COVER ILLUSTRATION  Confocal images of intracellular Ca²⁺ of a single mouse pacemaker cell.

Upper image: Ca²⁺ sparks, which represent the individual Ca²⁺ release event from the sarcoplasmic reticulum Ca²⁺ release channels, were recorded using time scan.

Lower image: Transiently increased intracellular Ca²⁺ was captured from a spontaneously beating pacemaker cell loaded with Ca²⁺ indicator fluo-4 AM.

(These pictures were provided by Senior Researcher, Dr Yue-kun Ju.)
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65 Systems Neuroscience Laboratory, Atomu Sawatari
67 Laboratory of Vision and Cognition, Samuel G Solomon
71 Laboratory of Retinal and Cerebral Neurobiology, Jonathan Stone

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The Discipline of Physiology is part of the School of Medical Sciences. Other disciplines in the School are Anatomy & Histology, Pathology, Pharmacology and Biomedical Sciences. As well as a large cohort of research students undertaking honours projects and post-graduate research, Physiology has major responsibilities for coursework teaching in the Faculties of Science, Pharmacy, Dentistry and Medicine. The School has close links with the Brain and Mind Research Institute (BMRI). The Scientific Director of BMRI, Professor Maxwell Bennett, is also a Professor in the Discipline. The Deputy Vice-Chancellor International, Professor John Hearn is another Professor in Physiology. Researchers in Physiology have contributed to improved understanding and better care of a range of health problems relating to vision, hearing, cognition, Parkinson's disease, hypertension, heart function, muscle damage, skin and prostate cancer and ageing.

Staff Matters:
Effective from 1 Jan 2008, Drs Cathy Leamey and Dario Protti received a much deserved promotion to Senior Lecturer/Level C. From the beginning of 2008, Dr Margot Day replaced Professor Max Bennett as Post-graduate co-ordinator for Physiology. Dr Day is also the Honours sub-dean (co-ordinator) for Medicine and oversees the Physiology component of the Talented Student Program in the Faculty of Science. Margot has been ably assisted as post-graduate co-ordinator by deputies Dr Cathy Leamey and Dr Dario Protti, who, along with Dr Steve Assinder and Professor Roger Dampney have organized the important post-graduate student interviews each year. Professor Bennett’s contributions as post-graduate co-ordinator over many years are much appreciated. Dr Isabel Arniaz, who completed her PhD with Dr Day in 2006, joined the part-time and casual teaching staff in 2008.

On a sadder note, in late 2009, we held a farewell party for Dr Christine Koeppl, who had been a senior lecturer in auditory neuroscience. Dr Koeppl had settled in Australia, but received an offer too tempting to refuse from the German Government, to move her research back there. Although we tried, the resources on offer from Germany on a continuing basis were much greater than those available at this University and in Australia generally. Dr Koeppl accepted an honorary appointment with Physiology and has continued to supervise a Masters student to completion.

Despite the occasional departure, we have a number of very long-serving academics. In June 2009, Professor Max Bennett received a silver medal at a ceremony in the Great Hall in honour of 40 years service as an academic in this University, all spent as a staff member of Physiology. The citation read out on this occasion mentioned Professor Bennett’s over 300 scientific articles and 8 books, his MacFarlane Burnett Medal from the Australian Academy of Sciences, together with numerous international honours and his appointment in 2000 as an Officer of the Order of Australia (AO).

Research
Research inputs and outputs remains strong. Grant income to Physiology researchers was over $2.5 million dollars per year, mostly from the National Health and Medical Research Council (NHMRC) and the Australian Research Council (ARC). Competitive grants and commercial funding were also received from the USA and Europe. Researchers in Physiology published over 50 publications each year in 2008-09, with around half being in the top 5% of journals worldwide (impact factor >3.5).

