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 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/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 2016. 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 18 September at 12 noon in Bosch Lecture Theatre 1.

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 20 Nov 2015.

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 through the Faculty of Science. Further information is available on the Faculty of Science URL: http://sydney.edu.au/science/cstudent/ug/course/honours/index.shtml

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 ≥ 65. Depending upon demand, the nominal acceptance cut-off for Honours in Pharmacology may be increased to ≥ 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. Each staff member has provided project details together with 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 (May (0%), 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 (Nov, 60%). Your supervisor will award you a mark (10%) that reflects your research dedication, competency and aptitude.
### Academic Staff in Pharmacology (Projects: p5-20)

<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>
</tr>
<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>
</tr>
<tr>
<td>Prof Paul Young</td>
<td>WIMR</td>
<td>Respiratory diseases, medical devices, lung-specific advanced formulations</td>
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### Affiliates (Projects: p21-22)

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<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Research Area</th>
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<tbody>
<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>RNSH W11c</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/Dr Karin Aubrey</td>
<td>KOL</td>
<td>Chronic pain and endocannabinoids, models of neuropathic pain</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 (2015): 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, motor and social function.

Cannabis is a complex mixture containing numerous cannabinoid compounds, therefore the active constituent/s need to be elucidated. Cannabisidol (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.

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 enkephalin expression in the amygdala. This project will determine whether a fearful experience alters enkephalin expression in the intercalated cells.

TECHNIQUES  
Immunohistochemistry, biochemistry

PROJECT 2  
Does fear change 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

PUBLICATIONS.
Our group focuses on innovative and effective ways to better manage chronic respiratory illness. This involves better understanding the health behaviours of patients and health care professionals. My group has a particular interest in asthma and respiratory medication use. Research students are important members of our research group and we promote a culture of learning through sharing and collegial support.


Research group (2015): 6 PhD students, 3 Research Assistants, 1 Honours, 6 MD students

**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 experiencing 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 SOLVING PARENT CONCERNS THROUGH EFFECTIVE COMMUNICATION**

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

A key component of effective disease management is the availability of good medication and/or management strategies and appropriate patient health behaviour. A critical enabler of ensure optimal management practices are followed by the patient, lies in the communication skills of the health care provider.

Paediatric asthma is an example of a condition in which parents/carers have many concerns and with effective communication, health care providers are able to address their concerns. This project explores the effectiveness of a Paediatric Asthma Communication Educational module on the confidence and skills of intern health care professionals in using communication strategies with parents/carers of children with asthma.

**TECHNIQUES**

Student will learn about practice research and repeated measures study design.

**PROJECT 3 ADOLESCENTS AND ASTHMA MEDICINE USE**

*Will suit a student who is interested in gaining hands on experience in skills development in health.*

The use of medicines in asthma is a complex process. Not only are individuals required to know the rationale for using different medicine, but they are also required to do so regularly and using the correct technique. Up to 90% of individuals do not use their inhalers correctly and up to 60% of them use them irregularly. This research explores the inhaler devices themselves and the intuitiveness of use i.e. how easy is it to use the different inhalers and if they are easier to use, in what way.

This research focuses on the intuitiveness of use of inhalers in two populations; adolescents and the elderly. In this research, we will be collecting data from adolescents from schools and the elderly through community pharmacy in order to better understand the way in which they use inhalers.

**TECHNIQUES**

Students will be exposed to quantitative research methods.
As part of the SACTRC collaboration I have helped developed a centre of clinical toxicology research excellence in Sri Lanka - funded by the NHMRC and Wellcome Trust. The focus is clinical, biomarker and public health research on drug, pesticide & plant poisoning, and snake envenomation.

Honours projects are based on Australian research and focussed around epidemiology and toxicovigilance of poisoning and adverse drug effects through local hospital clinical databases, the Poisons Information centre, the national Coronial database and routinely collected prescription data.

