Honours in Pharmacology

2017

Projects and Program Information
Message from the Head of Discipline and Honours Coordinator

The Discipline of Pharmacology invites you to apply to undertake a research year in the fourth year of your studies (Honours in Pharmacology). This program is designed to give students a greater depth to their studies and to promote research-led inquiry and intellectual endeavour. Students who complete Honours in Pharmacology will be equipped with a skill set that improves their employment prospects in industry or government, and is a requirement for undertaking postgraduate studies in Pharmacology. The Discipline of Pharmacology has a group of dedicated academic staff and affiliates who are conducting cutting-edge research across a variety of fields, including asthma pharmacology, cancer therapeutics, chemical biology, chronic inflammation and pain, clinical pharmacology, drug design and development, drug delivery, protein folding, neuropharmacology, pain management, pharmacogenomics, pharmacoinformatics and toxicological QSAR, therapeutic cannabinoids, transporter biology and pedagogical research. This booklet is designed to provide further details about the Honours program and describes the projects on offer to students in 2017. We hope you’ll join us for an enjoyable and rewarding Honours year. For further enquiries, please contact the Honours Coordinator, A/Prof Rachel Codd: rachel.codd@sydney.edu.au

I’m interested in Honours in Pharmacology – what do I do next?
Please join us for our Honours Information session, which is to be held on:
Friday 16 September at 12 noon in the Norman Gregg Lecture Theatre (Edward Ford Blg).
At this session, the Honours Coordinator will provide further details on the structure of the program and staff will give an overview of their research areas. After formal proceedings, you are warmly invited to a lunch in the Bosch precinct courtyard from 1 pm, where you can talk with individual staff members about their projects. Over the next 2 months, you should elect your preferred supervisor(s) and projects and submit your Honours Preference Form (end of this booklet) to the Honours Coordinator by Friday 18 Nov 2016.
Students can elect to start their Honours year in S1 or S2. To enable academics to plan their group composition, students who wish to begin in S2 should make their supervisor selection at the start of the year.
In addition to lodging your Honours Preference Form with Pharmacology, you must lodge an application for Honours with the Faculty of Science via the Sydney Student portal. Further information is available on the Faculty of Science URL: http://sydney.edu.au/courses/bachelor-of-science-honours

Am I eligible for Honours in Pharmacology?
All students with a strong record in Pharmacology are encouraged to apply to the Honours Program. Students are required to have completed a major in the area relevant to Honours and have a Science Weighted Average Mark (SCIWAM) of $\geq 65$. Depending upon demand, the nominal acceptance cut-off for Honours in Pharmacology may be increased to $\geq 68$. If you are uncertain about your eligibility, you should arrange to meet with the Honours Coordinator and have your academic transcript available for review.

Selecting a Research Group
This booklet describes projects that represent the research interests of the academics in Pharmacology and several affiliates. Staff members have provided project details and the link to their research profile on the Sydney Medical School website. Honours is the beginning of your research career and you should carefully consider the selection of the most suitable research leader to support your research development. Measures of research activity include external grants – which may be funding your project – and publications – which reflect the quality, impact and rigour of the research being conducted by the group. It is also wise to talk with current students in the group to gain first-hand knowledge of the day-to-day science and style of supervision.

What will I do during my Honours year?
You will undertake a research project under the direct supervision of a member of staff, and as part of their research group. You will deliver two oral presentations to the Discipline (April/May (0%), Oct/Nov (20%)), write a 16-page combined literature review and research proposal (June (10%)) and write a 50-page thesis detailing the aims, methods, results and discussion of your project (Oct, 60%). Your supervisor will award you a mark (10%) that reflects your research dedication, competency and aptitude.
## Academic Staff in Pharmacology

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Research Area</th>
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<tbody>
<tr>
<td>A/Prof Jonathon Arnold</td>
<td>BRMI: 503</td>
<td>Endogenous cannabinoid system, behavioural neuropharmacology</td>
</tr>
<tr>
<td>A/Prof Elena Bagley</td>
<td>BKB: W326</td>
<td>Synaptic physiology/plasticity, synaptic function/dysfunction, brain disorders</td>
</tr>
<tr>
<td>A/Prof Sinthia Bosnic-Anticevich</td>
<td>WIMR: 4017</td>
<td>Primary health care research: asthma, inhaler devices</td>
</tr>
<tr>
<td>Prof Nicholas Buckley</td>
<td>BKB: 301</td>
<td>Clinical pharmacology and toxicology</td>
</tr>
<tr>
<td>Dr Kellie Charles</td>
<td>BKB: 306</td>
<td>Cancer pharmacology, tumour-immune cell interactions</td>
</tr>
<tr>
<td>Prof Macdonald Christie</td>
<td>BKB: W300</td>
<td>Cellular/molecular neuropharmacology, pain pathways and pain therapeutics</td>
</tr>
<tr>
<td>A/Prof Rachel Codd</td>
<td>BKB: 274</td>
<td>Chemical biology and medicinal chemistry, metals in biology</td>
</tr>
<tr>
<td>Dr Tina Hinton</td>
<td>CPC: 2N12</td>
<td>CNS GABAergic neurotransmission, schizophrenia, pedagogical research</td>
</tr>
<tr>
<td>Dr Hilary Lloyd</td>
<td>BKB: 307</td>
<td>Neurotransmitter release mechanisms, neuroprotection</td>
</tr>
<tr>
<td>Dr Slade Matthews</td>
<td>BKB: 394C</td>
<td>Machine learning in biomedicine, toxicological QSAR</td>
</tr>
<tr>
<td>Dr Brent McParland</td>
<td>BKB: 215</td>
<td>Asthma pharmacology, human bronchus, smooth muscle</td>
</tr>
<tr>
<td>Prof Michael Murray</td>
<td>MFB: L1</td>
<td>Pharmacogenomics, cancer therapeutics</td>
</tr>
<tr>
<td>A/Prof Renae Ryan</td>
<td>BKB: 212</td>
<td>Biophysics of membrane transport, glycine transport</td>
</tr>
<tr>
<td>A/Prof Margaret Sunde</td>
<td>BKB: 214</td>
<td>Protein biophysics, protein misfolding, amyloid fibril formation and structure</td>
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<tr>
<td>A/Prof Daniela Traini</td>
<td>WIMR</td>
<td>Respiratory drug delivery science, asthma, COPD, bronchiectasis</td>
</tr>
<tr>
<td>Prof Robert Vandenberg</td>
<td>BKB: 210</td>
<td>Molecular biology, glutamate transport, electrophysiology</td>
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<tr>
<td>Prof Paul Young</td>
<td>WIMR</td>
<td>Respiratory diseases, medical devices, lung-specific advanced formulations</td>
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## Affiliates

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<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Research Area</th>
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<tbody>
<tr>
<td>Dr Karin Aubrey</td>
<td>KOL</td>
<td>Models of neuropathic pain</td>
</tr>
<tr>
<td>A/Prof Kay Double</td>
<td>BMRI</td>
<td>Parkinson’s disease, metalloneurochemistry</td>
</tr>
<tr>
<td>A/Prof Sarah Hilmer</td>
<td>KOL</td>
<td>Geriatric medicine and clinical pharmacology</td>
</tr>
<tr>
<td>Prof Michael Kassiou</td>
<td>CHEM 546</td>
<td>Drug design and medicinal chemistry, CNS active compounds</td>
</tr>
<tr>
<td>Dr Chris Vaughan</td>
<td>KOL</td>
<td>Chronic pain and endocannabinoids</td>
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*Generic format for e-mail: firstname.familyname@sydney.edu.au (eg, rachel.codd@sydney.edu.au).

