School of Biomedical Sciences
Available Honours Projects 2012

School of Biomedical Sciences—www.uq.edu.au/sbms

FUNCTIONAL AND COMPARATIVE ANATOMY

Associate Professor Mark Brown

- 3D reconstruction of human shoulder muscles
- Muscle fibre type distribution in human shoulder muscles
- Diagnosis of musculoskeletal injury (e.g. Chronic Low Back Pain) with mechanomyography
- Muscle fatigue in human segmented muscle
- Prediction of musculoskeletal injury
- The relationship between muscle architecture and fibre type in multifunctional muscles
- Comparative anatomy: evolution of the human shoulder musculoskeletal system

Dr Karen Samonds

- Identification and comparative biogeography of Cenozoic fish fossils from northwestern Madagascar
- Taphonomy and anatomical description of *Hippopotamus* subfossils from Anjohibe Cave, Madagascar

DEVELOPMENTAL AND REGENERATIVE BIOLOGY

Professor Brian Key/Dr Arnaud Gaudin

- Imaging growing axons in the living vertebrate brain: the search for guidance cues.
- in vivo analysis of the growth cone behaviour of the pioneer pineal axons in the 24 hours brain of transgenic zebrafish larvae
- Using Xenopus frogs to understand gene function and cell-cell interactions during embryogenesis

Dr David Pennisi

- Examining developmental cardiovascular defects in mouse embryos with Crim1 mutations
- Assessing cardiovascular function in adult mice with Crim1 mutations
- Investigating adhesion, migration and invasion of epicardial cells in the formation of the coronary vasculature
- Determine the biological significance of the IGFBP and putative integrin-binding domains of Crim1
- Is Crim1 involved in cardiac hypertrophy?

Dr David Simmons/Dr Georgia Kafer

- Investigating the role of sinusoidal trophoblast giant cells in placental development and function
- Are male and female placentas different? Analysing sex-specific differences in placental gene expression
- The differential use of histone variants in regulating trophoblast stem cell pluripotency and cell lineage commitment

Dr Annemiek Beverdam

- Investigate the role of axon guidance factors in the development of the olfactory system using transgenic and knockout mice
- Unravel the genetic control of stem/progenitor cell proliferation in the epidermis using transgenic and knockout mice

PHARMACOLOGY/ DEVELOPMENTAL BIOLOGY

Professor Steve Taylor/Dr Trent Woodruff/Dr Angela Jeanes

- Investigating the role of the anaphylatoxin C5a alternate receptor, C5L2, in the development of the neural tube: will knockout of C5L2 lead to spina bifida?

PHARMACOLOGY

Dr Trent Woodruff

- Innate immune complement receptors in neurodegenerative diseases: A new pharmacological target for neuroprotection?
- Pharmacological and pathological role of the under-explored complement fragment C3a: The gatekeeper to an informed immune response?
- Investigating the role of the anaphylatoxin C5a alternate receptor, C5L2, in the development of the neural tube: Will knockout of C5L2 lead to spina bifida?

Dr Mary-Louise Roy Manchadi/Dr Trent Woodruff/Professor Steve Taylor

- Pharmacodynamic analysis of intracellular calcium release in neuronal and non-neuronal cells following activation of complement receptors

Dr Simon Phipps

- Molecular signals that promote the formation of inducible bronchus-associated lymphoid tissues (iBALT)
- Counter regulatory mechanisms between type I IFN and IL-1b
- The contribution of pattern recognition receptors to host defence against helminthic worms (collaboration with Dr. Sumaira Hasnain)
- Understanding the mechanisms by which plasmacytoid dendritic cells protect against asthma
- Pathogen recognition and induction of inflammation by neuronal cells (collaboration with Dr. Stuart Mazzone)

Professor Rodney Minchin

- Arylamine N-acetyltransferase is a new target for cancer treatment
- Is the novel sulfotransferase SULT4A1 important in neurodegenerative disease?
- Regulation of metalloproteinases in breast cancer invasion
- Epigenetic regulation of the kinase PKD1, a key enzyme in aggressive cancers
- Activation and inhibition of cellular proteins by engineered nanoparticles
- Trafficking of nanoparticles across cell membranes

Dr Richard Clark

- Understanding the function of the iron regulatory hormone hepcidin
- Discovery and development of novel immunomodulatory peptides from hookworms.
- Development of conotoxin-based peptides for the treatment of neuropathic pain.
- Neuroprotective effects of conotoxins in ischaemic stroke (with Drs. Linda Haugaard-Kedström and Garrie Arumugam).