Research group (2015-6):  6 Postdoctoral Associates, 5 PhD students, 1 Honours

PROJECT 1  Biomarkers of oxidative stress and relationship to self-harm and alcohol use

involves joint supervision with Drs Kate Chitty & Devanshi Seth (http://www.genomalc.org/)

This project will investigate blood biomarkers of oxidative stress and alcohol use and their relationship to suicidal behaviour and other mental health outcomes in people who have presented to hospital for deliberate self-poisoning. This project will be embedded within a randomised control trial (RCT) based at the Drug and Alcohol Unit at Royal Prince Alfred Hospital (RPAH). Students will be required to collect clinical data from study participants (e.g. perform clinical interviews and mental health rating scales), assay blood samples and liaise with health professionals at RPAH. This project is ideally suited to students interested in a clinical research career and want experience in RCT design and analysis.

TECHNIQUES  RCT, study coordination, clinical assessment, blood analysis/assaying

PROJECT 2  Epidemiology of fatal poisoning in Australia

involves joint supervision with Dr Rose Cairns

This project will extract data from the national coronial information system (from 2000 to 2015) and explore trends over time in the drugs involved in fatal poisoning in Australia, the relationship to prescribing trends and geographic location and legislative/regulatory interventions.

This project may also involve utilising routinely collected data from Poison Centre calls and Australian prescription data to explore to what extent fatal poisoning just reflects frequency of overdose and whether doctor’s prescribing habits (co-prescription, etc...) modify risk.

TECHNIQUES  Epidemiology, Pharmacoepidemiology, statistics, database analysis

PROJECT 3

Osteoporosis is a disease of decreased bone strength that puts those effected at risk of breaking bones and is highly prevalent with 70% of those over eighty being diagnosed in our aging population. This study will examine the “UK Biobank” study of 500, 000 participants to measure the risk factors involved in the initiation and progression of this disease. There will be a particular focus on how medications, primarily serotonin reuptake inhibitors and protein pump inhibitors, increase the rate of bone loss.

TECHNIQUES  Epidemiology, Pharmacoepidemiology, statistics, database analysis
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.


**Research group (2015):** Ben Harris (PhD Student), Diana Shinko (PhD Student), Imogen Janus (Honours Student)

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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 CRC 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

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**PROJECT 2  INVESTIGATION OF ANTI-INFLAMMATORY STRATEGIES TO IMPROVE HEPATIC DRUG METABOLISM**

This project is designed for an honours student with an interest and background knowledge in pharmacology, drug metabolism and cancer. We have shown clinically that inflammation alters hepatic drug metabolism and pharmacokinetics of anti-cancer drugs. The project aims to investigate anti-inflammatory pharmacological interventions to reverse the inflammatory-mediated changes in hepatic drug metabolism and transport in HepaRG cells *in vitro*. The honours student will use *in vitro* cell culture and molecular biology techniques, including RNA extraction, cDNA synthesis, real-time RT-PCR, protein and functional activity assays.

**TECHNIQUES** Primer design, RNA isolation, PCR, protein and functional activity assays, 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 interests & publications:


### Research group (2015):

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,

**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

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**Selected publications**


Projects in my group blend aspects of chemistry, biochemistry, microbiology and biotechnology. We are interested in a class of compounds 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 technique designed in our group.

Research interests/publications:  
Research group (2015):  
2 Postdoctoral Research Associates, 4 PhD students, 1 Honours student

PROJECT 1  METAL-TEMPLATED SYNTHESIS OF THE SIDEROPHORE NATIVE TO BORDETELLA

**Will suit a student with interests in medicinal chemistry/drug design/synthetic chemistry**

Siderophores are low-molecular-weight organic compounds produced by bacteria as agents for sequestering local iron for delivery to the cytoplasm. Through deprivation of essential iron, siderophores have applications as anti-cancer and anti-infective agents. Our group has used metal-templated synthesis (MTS) to produce siderophores [1]. In this project, you will prepare the siderophore alcaligin from start fragments rac-1,4-dibromo-2-butanol or (S)-1,4-dibromo-2-butanol. Alcaligin is native to *Bordetella pertussis* (whooping cough pathogen). Access to alcaligin would allow for a more complete understanding of its role in virulence. In parallel, you will use an innovation in solid-phase organic synthesis to produce the equivalent apo-macrocycle.