* BKB = Blackburn building (D06). BMRI = Brain & Mind Research Institute. WIMR = Woolcock Institute of Medical Research. CPC = Charles Perkins Centre. MFB = Medical Foundation Building. RNSH = Royal North Shore Hospital. CHEM = Chemistry. KOL, Kolling Building.
Pharmacology is a broad discipline. Where will you fit?
Cannabis is the most widely used illicit drug in the world and cannabinoids are increasingly being utilised in therapeutics. For 20 years I have focused on the preclinical pharmacology and therapeutic application of the cannabinoids. My first major discovery was that phytocannabinoids reverse resistance to anticancer drugs. I have also isolated genes that modulate the effects of cannabinoids on the brain. My current work examines the efficacy of cannabinoids in various preclinical models of disease including childhood epilepsy, PTSD, addiction and schizophrenia.


Research group (2016): 1 Post-doc, 4 PhD students, 2 Honours students

**PROJECT 1**

**PRECLINICAL DRUG DEVELOPMENT OF CANNABINOIDS FOR THE TREATMENT OF CHILDHOOD EPILEPSY**

Dravet syndrome is a devastating form of childhood epilepsy that has a mortality rate of 16%. Seizures often commence within the first year of life and significant developmental delays in cognition, speech and motor skills become evident during childhood. Current treatments for Dravet syndrome are grossly inadequate and many families resort to using illegal cannabis extracts out of desperation. This is not without good reason, as there are numerous reports of cannabis dramatically reducing seizures and improving the health of children with Dravet syndrome. While conventional animal models of epilepsy have assisted in the development of anti-epileptic drugs, they have failed to find new agents that treat paediatric epilepsy. This project will utilise Dravet syndrome mice that provide a new platform to discover novel therapeutic agents for childhood epilepsy. Genetic mutations observed in Dravet syndrome have been introduced to mice that faithfully reproduce key features of the disorder, such as early-onset seizures, mortality and developmental delays in cognitive, social and motor function.

Cannabis is a complex mixture containing numerous cannabinoid compounds, therefore the active constituent/s need to be elucidated. Cannabidiol (CBD) is currently being tested in clinical trials for its efficacy in treating childhood epilepsy. CBD lacks psychoactivity and has a favorable toxicity profile. We will also assess the efficacy of other promising phytocannabinoids such as tetrahydrocannabinolic acid (THCA), cannabigerol (CBG) and cannabichromene (CBC). We will assess whether the cannabinoids protect against seizures and mortality in Dravet mice. Our proposed studies will also examine whether cannabinoids halt developmental delays in cognitive, social and motor function.

**TECHNIQUES**

- drug administration, transgenic mice, behavioural analysis, EEG measurements, immunohistochemistry, dendritic morphology analysis

Selected publications

Our research group is interested in normal synaptic function and synapse dysfunction. Synaptic dysfunction is emerging as a key player in many brain disorders. We use patch-clamp electrophysiology in brain slices, immunohistochemistry and biochemical assays to study synaptic properties and synaptic plasticity that may participate in physiological or pathophysiological processes. These honours projects focus on how endogenously released opioid peptides alter synaptic function and plasticity in the amygdala. Fear and anxiety are adaptive responses that allow animals to defend themselves against harm. Neural circuits in the amygdala are key for fear memory acquisition and storage but also for reducing the fear response (extinction). Extinction of the fear response relies on a special group of GABAergic interneurons in the amygdala, the intercalated cells.


Research group (2016):  Sarah Kissiwa (PhD student), Gabbi Gregoriou (PhD student), Sahil Patel (PhD student), Danashi Medagoda (Honours Student)

**PROJECT 1** Does fear change endogenous opioid expression in the amygdala?

Enkephalins are endogenous opioids that are strongly expressed in the amygdala and are thought to be involved in several aspects of fear. Mice deficient in the enkephalin precursor, preproenkephalin, are highly anxious and aggressive. Intercalated neurons (IA in figure) express very high levels of the μ-opiate receptor (MOR) and the endogenous opioid ligand enkephalin. Stress or anxiety may change opioid receptor or metabolizing enzyme expression in the amygdala. This project will determine whether a fearful experience alters the expression of elements of the endogenous opioid system in the intercalated cells.

**TECHNIQUES**  Immunohistochemistry, biochemistry

**PROJECT 2** Does fear endogenous opioid function in the amygdala?

Endogenous opioids are significant regulators of synaptic glutamate and GABA release in the intercalated region of the amygdala. Mice deficient in the enkephalin precursor, preproenkephalin, are highly anxious and aggressive. Intercalated neurons (IA in figure) express very high levels of the μ-opiate receptor (MOR) and the endogenous opioid ligand enkephalin. In this project we ask whether fear learning alters endogenous opioid regulation of neurotransmitter release in the intercalated region of the amygdala.

**TECHNIQUES**  Patch-clamp electrophysiology, immunohistochemistry, optogenetics

**PUBLICATIONS.**


Our group focuses on innovative and effective ways to better manage chronic respiratory illness. This involves. Research students are important members of our research group and we promote a culture of learning through sharing and collegial support.


Research group (2016): Dr Vicky Kritikos, Dr Sharon David, Amanda Elaro, Biljana Cvetovski, Pamela Srour, Rachel Tan, Marima Toumas, Sarah Barbara, Elizabeth Azzi, Samantha Khuu.

**PROJECT 1 KNOWING YOUR NOSE AND HOW TO TREAT IT**

*Will suit a student who is interested in health outcomes*

Allergic rhinitis is a highly prevalent condition. It is known to cause significant impact on an individual’s quality of life and is a common trigger for poor asthma control. In fact, approximately 90% of people with asthma have allergic rhinitis yet our recent data indicates that approximately half of these people have never had allergic rhinitis diagnosed by a doctor and less than one third of them are taking appropriate treatment, despite experience moderate to severe symptoms. We are interested in finding out why and to develop an effective intervention to solve this problem.

**TECHNIQUES** Students will learn to develop evidence based interventions and pilot test them.

**PROJECT 2 HEALTH CARE DELIVERY NETWORKS IN PRIMARY CARE**

*Will suit a student interested in developing clinical process to support better care delivery*

A key component of effective respiratory disease management is the regular review of patient disease status in order to ensure that diagnosis of illness is early, accurate and directed towards the most effective care pathway. In respiratory illness, there is a lack of regular review of illness and consequently patients with respiratory illness often receive a late diagnosis and medication management is suboptimal. This research explores the UK-based effective evidence-based programs Optimum Patient Care (OPC), with the aim of implementing and evaluating it into the Australian primary health care setting. As a result a novel model of care delivery, will be evaluated. This research has implications for the management of respiratory illness in the future.