Dr Johan Rosengren

- Understanding structure-activity relationships of the mouse intestinal antimicrobial peptide Cryptdin-4
- Development of novel drug leads targeting the relaxin receptors through combinatorial library synthesis
- Modelling of the interactions between relaxin peptide hormones and their receptors to allow structure based drug design

- Improving blood-brain barrier penetration and in vivo stability of a single chain relaxin-3 receptor antagonist for the treatment of neurological disorders

PHYSIOLOGY

Associate Professor Peter Thorn

- Acid secretion in cystic fibrosis
- Control of insulin secretion

Associate Professor Karen Moritz/Dr Megan Probyn/Dr Reetu Singh

- How does alcohol exposure around the time of conception alter fetal development?
- The effects of hypoxia on fetal renal development (in collaboration with Melissa Little and Lorine Wilkinson)
- Does fetal hypoxia program adult onset disease?
- How do glucocorticoids affect mammary gland development and function? (In collaboration with Drs Smart and Saunus at UQCCR)
- Exploring links between glucocorticoids and breast cancer (In collaboration with Drs Smart and Saunus at UQCCR)

Dr Tamara Paravicini/Associate Professor Karen Moritz

- Regulation of magnesium transporters during pregnancy: does magnesium influence development?

Dr Tamara Paravicini

- Cardiac complications of hypertension: is there a role for magnesium transport and signaling by the ion channel TRPM7?
- Do growth factors influence magnesium homeostasis by regulating the TRPM6 ion channel in the kidney?
- The renin-angiotensin system in vascular remodelling and calcification

Professor Wally Thomas/ Dr Brooke Purdue
Receptor Biology Group

- A role for taste receptors in heart function
- A functional role for tetraspanins (membrane scaffolding proteins) in regulating vascular responses to angiotensin
- A functional interaction of the AT1R with a hydrogen ion pump
- Regulation of gene expression by the NR4A nuclear receptors in cardiac disease

Projects in this lab may involve a wide variety of techniques, including cell culture and isolation, PCR, Western blotting, cellular imaging and confocal microscopy, radioligand binding, RNA interference, molecular biology techniques for cloning of receptors and channels, and in vivo models.

Dr Stephen Anderson

- Endocrinology of early pregnancy in the mare
- Pathogenesis of osteochondrosis in horses
- Endocrinology of growth and reproduction in Bos indicus cattle

Dr Brad Launikonis

- Understanding calcium regulation inside muscle fibres with fluorescence imaging

Professor Daniel Markovich

- Cell biology of membrane proteins

- Genetic diseases of membrane transporters
- Cancer and Membrane transporters
- Molecular biology of kidney stones
- Developmental expression of transporters

NEUROSCIENCE

Dr Ethan Scott

- Microscopic observation of neural activity, and light-based control of behaviour in free-swimming zebrafish

Dr Sean Millard

- Neuron-specific alternative splicing of Dscam2
- The role of complement-like proteins in fly neurodevelopment
- Investigating whether neurons and glia collaborate to generate boundaries in the brain
- How does Dscam2 signal repulsion?
- Manipulating Complement Proteins in a fly Model for Parkinson's Disease
- Correlating synaptic defects with visual system behaviours in the Dscam2 mutant

Dr Marc Ruitenberg

- Characterising inflammatory changes following experimental spinal cord injury in mice

Dr Stuart Mazzone

- Understanding the activation properties of airway sensory neurons
- Mechanisms regulating growth of sensory neurons
- Pathogen recognition and induction of inflammation by neuronal cells (Collaboration with Dr Simon Phipps)
- Mapping of neural circuits using recombinant Herpes Simplex Virus 1

Associate Professor Peter Noakes

- Molecular mechanisms of neuronal cell death – molecular consequences of innate immune system activation (C5a – CD88/C5L2) in motor neurons, astrocytes and micoglia.
- Regulation of developmental neuronal numbers by the innate immune system
- Modification of neuronal morphology and function by glia
- Regulation of neuronal number and morphology by synaptic activity during development
- Cell and molecular changes at neuromuscular synapses during old age and during motor neuron disease progression

Dr Mark Bellingham/ Dr Shyuan Ngo/ Refik Kanjhan

- Electrophysiology, immunohistochemistry and molecular biology of the neuromotor control system
- Causes and potential treatments of motor neuron disease
- The relationship between neuronal activity and motor neuron morphology and development
- Neuropharmacological control of motor neuron excitability in health and disease
- Brain body interactions – the interchange between body composition/metabolism and neuroendocrine control of metabolism
- Dendritic morphology of motor cortex neurons in wild type and SOD1 (motoneuron disease model) mice, before and after 2-4 weeks riluzole treatment
- Quantitative comparison of vascularization and microglia numbers in the hypoglossal motor nucleus of wild-type and SOD1 (motoneuron disease model) mice:Effects of riluzole treatment

My lab uses a variety of techniques, including electrophysiology, immunohistochemistry and molecular biology. I have strong collaborations with Peter Noakes' and Prof Chen Chen's laboratories in SBMS and with Assoc Prof Elizabeth Coulson in QBI, and joint projects with these labs are also possible.