**TECHNIQUES**  
Synthetic chemistry, LC-MS, Coordination chemistry, Solid-phase organic synthesis

PROJECT 2  ISOFORM-SELECTIVE INHIBITORS OF HISTONE DEACETYLASES

**Will suit a student with interests in medicinal chemistry/drug design/synthetic chemistry**

The Zn(II)-containing histone deacetylases (HDACs) are validated cancer targets [2]. Uregulated HDAC activity promotes chromatin condensation and transcriptional silencing. Inhibition of aberrant HDAC activity reactivates the expression of tumour suppressor genes. Clinical agents, including vorinostat and panobinostat, inhibit Zn(II)-containing HDACs via the hydroxamic acid Zn(II)-binding moiety at the head (red). These drugs contain variable structural complexity at the tail. In this project, you will prepare a suite of compounds designed to inhibit a sub-group of the 11 Zn(II)-containing HDAC isoforms in a selective fashion. These compounds will help delineate the role played by HDACs in health and disease.

**TECHNIQUES**  
Synthesis/characterisation, fluorometric HDAC inhibition assay, computer modelling

PROJECT 3  A NEW METABOLOMICS-BASED PLATFORM FOR DRUG DISCOVERY

**Will suit a student with interests in chemical biology/biochemistry (no chemistry required)**

Our group has discovered a new method to prepare molecular probes of bacterial metabolites [3]. This method is significant, since it offers a new way to readily prepare libraries of molecular probes that could select for cognate binding partners from the complex bacterial proteome. This project has the potential to identify a new platform for the identification of drug leads and drug targets.

**TECHNIQUES**  
Biotechnology, biochemistry, pull-down assays, western blots, drug discovery

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. The current research projects form part of the Charles Perkins Centre Science of Learning Science Research Node. This research node has an ongoing interest in understanding how both staff and students experience new learning spaces and opportunities to develop new ways of teaching and learning in these spaces.

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

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**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 our current 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 previously unknown 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 group (2015):
Aaron Schockman (MPhil), Davy Guan (Hons), Bosco Chan (Hons)

**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 of 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:**
Our research group investigates mechanisms behind increased bronchial responsiveness with respect to respiratory disease such as asthma. We also have a focus on emerging diseases that arise from tick bites such as Lyme borreliosis.

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**PROJECT 1  Bronchial segment model to assess beta2-adrenoceptor desensitisation**

This project will be co-supervised by Paul Young and Daniela Traini from the Woolcock. People with asthma have airways that are too sensitive and narrow too much. The epithelium provides a barrier between the outside and the inside of the body and this may be impaired in asthma. This project is to investigate whether the epithelial barrier alters beta2-adrenoceptor desensitisation and whether there are differences between the following agonists: isoprenaline, salbutamol, fenoterol, salmeterol and formoterol. Bronchial airway segments will be obtained from pig lungs picked up from a local abattoir.

**TECHNIQUES**

- Organ bath pharmacology
- Tissue dissection
- Histology/Morphometry
- Radioligand binding assays (possibility)
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 group (2015):
Sarah Allison, Julie Dwyer (postdocs), Kirsi Bourget (Res Asst), Nooshin Koolaji, William Sudarmana, Jian Zhang (postgrads), Hassan Choucair (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
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 (2015):**
Rob Vandenberg, Jane Carland, Josep Font, Cheryl Handford, Rosie Cater, Ben McIlwain, Shannon Mostyn, Ben Gallagher, Chris Sirote

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**PROJECT 1 Developing novel cancer therapeutics that target the glutamine transporter, ASCT2**

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 (GltPh) 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 selectively 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.

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**PROJECT 2 Investigating the chloride permeation pathway 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 identified part of the chloride permeation pathway. 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, fibrillar protein complexes known as amyloid fibrils is associated with many diseases. However, amyloid protein fibrils with similar structural features have recently been identified in mammals and many different microorganisms. In these cases the amyloid is advantageous to the organism and often plays a critical role in mediating recognition by the host immune system. The Sunde lab uses a range of molecular biology, protein chemistry and structural techniques to study the formation and structure of amyloid fibrils associated with microbial infections [1].