**TECHNIQUES** Implementation science and translational research methodologies.

**PROJECT 3 WHAT CAN MEDICATION USE TELL US ABOUT THE SEVERITY OF ASTHMA**

*Will suit a student who is interested in exploring the way in the patterns of medication use can help us understand patient behaviour and clinical needs.*

Over the last decade, severe asthma has become a defined sub-category of asthma, characterized by high dose medication use and difficult to treat symptoms. One of the medications more commonly used to treat severe asthma is oral glucocorticosteroids (OCS). However, OCS are convenient to take and certainly provide an easier route of medication administration compared to inhaled medicines, often used incorrectly and irregularly. This research is based on the hypothesis that some patients do not take their inhaler medicines regular but rather turn to OCS, giving the overall impress that they suffer from severe asthma rather than the reality of non-adherence to their inhaler medicines. This research will explore this hypothesis and identify the truth behind OCS in the community.

**TECHNIQUES** Students will be exposed to a mixed methods research approach.
We are a multi-disciplinary collaboration of researchers, our goal is to integrate the clinical, epidemiological and laboratory research in human toxicology in order to investigate a range of human toxicology problems. We have established the two largest clinical cohort studies on poisoning in the world. These enable us to conduct population based studies into poisoning and its treatments. Honours projects carried out within the group offer an excellent introduction to the emerging and exciting field of “big data” - using large datasets to reveal trends, patterns and associations that can have big public health impact. Projects are well-suited to students interested in moving into research areas of epidemiology, public health, or clinical medicine. Below are two examples, but with the resources and datasets available to the group many other research possibilities are also available.

Research group (2016):  Kate Chitty, Rose Cairns, Nick Osborne, Kat Kirby, Andrew Dawson

PROJECT 1  Epidemiology of antidepressant use and poisoning in the elderly in Australia

involves joint supervision with Dr Rose Cairns

This project will extract data from the Poisons Information centre database and the national coronial information system (from 2000 to 2015) and compare this to publically available data on Australian use of antidepressants in those aged over 65 years in different locations in Australia. Students will review the evidence for efficacy in this age group, explore trends over time in the use of antidepressants in the elderly, the impact on non-fatal and fatal poisoning and suicide in Australia, and relationship to geographic location and guidelines. This project may also involve utilising routinely collected Australian prescription data to explore doctor’s prescribing in this age group (dose, co-prescription, etc)

TECHNIQUES  Epidemiology, Pharmacoepidemiology, statistics, database analysis

PROJECT 2  Links between alcohol, medicines, inflammation and depression

involves joint supervision with Dr Nick Osborne and Dr Kate Chitty

This project will examine data from the US (NHANEs). Participants in this study have a range of medical tests and questionnaires for health biomarkers. Biomarkers of inflammation and health, questionnaire data on depression and drug use will be used to answer the question about the relationship between inflammation and depression, as well as considering the effects of alcohol consumption, other pharmaceutical use (prescription and recreational) and demographic factors on this relationship. The study would include recruiting a small cohort of Sydneysiders to examine the question in the Australian context (questionnaire and blood sample).

TECHNIQUES  Epidemiology, statistics, database analysis, clinical research, questionnaire design

Other opportunities

There are other ongoing studies and data sources available to the group that can be utilised to suit a wide array of research interests. Here are just a few examples:

- Using the “UK Biobank” study of 500000 participants to measure the risk factors involved in the initiation and progression of osteoporosis
- Investigating the role that a positive blood alcohol concentration has in suicides in Australia
- Linking medicines data to coronial data to determine drugs that are over-represented in suicides
- Comparing the role of alcohol in deliberate self-poisonings in Australia versus Sri Lanka - what part do cultural alcohol “norms” play?
- Examine liver and alcohol biomarkers from clinical studies/trials of paracetamol poisoning.

Have other ideas? Come talk to us and we can help you design your own project around a specific area of interest!
Our research group is primarily focused on how chemotherapy drugs (currently used and new agents) alter the local and systemic inflammatory response. Our group has shown that inflammation impacts the pharmacological response to chemotherapy in terms of response and toxicity. We conduct both clinical and preclinical investigations of the response and toxicity induced by chemotherapy drugs to further understand how to improve the treatment of patients with cancer. New drugs are also tested in our research group to limit the toxicity of the current anti-cancer treatments.

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<tr>
<td>Research group (2016):</td>
<td>3 PhD Students, 1 honours student, 1 TSP student</td>
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**PROJECT 1 IMPACT OF INFLAMMATION ON CHEMOTHERAPY OUTCOMES**

This challenging project is designed for an honours student with an interest and background knowledge in pharmacology, cancer and immunology. Our clinical trial data shows that lung cancer patients with inflammation have poorer response to chemotherapy and shorter survival. However, we do not understand the reasons underlying this relationship nor if it relates to the wider cancer population that do not fit clinical trial eligibility criteria. This pharmacoepidemiology project will investigate real-world clinical data and pharmacy records to determine the impact of systemic inflammation on chemotherapy dosing and outcomes in colorectal patients in the community.

**TECHNIQUES** Clinical data analysis and biostatistics
Two major areas of study in pain and opioid mechanisms aim to; (1) understand mechanisms of adaptation in ion channels and cell physiology contributing to chronic pain states, and develop of novel pain therapeutics to target these mechanisms, and (2) understand the molecular and cellular mechanisms of opioid tolerance and physical dependence with the goal of improving opioid therapeutics. We use patch clamp electrophysiology in mammalian cells and spinal cord slices integrated with behavioural models of chronic pain. It is likely that only one of the two possible projects will be run in 2016.


Research group (2016):
4 postdocs, 1 research assistant, 1, PhD student, 1 MPhil student, 1 Hons student

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**PROJECT 1  MECHANISMS OF ACTION OF NOVEL ω-CONOTOXINS IN PAIN STATES**

*Will suit a student with interests in behaviour/cellular physiology*

One ω-conotoxin, Prialt (ω-conotoxin MVIIA), that irreversibly antagonizes N-type voltage-gated calcium channels is currently used to help manage severe chronic pain but it produces severe on target side-effects that limit its usefulness. We have identified a series of novel ω-conotoxins, starting with CVID, that reversibly inhibit N-type channels and show an improved side effect profile after intrathecal administration in neuropathic pain. The therapeutic index of this series of conotoxins is related to the reversibility of inhibition of N-type channels, a process that changes in neuropathic pain states due to an as yet unknown adaptation of channel properties. The present project will involve investigation of these adaptations in a chronic inflammatory pain model that is well established in our laboratory. You will develop skill in the inflammatory pain model in rats, measuring behavioural outcomes and then determine changes to basic N-type calcium channel kinetics and binding kinetics of several novel ω-conotoxins using patch clamp electrophysiology in sensory neurons isolated from animals displaying signs of inflammatory pain. If time permits you will examine potential adaptations to N-type channel composition in inflammatory pain using real-time PCR.