EDUCATION RESEARCH UNIT

Dr Kirsten Zimbardi/Dr Kay Colthorpe

- Student learning in the sciences- How do science students learn? How can this learning be facilitated, improved and made more efficient?
- Research careers in the biomedical sciences- What factors influence how students choose research courses and a research career in biomedical sciences? What are the impacts of these choices?

Available Honours Projects 2012

Diamantina Institute—www.di.uq.edu.au

Associate Professor Nicholas Saunders
Epithelial Pathobiology Group

All our projects are translational in nature and use human cells and tumours to address the following aims:

- Understanding the molecular basis for the control of squamous differentiation
- Understanding how these processes are dysregulated during the development of oral and skin cancers
- Exploiting this knowledge in the development of novel treatments for skin cancers and oral cancer
- Understanding the biological basis for the development of fatal pulmonary metastases in osteosarcoma patients
- Interrogating chemotherapeutic sensitivity of tumour tissue using novel imaging techniques

Dr Antje Blumenthal
Epithelial Cancer Division

- Functions of the Toll-like receptor RP105 in innate immune recognition of pathogens
- Wnt proteins as new regulators of immune responses during infection and inflammation
- Discovery of novel anti-microbials against tuberculosis

Dr Michelle Hill
Cancer Proteomics Group

- Cellular mechanisms for caveolin-1 mediated prostate cancer progression.

Associate Professor Brian Gabrielli
Cell Cycle Group

- Cell cycle control of entry into mitosis in normal and disease conditions; target for anti-cancer therapies.

Dr Graham Leggatt
Cancer Immunotherapy Group

- Trafficking of T cells to hyperplastic epithelium
- T cell function in normal and cancerous skin tissue

Dr Brendan O'Sullivan
Dendritic Cell Group

- Targeting inflammatory DC and immune responses to treat type 2 diabetes.

Dr Fiona Simpson
Epithelial Cancer Cluster

- Imaging oncogenic molecules in live human tumours
- Investigating patient resistance to anti-EGFR monoclonal antibody therapies in Head and Neck and Skin squamous cell carcinoma.
- Localisation dependant signaling of receptor tyrosine kinases.

Dr Gethin Thomas
Autoimmunity Division

- Defining the factors contributing to the progression from inflammation to uncontrolled bone formation in ankylosing spondylitis.
- Transcriptional and genetic profiling of ankylosing spondylitis

Dr Tony Kenna
Autoimmunity Division

- Contribution of the immune system to the autoimmune arthritis, ankylosing spondylitis

Dr Anne Sophie Bergot
Epithelial Cancer Division

- Evaluation of the role of regulatory cells - mast cells, Treg cells and iNKT cells - in the regulation of immune responses to HPV-infected skin in mice

Dr Paul Leo
Bioinformatics Group

- Development interactive methods for discovering disease causing genes using Next-Gen sequencing data.
- Discovery of rare genetic variants that contribute to common diseases using Next-Gen sequencing data.

Available Honours Projects 2012

Centre for Integrated Preclinical Drug Development—www.tetraq.com.au

Professor Maree Smith, Dr. Bruce Wyse, Dr. Sussan Ghassabian, Dr. Ai-Leen Lam
Centre for Integrated Preclinical Drug Development (CIPDD)

Research projects conducted at CIPDD include research in methodology innovation and mechanism of action in the area of drug development, and as such utilises a wide array of both in vivo and in vitro techniques such as HPLC (High Performance Liquid chromatography), and LC-MS/MS (Liquid chromatography- mass spectrometry), cell culture, cAMP assays, BRET (Bioluminescence resonance energy transfer) technique, real-time PCR and whole body imaging.

- Determining methodological specificity in lentiviral particle detection
- Characterisation of Novel Opioid Receptor Ligands
- Molecular mechanism and regulation of opioid receptor signalling
- Development of bioanalytical methods using LC-MS/MS instrumentations to measure the concentration of the drugs or novel compounds in biological specimens for application in *in vivo* pharmacokinetics of the compounds of interest, and/or the associated drug metabolism pathways