Research interests/publications:  

Research group (2015):  
Dr Chi Pham (Postdoctoral Research Associate), Jennifer Lai (PhD student), Victor Lo (PhD student). Jenny Chiem (Student volunteer).

PROJECT 1  THE ROLE OF FUNGAL AMYLOID FIBRILS IN STABILISING BIOFILMS

Will suit a student with interests in microbiology and antimicrobials

Fungi produce amyloid fibrils that are composed of hydrophobin proteins [2]. These fibrils form a protective coating on the spores and also facilitate formation of biofilms. Human infection by the opportunistic pathogen *Aspergillus fumigatus* causes invasive aspergillosis in immune-compromised patients, after spore germination in the lung and dissemination into the bloodstream. Invasive aspergillosis is associated with a mortality rate of ~50%. The expression of the hydrophobin RodB in *A. fumigatus* increases >3500-fold in the biofilm context of the lung. You will express RodB recombinantly in bacteria and purify this protein. You will study the formation of amyloid fibrils by the hydrophobin RodB in a biofilm-like environment. You will characterise the structure of the RodB fibrils and determine the stability of the biofilms using enzyme digestion experiments to determine biofilm persistence. You will determine the effect of extracellular matrix components on the rate of RodB self-assembly and on the nature of the RodB polymers.

TECHNIQUES  
Molecular biology, protein expression and purification, fibril formation assays, fluorescence studies, fungal culture, biofilm disassembly experiments.

PROJECT 2  FUNCTIONAL AMYLOID COMPLEXES IN THE NECROPTOSIS CASCADE

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. Li et al. (Cell (2012) 150: 339-50) demonstrated that this involved amyloid formation by RHIM domains within the RIPK1 and RIPK3 kinases. Such functional amyloid complexes have also recently been shown to be associated with oligodendrocyte cell death in multiple sclerosis (Ofengeim et al. (2015) Cell Reports 10: 1836-1849)). Two other human proteins, ZBP1 and TRIF, also contain RHIM domains. We hypothesize that these proteins can also self-assemble into functional amyloid fibrils and may be able to form complexes with form complexes with RIPK1 and RIPK3. You will clone and express the RHIM domains of human ZBP1 and TRIF, also contain RHIM domains. You will investigate whether ZBP1 and TRIF form functional amyloid complexes with human RIPK1 and RIPK3 kinases. You will investigate the stability of these functional amyloid fibrils and determine whether chaperones are able to disaggregate the fibrils.

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.

Research interests/publications:  http://sydney.edu.au/medicine/people/academics/profiles/danielat.phd

PROJECT 1  Targeting LAM via direct lung delivery

Lymphangioleiomyomatosis (LAM) is a progressive lung disease that usually strikes women during their childbearing years. Whilst research into LAM has rapidly progressed over the last 15 years - there are still many unmet needs. Rapamycin (RAPA) is cytostatic and thus the disease continues to progress, with lung function declining rapidly, upon cessation of therapy. Thus there is a need for additional treatments. One such potential therapy is simvastatin (SV), a common cholesterol-lowering agent of the statin class, which has been shown to not only inhibit cell growth but also to decrease LAM cell survival. We will reformulate these two drugs as combination 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: A/Prof Young, Dr Moir, 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: A/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. Glycine is an unusual neurotransmitter in that it acts on inhibitory glycine receptors and excitatory NMDA receptors. The Glycine Transporter GLYT1 regulates the concentrations of glycine at excitatory synapses, whilst a combination of GLYT1 and GLYT2 are required for regulation of glycine at inhibitory synapses. GLYT1 inhibitors are currently being developed for the treatment of schizophrenia, whilst GLYT2 inhibitors may have potential as analgesics in the treatment of chronic pain.


Research group (2015): Prof Robert Vandenberg, Ass Prof Renae Ryan, Dr Jane Carland, Dr Pep Font, Cheryl Handford, Amanda Scopelliti, Rosie Cater, Ben McIlwain, Shannon Mostyn, Chris Sirote, Ben Gallagher

**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-arachidonyl-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. 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.


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### 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 either 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

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**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).