**TECHNIQUES** behavioural assays in animal models, neuron isolation,

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**PROJECT 2  BIASED SIGNALING OF NOVEL OPIOID RECEPTOR AGONISTS**

*Will suit a student with interests in cellular physiology/ molecular pharmacology*

We have developed a novel series of opioid receptor agonists based on a new tetrapeptide structure. We have introduced functional groups into the peptides to facilitate blood brain barrier penetration. This project will determine whether these agonists show a similar signaling bias to the parent peptide compounds, which would suggest they have novel capacity to produce analgesia versus adverse effects such as tolerance. You will learn to culture mammalian cells expressing µ-opioid receptors, measure receptor endocytosis and phosphorylation with immunohistochemistry and confocal microscopy, and receptor function with patch clamp electrophysiology.

**TECHNIQUES** Cell culture, immunochemistry, patch clamp electrophysiology, simple kinetic analyses

Selected publications


Projects in my group blend aspects of chemistry, biochemistry, microbiology and biotechnology. We are interested in a class of bacterial compounds called 'siderophores' used to treat conditions that arise from iron dyshomeostasis, with broader applications as anti-infective and anti-cancer agents. Some projects use traditional chemical synthesis as part of the drug design approach. Other projects use bacterial fermentation and precursor-directed biosynthesis to produce known and new compounds, which we purify using a specialist technique developed in our group.


Research group (2016): 2 Postdoctoral Research Associates, 3 PhD students, 2 Honours students

**PROJECT 1 HIJACKING THE BACTERIAL BIOSYNTHETIC MACHINERY FOR NEW SIDEROPHORES**

Will suit a student with interests in microbiology/biochemistry and chemistry

Siderophores are low-molecular-weight organic compounds produced by bacteria which bind iron(III) with high affinity. Bacteria produce these compounds as a mechanism to supply iron to the cell, as essential for growth. As metal-binding molecules, siderophores have a number of applications as drugs, particularly in conditions that involve metal ion dyshomeostasis. The siderophore desferrioxamine B (DFOB) (structure above) produced by the soil bacterium Streptomyces pilosus, is used to treat secondary iron overload, which occurs as a complication of transfusion-dependent genetic blood disorders, including B-thalassemia. This structurally complex molecule is difficult to prepare in the laboratory, and industrial-scale production relies on bacterial fermentation. In an exciting development in our group, we have discovered that we can commandeer the biosynthetic machinery of S. pilosus and drive the bacterium to produce unusual analogues of DFOB. This is a significant discovery, since these new compounds could have properties superior to DFOB as the clinical parent. In this project, you will culture S. pilosus in the presence of new building blocks to generate new DFOB analogues for purification and characterisation. In a new twist, the target analogue could be amendable to downstream semi-synthetic chemistry to further expand structural diversity.

**TECHNIQUES** Microbiology, LC-MS, Coordination chemistry, Semi-synthetic chemistry

**PROJECT 2 THE SIDEORPHORE METABOLOME OF SALINISPORA TROPICA: A RECORD BREAKER**

Will suit a student with interests in microbiology/biochemistry (no chemistry required)

The focus on the discovery of bioactive compounds from natural sources has shifted in recent times from terrestrial bacteria to marine bacteria. As a result of adaptations to variable ocean microenvironments, the genomes of marine bacteria indicate a plethora of yet-to-be-discovered secondary metabolites. This is a frontier field in natural products. Our laboratory has studied the siderophores produced by the marine actinomycete Salinispora tropica CNB-440, and shown that this species produces a number of different linear and macrocyclic siderophores (Figure at right). In this project, you will undertake an approach designed to significantly increase the number of siderophores biosynthesized by this species - we aim to break the record for the number of siderophores able to be characterised from a single species.

**TECHNIQUES** Microbiology, LC-MS, Coordination chemistry, Analytical biochemistry

Selected publications


Pharmacology is a biomedical science taught to numerous cohorts (science, medicine, pharmacy, nursing) requiring different applications of the discipline skills and knowledge. Research projects to date have included national and multidisciplinary teams evaluating pharmacology curriculum across degree programs, student experience of specific learning activities, student engagement and student learning, and impact of changes to curriculum on skills development and learning outcomes. A number of projects are currently underway in the area of innovative learning spaces. This research forms part of the Centre for Research in Learning and Innovation and the Charles Perkins Centre Science of Learning Science Research Node.

Co-supervisors: Professor Philip Poronnik (Physiology), Professor Peter Goodyear (Education)


**PROJECT 1  IMPACT OF LEARNING SPACE ON BIOMEDICAL SCIENCES LEARNING AND TEACHING**

*Will suit a student with interests in field research methods, education and translation of pharmacology skills and knowledge into education*

The Charles Perkins Centre (CPC) encourages a new model for multi- and transdisciplinary education and research. The new learning spaces within the CPC building include large collaborative learning spaces, flexible learning spaces and a learning studio, and custom-built learning spaces such as an exercise laboratory. These spaces were designed to provide opportunities for teaching large groups, with cohorts from different disciplines, years of candidature, units of study and degree programs working side by side. This is a major departure from traditional learning spaces and provides an unprecedented opportunity to evaluate the impact of learning space on what and how we teach and learn in pharmacology and other biomedical sciences. This project will form part of an investigation into student and staff experiences of physical and social factors that influence learning and teaching, as well as changes in learning and teaching practices and curriculum and pedagogical design in new learning spaces. This project involves learning the skills associated with qualitative and quantitative education research – designing and analysing interviews and surveys as well as ethics and recruitment. The project occurs in collaboration with Professor Philip Poronnik (Physiology) and Professor Peter Goodyear (Education).

**TECHNIQUES**  Field research methods - questionnaire, interview, data analysis and statistics
Dr Slade MATTHEWS  
PharmacoInformatics Laboratory  
Room 349C, Blackburn Building  
slade.matthews@sydney.edu.au  

The PharmacoInformatics Laboratory uses computer technologies to uncover new relationships in biomedical data. PharmacoInformatics incorporates the principles of computerised data management, machine learning techniques and complexity analysis in a pharmacology context. These techniques as well as applied statistics are used on a range of problems in this lab including clinical observational studies and laboratory based data driven studies.

Research interests/publications:  

Research group (2016)  
Davy Guan (PhD student), Yuhanif Yusof (Post Doc), Zuriyat Iqbal (MD student), Peter Wang (MD student), Dargos Stefanescu (MD student), Hamish Carmichael (MD student)

PROJECT 1  
IN SILICO TOXICOLOGY MODELLING

The prediction of toxicity is an important part of the assessment of drugs in development. The cost associated with detection of drug toxicity late in drug development is enormous and so it has become important to develop in silico models of toxicity to detect toxic effects early. In silico toxicology is essentially similar to QSAR but considers combinations of a greater number of parameters for making toxicity predictions. Computational models are also useful when considering drug impurities and theoretical impurities that may not be sufficiently abundant to be fully tested in vivo. This project aims to generate a model of fatal toxicity of antidepressants and/or sedative hypnotics using the fatal toxicity index (FTI) and a range of databases and several in silico toxicology and chemistry programs. Sodium channel binding and offset kinetics and physicochemical properties will be used to characterise these drugs.

