3D object during perceptual learning leads to more efficient comprehension of the object and when made available for tactile exploration, students gain greater skills in recognition and awareness of anatomical structures.

#### **Aims of the project:**

This research project will investigate the effectiveness of virtual and 3-dimensional environments on student learning within biomedical sciences and medicine. Virtual Reality, tablet-based applications, holographic technology and lecture recordings will be examined and the outcome of this research study will provide a greater understanding as to the most effective methods for teaching.

#### **Methods to be used/skills to be developed by the student:**

Students will develop skills in both quantitative and qualitative research methodology. Comparisons will be made between control groups of research participants, and participants undergoing mixed-reality interventions. The student will also develop their knowledge of anatomy and physiology of certain human body systems. This project will also enable the student to perform a robust literature review regarding the impact of teaching styles and methodology on biomedical and medical student learning.

#### **Significance and expected outcomes of the project and for the student:**

Student performance in anatomy and physiology has shown improvement when interactive technology tools are introduced into the classroom. Modern technologies such as computerised 3D models show promise in being able to bridge the gap between learning anatomy using cadaveric material and conventional 2D images. The outcomes of the project will provide insight into the effectiveness of these mixed-modes of teaching in health sciences.

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