Our academics continue to receive invitations to speak at national and international conferences. Many of our academics and research students received significant recognition in 2008 and 2009. Dr Samuel Solomon was awarded a prestigious RD Wright Career Development Award by the NHMRC. Both Dr Solomon and Professor Jonathan Stone, who returned to Physiology from the Australian National University in late 2007, joined the Sydney node of the ARC Centre of Excellence in Vision Science. The funding for this Centre of Excellence was renewed in 2009 for the period 2010-13. Also renewed in 2009 was the NHMRC Program grant on “Molecular mechanisms of cardiac function and disease” with Professor David Allen as a one of the chief investigators. Professor Max Bennett, was appointed as a Distinguished Senior Adviser to the Templeton Foundation and an Honorary Fellow of the Australian Neuroscience Society. Professor Bennett also published a book entitled “History of Cognitive Neuroscience” with Dr Peter Hacker from Oxford University. This was launched by the Vice-Chancellor, Dr Michael Spence. Dr Cathy Leamey won the 2008 Sir Zelman Cowen Universities Fund Prize in medical research for her discovery of the protein Ten-m3 and its role in vision. At the 14th International Workshop on Vitamin D, in Brugges, Belgium, Professor Rebecca Mason was presented with an award for “Career contributions to Vitamin D research”. 
At the same conference, Dr Katie Dixon, who completed her PhD with Rebecca Mason, received a Young Investigator award for her work on photoprotection by vitamin D and analogs. The year earlier, in May 2008, Katie was bestowed the Premier’s Award for Outstanding Cancer Research Scholar for these studies. In 2009, Katie also won an NHMRC Biomedical Fellowship, following in the footsteps of Dr Helena Mangs, from Professor Brian Morris’ group, who won an NHMRC Biomedical Fellowship for the period 2008-11. In 2008, Dr Aaron Camp, working with Dr Sam Solomon was awarded a Cass Foundation Travel Fellowship. Vanessa Sequeira, who was a PhD candidate in Rebecca Mason’s group, won the Kumar Young Investigator award from the Molecular and Experimental Pathology Society of Australasia in 2008. Nuwan Dharmaratne, an Honours student with Dr Leamey won the Australian Neuroscience Society Student Poster Prize in 2008, while this prize was awarded in 2009 to a PhD student of Dr Atomu Sawatari, Hyunchul Lee. Our senior colleagues were also recognized. Honorary Associate Professor Arthur Everitt received a Distinguished Achievement Award from the American Aging Association in 2008 and in that year was also inducted into the Hall of Great Names by the International Association of Gerontology and Geriatrics. Emeritus Professor Liam Burke had the distinction of having the oldest paper, from 1954, cited in 2008-09.

Professor David Cook was instrumental in obtaining Federal Government funding for a new Centre for Obesity, Diabetes and Cardiovascular Disease, to be built on campus. This will be a very large building, housing state-of-the-art equipment and facilities, wet and dry laboratories and new teaching space. The Centre will facilitate cross-disciplinary studies in these areas of human health that are becoming an increasing problem in our society. The early planning stages which commenced in earnest in 2009, have involved a great deal of input from most of the Physiology academics, particularly Professor Cook, as a leader of the process and Dr Haydn Allbutt who collated essential information to help the planning work.

Associate Professor Simon Carlile, in conjunction with a spin-off company, Vast Audio, concluded an agreement with the world’s largest manufacturer of in-the-ear hearing aids to test in phase III trials, the spatial hearing aid developed originally in his Laboratory. The new hearing aid is expected to significantly improve the communications capability of hearing-impaired people in the work-place and in social situations.

**Teaching**

Undergraduate student numbers continue to increase, with overall around 50 more students enrolled across all our units of study in 2008 compared with 2007, excluding students enrolled in Medicine or Dentistry. The increases were fairly evenly spread across all units. During this period, the Physiology for Pharmacy unit of study, coordinated by Dr Bronwyn McAllan, again became a stand-alone unit of study, rather than being combined with Pharmacology.

Dr Meloni Muir and Dr Miriam Frommer were awarded a large Teaching Improvement and Equipment Scheme Grant in 2009 for a project “Feedback in the Sciences: what is wanted, what is given and how can it be improved?” Co-investigators included Dr Fiona White (Psychology), Dr Vanessa Gysbers (Molecular Biology and Genetics) and two staff from the Learning Centre. The project aims to improve teaching quality and student learning by identifying the kinds of feedback on writing, which science students perceive as contributing to their overall learning and developing an online handbook of best practice for markers. The aim is then to integrate this information with current research to develop guidelines and models for an online staff handbook illustrating best practice for giving feedback in the sciences. An online tutorial, developed by Meloni and Miriam, was the prototype for an Australian Learning and Teaching Centre funded project titled “Writing Reports in Science and Engineering”, which was launched across Australian Universities in 2008-09. Pedagogical research, some formal, some informal, is developing to a high standard and engages more academics in Physiology.