Students will be co-supervised by Professor Nick Buckley

TECHNIQUES  
The techniques employed include: use of computational toxicology softwares; searching and researching databases including PubChem, TGA, PubMed, interpretation In Silico toxicological relationships.

PROJECT 2  
Hand cream interference with Blood glucose monitoring

Blood glucose monitoring is essential for patient care in type 1 and 2 diabetic patients. The importance of accurate blood glucose (Bgl) measurement is paramount but there are several conditions which affect the accuracy of these devices including temperature, altitude, and substances on the skin. There are several types of monitors that contain different enzyme systems and the substances that interfere with the results may vary. In this project you will investigate the level of interference caused by dermally applied substances including cosmetics and medicines. The results will inform correct use of the monitors and lead to higher quality diabetic patient care.

Students will be co-supervised by Professor Nick Buckley

TECHNIQUES  
BGl monitoring, Experiments with humans

RECENT PUBLICATIONS:

Projects in the Pharmacogenomics and Drug Development Group take a multidisciplinary approach to problems in cancer chemotherapy. Our current focus is on the development of new anti-cancer drugs, and on anticancer drug resistance, which leads to tumours that are untreatable with the available drugs. We use a combination of molecular pharmacology, cell biology, synthetic chemistry and in vivo preclinical models in these projects. Our aim is to develop effective new drugs that treat cancers by new mechanisms and to use pharmacogenomics to assist drug selection in cancer.

Research interests/publications:  

Research group (2016):  
Sarah Allison, Yong Chen (postdocs), Kirsi Bourget (Res Asst), Nooshin Koolaji, Hassan Choucair, Yassir Al-Zubaidi, Md Khalilur Rahman (postgrads), Bala Umashankar (Hons)

PROJECT 1  New anticancer drugs that target tumour cell mitochondria

The treatment of advanced breast cancer often fails due to limited choices of drugs for therapy. New molecules that act by different mechanisms are needed to provide additional therapeutic options. We have designed a new class of anti-cancer agents that act like ω-3 fatty acid metabolites that are formed in cells. These agents rapidly kill breast cancer cells in vitro and in vivo in nude mice carrying xenografted tumours. Identifying how these agents kill cancer cells will provide new drug targets for the rational design of next generation anti-cancer drugs.

TECHNIQUES  
cell culture, immunoblotting, real-time PCR, medicinal chemistry, cell-based assays

PROJECT 2  Novel anti-metastatic agents based on ω-3 fatty acid metabolites

Metastasis is the major life-threatening consequence of malignant tumours. At present there are no effective drugs to prevent metastasis. In our current work we have designed a new class of anti-metastatic agents that inhibit the growth and migration capacity of highly aggressive breast and prostate tumour cells in vitro and in vivo. Understanding how these agents prevent tumour cell migration will enable the synthesis of optimal anti-metastatic agents to treat advanced cancers.

TECHNIQUES  
cell culture, RNA-seq, proteomics, immunoblotting, real-time PCR, cell-based assays

Selected publications
A/Prof Renae RYAN  
Transporter Biology Group  
Room 211, Blackburn Building  
renae.ryan@sydney.edu.au

The Transporter Biology Group investigates the molecular mechanisms of neurotransmitter and amino acid transporters. The aim of our research is to develop a structural model for how these transporters work, and in this way lay the foundations for a more rational approach to the development of drugs that are both transporter-specific and subtype selective and can be used to treat neurodegenerative disorders, schizophrenia, chronic pain and cancer.

Research interests & publications:  

Research group (2016):  
Prof Rob Vandenberg, Dr Josep Font, Rosemary Cater, Shannon Mostyn, Natasha Freidman, Qianyi Wu, Emily Crisafulli, Cheryl Handford

PROJECT 1 Developing novel cancer therapeutics that inhibit glutamine transport

The glutamate transporter family (SLC1 family) is made up of proteins from several species and includes the human glutamate transporters (EAATs) and neutral amino acid transporters (ASCTs), and a prokaryotic aspartate transporter (GltP) which is a structural model of the SLC1 family. We have used the similarities and differences between these family members to better understand the molecular basis for their specific functions and have used this information to develop novel compounds to selectivity target ASCT2.

Cancer cells rely heavily on the import of the amino acid glutamine to fuel their excessive growth and proliferation. ASCT2 is a glutamine transporter that is known to be upregulated in several types of cancer including breast cancer, prostate cancer and melanoma and ASCT2 is the primary route for glutamine entry into these cancer cells. Our group is currently developing novel selective and potent ASCT2 inhibitors that will hopefully lead to a new class of cancer therapeutics. This project will focus on characterising several novel compounds that have been developed to selectively target ASCT2. The results of this project will further inform drug design to develop potent and selective ASCT2 inhibitors as novel cancer therapeutics.

PROJECT 2 Investigating the elevator mechanism of the glutamate transporters

In addition to their primary role of clearing glutamate from the synapse, the human glutamate transporters (aka the EAATs) allow the flux of chloride across the membrane. Work in our group is focused on understanding the molecular basis for these dual mechanisms and their role in physiology. We have already identified two distinct pathways through the transporter for glutamate and chloride and have shown that activation of the chloride conductance is linked to the elevator mechanism that is required for glutamate transport. The aim of this project is to further examine this newly identified region of the transporter to gain more information about how these proteins carry out these dual functions.

**TECHNIQUES**  
molecular biology (including site-directed mutagenesis); electrophysiology; protein purification; liposome reconstitution; radiolabelled uptake; x-ray crystallography molecular modelling; drug design

Glutamate transporter dysfunction has been implicated in disease states such as ischemia following a stroke, Alzheimer’s disease and obsessive compulsive disorder and the expression of ASCT2 is known to be upregulated in several cancers including prostate, breast and skin cancer. Through a better understanding of the mechanism of these transporters we can develop novel therapies to treat these disease states.

Selected publications


The formation of stable thread-like protein assemblies known as amyloid fibrils is associated with many human diseases. However, functional amyloid protein fibrils with similar structural features have recently been identified in mammals and many different microorganisms. These amyloid fibrils perform a wide range of functional roles and are advantageous to the organisms. The Sunde lab uses molecular biology, protein chemistry, fluorescence and structural techniques to study the formation of functional amyloid fibrils associated with microbial infections and cell death by necroptosis [1].