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

Our research focuses on understanding brain cell death in neurodegenerative disorders, particularly the movement disorder Parkinson’s disease. Ultimately we aim to use this knowledge to develop treatments which can slow or halt brain cell death to slow disease progression and deliver clinical benefits for patients. Our laboratory is based in the Brain and Mind Centre in Mallett St, Camperdown.

Research group (2016): 7-8 researchers including Honours students, PhD students and research staff.

PROJECT 1  A NOVEL PROTEIN AGGREGATE IN THE PARKINSON’S DISEASE BRAIN

In many neurodegenerative diseases brain cell death is associated with the abnormal accumulation of proteins into insoluble aggregates. Brain cell death in Parkinson’s disease is thought to be associated with the aggregation of the protein alpha-synuclein, although aggregation of this protein is also seen in brain regions where cells do not degenerate. We have recently identified a new type of protein aggregate in the Parkinson’s disease brain which is found only in brain regions where brain cells degenerate. Interestingly, a similar type of aggregate is also found in the degenerating spinal cord in another neurodegenerative disorder amyotrophic lateral sclerosis (ALS). Clinical trials are now underway in ALS which target these aggregates for removal in the hope of slowing the disease process. We are studying the new aggregates in the Parkinson’s disease brain to determine how they compare with the aggregates seen in ALS and if their presence might explain the regional cell death that occurs in the Parkinson’s disease brain. If so, they may represent a new treatment target.

TECHNIQUES  human tissue preparation, immunohistochemistry, mass spectroscopy and metal analyses


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

Sarah Hilmer leads a translational geriatric pharmacology research group based 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, we study the hepatic disposition and hepatotoxicity of drugs and the effects of polypharmacy in our Laboratory of Ageing and Pharmacology. Our clinical pharmacology research investigates drug use, pharmacokinetics, pharmacodynamics, risks and benefits in fit and frail older people. Pharmacology honours students are co-supervised by Dr Slade Matthews and Professor Peter Carroll.

Research group (2015): 2 Post-doctoral scientists, 4 PhD students, 1 MPhil student, 3 Honours students (1 pharmacology, 1 pharmacy, 1 medicine), 2 clinician researchers

PROJECT 1  MONITORING DRUG THERAPY IN OLDER PATIENTS

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

In older patients, it is important to monitor pharmacodynamic effects of medicines. This is often done using surrogate outcomes, eg serum liver function tests (LFTs) as a marker of hepatotoxicity. LFTs are affected by many of the patient’s medicines (polypharmacy is the norm in old age), ageing physiology, frailty and multimorbidity. This project involves recruiting young, old robust and old frail patients, collecting clinical data from patient interviews and medical records, measuring LFTs, and performing in vitro tests on the effect of increasing doses of drugs on liver enzymes in blood from patients with different characteristics. The results will inform how medicines are monitored and used in older adults.

TECHNIQUES  Data collection from patients and medical records, blood tests, 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 interests/publications:  

Research group (2015):  
Dr Eryn Werry (Post-doc), Ms Miral Mikhail (PhD Student), Mr Alex Jackson (PhD Student), Mr Erick Wong (Masters Student), Ms Lola Awofala (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

PUBLICATIONS.  

Dr Chris VAUGHAN & Dr Karin AUBREY  
Pain Management Research Institute  
Kolling Institute at Royal North Shore Hospital  
chris.vaughan@sydney.edu.au  
karin.aubrey@sydney.edu.au

Our research groups examine the mechanisms underlying chronic pain and identifying novel analgesics. This work is done using a range of behavioural and in vitro techniques.

Research interests & publications:  

Research group (2015):  
Chris Vaughan, Wayne Anderson, Jin Jeong, Vanessa Mitchel, Patrick Seow

PROJECT 1 Chronic Pain & Cannabinoids. Supervisor: Dr Chris VAUGHAN

Will suit a student with interests in pharmacology

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 pain1,2.

TECHNIQUES  

RELEVANT PUBLICATIONS.  
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>
</thead>
<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>
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<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 (Pharmacology, University of Sydney)</td>
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<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>
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<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 (2016)

This form must be submitted to the Honours Coordinator by: Friday 20 November 2015.
An application for Honours must be lodged on line through the Faculty of Science.

I wish to apply for the following course in 2016 (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)