Research group (2017):  1 postdoctoral researcher, 2 PhD students, 1 research assistant

### PROJECT 1  THE ROLE OF FUNCTIONAL AMYLOID FIBRILS IN FUNGAL INFECTIONS

**Will suit a student with interests in protein self-assembly and antimicrobials**

Fungi produce amyloid fibrils that are composed of hydrophobin proteins [2]. These fibrils form a protective coating on fungal spores and facilitate infection of human, animal and plant hosts. Fungal infection of rice by the fungus *Magnaporthe oryzae* causes loss of up to a third of the annual global rice harvest. The protein MPG1 forms fibrils on the surface of *M. oryzae* spores and assists in attachment to rice leaves and infection. You will express MPG1 and a number of mutant forms of this protein recombinantly in bacteria. You will purify these proteins and study the process of the formation of amyloid fibrils by the hydrophobin MPG1 and mutants. In this way you will identify the important regions of MPG1 that control formation of amyloid fibrils and provide structural stability to the hydrophobin layer. You will study the effect of chemical chaperones on the process of hydrophobin amyloid formation with a view to identifying small molecules that could inhibit the formation of this protective protein coat. This could have broad application in treatment of human, animal and plant infections caused by hydrophobin-secreting fungi.

**TECHNIQUES**  Molecular biology, protein expression and purification, fibril formation assays, fluorescence studies, fibril inhibition and disassembly experiments.

### PROJECT 2  FUNCTIONAL AMYLOID COMPLEXES IN REGULATED CELL DEATH

**Will suit a student with interests in cell biology and protein:protein interactions**

The formation of functional amyloid complexes in human cells is associated with the induction of cell death in response to microbial infection and in other inflammatory conditions. Li et al. (Cell (2012) 150: 339-50) demonstrated that this involved amyloid fibril formation by the RIPK1 and RIPK3 protein kinases. These kinases contain amyloid-forming RHIM domains. Two other human proteins associated with the host response to microbial infections, ZBP1 and TRIF, also contain RHIM domains. We hypothesize that these proteins form amyloid fibril complexes with RIPK1 and RIPK3 to signal for cell death by the regulated pathway to cell death known as necroptosis. You will express the RHIM domains of human RIPK1, RIPK3, ZBP1 and TRIF and will study amyloid formation by these domains. You will investigate whether ZBP1 and TRIF can form functional amyloid complexes with human RIPK1 and RIPK3 kinases. You will use site-directed mutagenesis to identify the key residues in these proteins that are required for amyloid fibril formation.

**TECHNIQUES**  Molecular biology, protein expression and purification, fibril formation assays, protein:protein interaction studies.

Selected publications


Dr Traini’s research explores respiratory drug delivery science. It focuses on understanding the physical properties of materials used in pharmaceutical sciences and then in relating those to in-vitro and subsequent in-vivo performance. She has expertise in projects related to asthma, chronic obstructive pulmonary diseases and bronchiectasis. High-end imaging is also one of her interests. She is currently working toward understanding the co-formulation and co-deposition of inhalation active pharmaceutical ingredients to enhance their synergistic therapeutic effect.


PROJECT 1  Formulationing antifungal lung delivery

Pulmonary infections caused by *Aspergillus* species are associated with significant morbidity and mortality in immunocompromised patients. Although the treatment of pulmonary fungal infections requires the use of systemic agents, aerosolized delivery is an attractive option in prevention because the drug can concentrate locally at the site of infection with minimal systemic exposure. Currently there are no treatment available, thus there is a need for additional treatments. In this project we will reformulate antifungal drug, as mono or combined formulation, to be delivered directly to the lungs. Once formulated, we will analyse its performance and physico-chemical characterises by a number of state of the art analytical methods for aerosol performance. Furthermore, their toxicity and transport on calu-3 cells grown in the air interface model will be also investigated.

**TECHNIQUES**  Calu-3; Drug transport; Spray drying; Dissolution testing; HPLC

Co-supervisors: Prof Young, Dr Ong

PROJECT 2  Treating acute bronchiolitis

Bronchiolitis is an acute inflammatory injury of the bronchioles that is usually caused by a viral infection. A combination of oral high dose antibiotics and inhaled long-acting beta agonists (LABAs) are used for its treatment. In this project we will develop a novel inhalable combination formulation of an antibiotic i.e. amoxicillin and a LABA i.e. Salmeterol, to avoid problems associate with high oral doses, variable bioavailability and increase side effect effects. Once the microparticles will be produced these will be analysed by a number of state of the art analytical methods i.e. Light Scattering, Scanning Electron Microscope and X-Ray Powder Diffraction. Aerosol performance and Chemical stability will be also investigated.

**TECHNIQUES**  Particle size, Spray drying; Dissolution testing; HPLC

Co-supervisors: Prof Young, Dr Ong

Selected publications

Haghi , M., Ong, HX., Traini, D., Young, PM. (2014) Across the pulmonary epithelial barrier: integration of physicochemical properties and human cell models to study pulmonary drug formulations. Pharmacology & Therapeutics 144, 235-252

Research in the Transporter Biology Group is focused on understanding the molecular basis for neurotransmitter transporter functions and how this can be manipulated by endogenous regulators and pharmacological agents. The glycine transporter, GlyT2, is a promising target for the development of novel analgesics for the treatment of neuropathic pain. Our group has generated a series of potent lipid-based inhibitors of GlyT2 and we are interested in understanding their mechanism of inhibition.


Research group (2016):
Co-group leader A/Prof Renae Ryan, Postdoc Dr Pep Font, PhD students Shannon Mostyn, Rosie Cater, Diba Sheipouri. Honours students Emily Crisafuli, Natasha Freedman, Qianyi Wu, Lab Manager Cheryl Handford

PROJECT 1 Allosteric Inhibitors of GlyT2

Will suit a student with interests in pharmacology/biochemistry/neuroscience/physiology

Glycine transport by GlyT2 can be allosterically inhibited by a range of compounds, some of which show promise as analgesics for the treatment of chronic pain. In this project you will form part of a multidisciplinary group that is working towards the development of novel drugs for the treatment of pain. N-arachidonoyl-glycine is an endogenous lipid inhibitor of GlyT2, but there is little understanding of how it interacts with the transporter. In this project you will investigate how this and related compounds interact with GlyT2 and then use this information to develop potent and selective GlyT2 inhibitors (see figure). A number of research directions and techniques are possible with this project. Students are encouraged to discuss the project with Professor Vandenberg so that the style of the project can be tailored to the student’s interests. Techniques to be used included recombinant DNA techniques such as site-directed mutagenesis, DNA/RNA synthesis, electrophysiology, computer simulations of protein structure and function. Work on this project is supported by a Project Grant from the NHMRC.

TECHNIQUES Molecular biology, site-directed mutagenesis, electrophysiology, molecular modelling

Selected publications
My research group develops new approaches and tools to study and treat respiratory diseases. We focus on developing new medical devices and advanced formulations that can target specific regions of the lung.

### PROJECT 1  Development of a functioning tissue model of the respiratory tract

This project, co-supervised with Brent McParland will focus on developing representative models of the lung epithelia that incorporate cilia escalator and transport function. The lung is a complex organ and the uptake and disposition of drugs is dependent upon the properties of the epithelia (including influx and efflux trans-membrane transporters, mucus properties and cilia function) and the properties of the drug molecule (such as ionisation and solubility parameters). This project will establish a tissue model that can be used to study the transport and clearance of drugs after deposition at the interface. Based on a porcine model, you will isolate tracheal tissue and study the expression of a range of transport relating proteins, cilia function and mucus properties. You will then utilise this model to investigate the uptake properties of a range of pharmacologically relevant drug molecules.

**TECHNIQUES**  HPLC, PCR, Western blot, Drug delivery, microscopy

**Co supervisors**  B McParland, D Traini, H-X Ong

### PROJECT 2  Developing new particulate systems to treat respiratory disease

Respiratory tract infection is the number 1 cause of communicable disease worldwide. Currently treatment regimes involve ether oral delivery of antibiotics or, when in intensive care, antibiotic intravenous injection. A logical approach would be to deliver antibiotics by inhalation since this would reduce the required dose and the potential for antibacterial resistance. However, in order to achieve this the particles must have a diameter < 5µm and have enhanced residency time at the epithelia. In this project, you will gain experience in the area of particle engineering, state-of-the-art physico-chemical characterisation and drug delivery. We will design a novel inhaled antibiotic particle that has enhanced residence in the lung through its interaction with the epithelia/surface lung fluid.

**TECHNIQUES**  Particle engineering, in vitro testing, HPLC, microscopy, colloid science

**Co supervisor**  D Traini

Selected publications

- Ong, H.X., Benaouda F., Traini, D., Cipolla, D., Gonda, I., Bebawy, M., Forbes, B., Young, P.M. In vitro and ex vivo methods predict the enhanced lung residence time of liposomal ciprofloxacin formulations for nebulisation. European Journal of Pharmaceutics and Biopharmaceutics (Accepted June 23rd 2013).
- Ong, H.X., Traini, D., Young, P.M. Pharmaceutical Applications of the Calu-3 lung epithelia cell line. Expert Opinion on Drug Delivery. (Accepted May 9th 2013).
Information about pain is first processed in the dorsal horn of the spinal cord and then sent to the brain by specialized ascending pain-pathways. Incoming noxious signals are processed and modulated in the spinal cord by local circuits, as well as by descending pathways from higher brain regions. The neurobiology of pain research group examines spinal cord circuits in order to understand how specific and nuanced pain signals are communicated and what happens to these signals when chronic pain develops.


**PROJECT 1 Inhibitory Synapses of the Spinal Cord**

*Will suit a student with interests in pharmacology or physiology*

Two similar, but functionally distinct amino acid neurotransmitters carry out fast inhibitory transmission in the spinal cord. The reason two transmitters are required in this region is unclear. In this project you will examine how the two inhibitory neurotransmitters interact at the presynaptic terminal by recording synaptic currents from pairs of connected spinal cord neurons in culture.

**TECHNIQUES**  Primary neuronal culture, electrophysiology, pharmacology, brain slice


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Our research group examines the mechanisms underlying chronic pain and is identifying novel pain relieving drugs, particularly those related to cannabinoids. This work is done using a range of behavioural and cellular techniques.


**PROJECT 1 Chronic Pain & Cannabinoids**

Chronic pain syndromes particularly those caused by injury to the nervous system (neuropathic pain) are often resistant to traditional analgesics. The psychoactive ingredient of marijuana, THC, is effective in alleviating these pain syndromes by acting on an endogenous cannabinoid neurotransmitter system, however, its use is limited by side-effects. This project will examine the pain relieving actions and side-effects of other cannabis constituents activity in an animal model of chronic pain\(^1-3\).


A/Prof Kay DOUBLE (kay.double@sydney.edu.au)  
Neurodegenerative disorders (Brain & Mind Centre)

Our research focuses on developing pharmaceutical treatments for Parkinson’s disease and amyotrophic lateral sclerosis, based around degenerative cascades involving protein and metal changes in these disorders. Approaches include extensive use of human CNS tissues, as well as animal modelling and clinical projects. Our laboratory is based in the Brain and Mind Centre in Mallett St, Camperdown.

Research group (2016)  Research group of eight including 5 PhD and 1 Hons student.

PROJECT 1  COX AND MITOCHONDRIAL DYSFUNCTION IN PARKINSON’S DISEASE

Suits students with interests in wet lab-based research, neurodegenerative disease and human brain

Metals are key co-factors in a number of cell processes, including energy production by mitochondria. In the neurodegenerative disorder Parkinson’s disease mitochondrial function is thought to be impaired and contribute to degenerative processes. We have recently shown that neuronal copper levels are markedly decreased in the Parkinson’s disease brain and that this change is associated with reduced function of a number of cellular copper-dependent processes. Within mitochondria, cytochrome c oxidase (COX) is a copper-dependent enzyme in the electron transport chain but it is unknown if the function of this critical cuproprotein is altered in the copper-deficient Parkinson’s disease brain and, if so, the implications of this for neuron survival. In this project we will isolate mitochondria from Parkinson’s disease and age-matched brains and investigate copper levels and activity of COX in these tissues. This project will have implications for planned clinical trials which aim to restore brain levels of copper, and thus the function of copper-dependent proteins, in Parkinson’s disease.

TECHNIQUES  human tissue preparation, metal analyses using mass spectroscopy, immunoblotting, enzyme activity assays


Prof Sarah HILMER (sarah.hilmer@sydney.edu.au)  
Ageing and Pharmacology (Kolling Building, RNSH)

Sarah Hilmer leads a translational geriatric pharmacology research group at the Kolling Institute, Royal North Shore Hospital. We study pharmacology in ageing, aiming to improve the safety and efficacy of medicines for older people. Using basic experimental pharmacology in our novel pre-clinical models, we study the effects of polypharmacy and deprescribing in old age. Our clinical pharmacology research investigates drug use, pharmacokinetics, pharmacodynamics, safety and efficacy of drugs, alone and in combinations, in fit and frail older people with and without dementia. Pharmacology honours students are co-supervised by Dr Slade Matthews and Professor Peter Carroll.

Research group (2016)  Postdocs 3; Students 2 PhD, 1 Masters, 2 Honours; Research Pharmacist 1; Research Assistants 2; International Fellow 1

PROJECT 1  UNDERSTANDING AND OPTIMISING THE EFFECTS OF POLYPHARMACY IN OLD AGE

Suits students with interests in pre-clinical or clinical research, prescribing practice and ageing

In old age, with an increase in multi-morbidity, comes an increase in polypharmacy (concurrenct use of ≥5 different medicines). We have developed a novel pre-clinical model of polypharmacy to evaluate the effects of polypharmacy on physical and cognitive function in old age, and whether the effects are reversible with medicines withdrawal (deprescribing). We are also conducting clinical studies in the community and in hospital, investigating how to improve medicines use by older people with and without dementia to optimise their independence. Opportunities exist for an honours student to contribute to our pre-clinical or clinical research.

TECHNIQUES  Measuring physical and cognitive function and frailty, histopathology/immuno-histochemistry, LCMS, data collection from patients and medical records, data analysis

Drug discovery research within my group is multidisciplinary and at the interface between chemistry and biology. The research is primarily concerned with the understanding of drug-protein and drug-binding site interactions in order to obtain structure-activity relationships of bioactive CNS molecules. This allows the rational design of more efficacious treatments for diseases of the brain.


Research group (2016):
Dr Eryn Werry (Post-doc), Ms Miral Mikhail (PhD Student), Mr Alex Jackson (PhD Student), Mr Erick Wong (PhD Student), Mr Damien Gulliver (PhD Student)
Ms Sophie Vo (Honours Student), Ms Helen Clunas (Masters Student), Mrs Kata Popovic (Research Assistant)

**PROJECT 1  THE ROLE OF TRANSLOCATOR PROTEIN POLYMORPHISM IN DRUG DISCOVERY**

The translocator protein (TSPO) in the outer mitochondrial membrane is a novel target for development of anxiolytics, anti-cancer drugs and diagnostic imaging agents. A recent phase II clinical trial of a TSPO ligand in general anxiety disorder failed due to the presence of a common TSPO polymorphism (Ala147Thr) at which the ligand lost activity. Our group has developed novel TSPO ligands hypothesised to interact effectively with Ala147Thr TSPO. This project will involve characterising the ability of these ligands to bind to and activate both wild type and Ala147Thr TSPO to identify a novel candidate to progress through further stages of drug discovery.

**TECHNIQUES**  Cell culture, radioligand binding, cellular assays

**PROJECT 2  DRUG DISCOVERY FOR NEUROINFLAMMATION**

Microglia are the resident immune cells of the central nervous system. They carry out a wealth of helpful neuroprotective functions, including refining neural networks, phagocytosis of harmful molecules like β-amyloid and release of anti-inflammatory mediators. Threatening stimuli, however, can trigger the transformation of microglia into a pro-inflammatory state that can damage cells and even cause accumulation of β-amyloid. Recently, it has been shown that transforming microglia from the pro-inflammatory to the neuroprotective state is sufficient to reverse the pathological features and cognitive symptoms of a mouse model of Alzheimer’s disease. The aim of this honours project is to develop a brain-permeant molecule that can drive pro-inflammatory microglia into the neuroprotective form. It is hoped that this molecule can then be progressed into preclinical trials in neuroinflammatory disease models, such as Alzheimer’s disease.


**TECHNIQUES**  Cell culture, cellular assays, immunofluorescence

Where are they now?

Honours is a fantastic year in itself, but is also a springboard to postgraduate studies and careers in industry and government. Shown in the Table below are the current positions of a selection of students who have completed Honours or a Graduate Diploma in Pharmacology.

<table>
<thead>
<tr>
<th>Name</th>
<th>Completed</th>
<th>Current Position</th>
</tr>
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<tbody>
<tr>
<td>Phuoc Huynh</td>
<td>2010</td>
<td>PhD Candidate (Pharmacology, University of Sydney)</td>
</tr>
<tr>
<td>Carleen Fernandez</td>
<td>2010</td>
<td>PhD Candidate (Centenary Institute)</td>
</tr>
<tr>
<td>Vivian Liao</td>
<td>2010</td>
<td>PhD Candidate (Pharmacy, University of Sydney)</td>
</tr>
<tr>
<td>Dmitry Goloskokov</td>
<td>2010</td>
<td>Laboratory Aide (Douglass Hanly Moir Pathology)</td>
</tr>
<tr>
<td>Lauren Brites</td>
<td>2009</td>
<td>Research Assistant (EnGenelC)</td>
</tr>
<tr>
<td>Sai Krishnan</td>
<td>2009</td>
<td>PhD Candidate (Children’s Medical Research Institute)</td>
</tr>
<tr>
<td>Marietta Salim</td>
<td>2009</td>
<td>Research Assistant (Transporter Biology Group)</td>
</tr>
<tr>
<td>Areeg Hamdi</td>
<td>2009</td>
<td>Masters Candidate (Pharmacy, University of Sydney)</td>
</tr>
<tr>
<td>Steven Devenish</td>
<td>2008</td>
<td>PhD Candidate (Pharmacy, University of Sydney)</td>
</tr>
<tr>
<td>Nicholas Kortt</td>
<td>2008</td>
<td>Medicine (University of Notre Dame)</td>
</tr>
<tr>
<td>Phoebe Hone</td>
<td>2008</td>
<td>Research Assistant (Veterinary Science)</td>
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<tr>
<td>Cho Zin Soe</td>
<td>2007</td>
<td>PhD Candidate (Pharmacy, University of Sydney)</td>
</tr>
<tr>
<td>Jonathon Tobin</td>
<td>2007</td>
<td>Medicine (University of Wollongong)</td>
</tr>
<tr>
<td>Jessica Kermale</td>
<td>2007</td>
<td>PhD Candidate (Woolcock Institute of Medical Research)</td>
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<tr>
<td>Amelia Eddington</td>
<td>2007</td>
<td>PhD Candidate (Pharmacology, University of Sydney)</td>
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<tr>
<td>Alana Scarf</td>
<td>2007</td>
<td>PhD Candidate (Brain &amp; Mind Research Institute)</td>
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<tr>
<td>Chiu Chin Ng</td>
<td>2006</td>
<td>PhD Candidate (Pharmacology, University of Sydney)</td>
</tr>
<tr>
<td>Tim Bakas</td>
<td>2006</td>
<td>MPhil Candidate (Pharmacology, University of Sydney)</td>
</tr>
<tr>
<td>Brina Sheriff</td>
<td>2005</td>
<td>Poisons Information Centre</td>
</tr>
<tr>
<td>Nathan Gunasekaran</td>
<td>2005</td>
<td>PhD (University of Sydney), Medicine (University of Notre Dame)</td>
</tr>
</tbody>
</table>
Discipline of Pharmacology: Honours Preference Form (2017)

This form must be submitted to the Honours Coordinator by: Friday 18 November 2016.
An application for Honours must be lodged on line through the Faculty of Science.

I wish to apply for the following course in 2017 (circle choice):

BSc (Hons)  BSc Adv (Hons)  BMedSc (Hons)  Graduate Diploma

I intend starting my studies in (circle choice): Semester 1 or Semester 2.

STUDENT DETAILS:

First Name ...................................................................................................................................................

Family Name ..................................................................................................................................................

SID ..................................................................................................................................................................

E-mail (University of Sydney Account) ............................................................................................................

Postal address .................................................................................................................................................

Phone (home) .................................................................................................................................................

Phone (mobile) ...............................................................................................................................................}

STUDENT PREFERENCES:

Please list your preferences for an Honours supervisor (from 1st to 4th preference). You must provide 4 names.

1 .................................................................................................................................................................

2 .................................................................................................................................................................

3 .................................................................................................................................................................

4 .................................................................................................................................................................

STUDENT TRANSCRIPT:

Please attach your academic transcript (photocopy or original) to this application.

Return to: A/Prof Rachel Codd, Room 274 Blackburn Building (D06)