Particular thanks are due to Dr Bill Phillips as head of the School Teaching Committee, ably assisted by deputy chair, Dr Meloni Muir. Especial thanks are due to our unit of study coordinators, Dr Meloni Muir (Intermediate Physiology), Drs Atomu Sawatari and Sam Solomon (Advanced Intermediate Physiology), Dr Bronwyn McAllan (Pharmacy), Drs Miriam Frommer and Michael Morris (Intermediate Medical Science), Dr Bill Phillips (Human Cellular Physiology), Dr Steve Assinder (Cardiovascular Function and Dysfunction), Drs Dario Protti and Cathy Leamey (Neurosciences), Dr Haydn Allbutt, who coordinates our practical classes and to Professor David Allen who runs the Honours program.
Service
Our academics serve on large numbers of committees and not-for-profit Boards of the University as well as National and International organizations. They organize a large number of conferences, serve on journal editorial boards, on grant review panels for the NHMRC, ARC and others, and review many journal articles, grant applications and scholarly theses each year. These are detailed in subsequent pages of the report, but some brief highlights follow. Professor David Cook served as Associate Dean Finance for the Faculty of Medicine during this period, a very large task to try to rationalize the finances of a large and complex faculty. He was also a member of the Faculty and University Research Committees, and served in a variety of leadership roles on Ethics Committees for the University and the Health Service. Professor Max Bennett in his role as Director of the Brain and Mind Research Institute, raised funds for and presided over the opening of the Youth Mental Health Building of the Institute in 2009, as well as the Ken Parker Research Laboratory and the Mass Spectrometer Facility. Professor Roger Dampney, a long-standing Board member of the Prince of Wales Medical Research Institute was made an Honorary Life Governor in 2008. Roger is also a Board member of the National Heart Foundation (NSW). Professor David Allen is a Board member and Chairs the Scientific Advisory Committee of the Heart Research Institute. He was a member of the National Committee of the International Society for Heart Research and is a member of the National Committee for Medical Sciences of the Australian Academy of Science. Professor Rebecca Mason moved from President-Elect of the Australian and New Zealand Bone and Mineral Society in 2008 to President of the Society in 2009 and is a Board member of Osteoporosis Australia. Professor Brian Morris continues to be much sought by the media for his expertise on cervical screening, circumcision and the genetics of hypertension. He continues as a member of the Executive Committee of the High Blood Pressure Research Council of Australia as Treasurer. In early 2008, Professor John Stone became convener of the Anderson Stuart Heritage Committee, a position he had held earlier while at the University of Sydney. Dr Haydn Allbutt continued his role as the co-ordinator of Occupational Health and Safety for Physiology, while Dr Bronwyn McAllan served on the Faculty (OHS) committee from 2006-08. Our staff contribute many hours to regulatory committees for the University, Drs Bronwyn McAllan and Dario Protti are members of the Animal Ethics Committee; Dr Stephen Assinder is a member of the Human Research Ethics Committee, while Professor David Cook has been Chair and Deputy Chair of this committee, as well as contributing to Ethics committees for Royal Prince Alfred Hospital (Sydney South West Area Health Service) and NSW Health. Dr Bill Phillips continued as a longstanding member of the University Biosafety Committee.

Function in honour of the late Professor F.S. Cotton
A function was held in the Common Room of the Anderson Stuart Building on 19 March, 2009, in honour of the late Professor F.S. Cotton, Professor of Physiology at the University of Sydney from 1946 until his retirement in 1955. This function was coordinated by Professor Roger Dampney and attended by the Chancellor, Professor Marie Bashir AC CVO, who unveiled a plaque to commemorate the work of Professor Cotton. The plaque is placed outside the room in the Anderson Stuart building where Professor Cotton did much of his research. In this room, which is now called the Cotton Laboratory, Professor Cotton constructed a human centrifuge which he used for his very important work in developing an anti-gravity suit to protect pilots from blackout during high speed manoeuvres during combat in World War II. After the war, Professor Cotton did pioneering work in the field of sports physiology, leading to the development of new training methods that contributed greatly to the success of Australian athletes during the 1950s and 1960s.

The unveiling ceremony was preceded by a seminar during which three speakers, Dr Wilfred Brooks, Mr Forbes Carlile, and Emeritus Professor Paul Korner spoke about Professor Cotton’s scientific achievements and contributions to the war effort. A display summarizing Professor Cotton’s work has also been installed in the Cotton Laboratory.
Acknowledgements

All of our activities would not be possible without the dedicated support of our general staff. Our computers and computing networks are essential for our work. These are bought, upgraded and maintained by IT staff, Li Jin and Peter Ceiley under the highly energetic leadership of John Dodson, who also does his best to see that building changes are sensible and realistic and cause minimal disruption to activities. The manager of the Discipline of Physiology, Lali Jacob, does a remarkable job facilitating our interactions with the University administration. Lali is ably assisted by Louise Harrison our very capable student liaison officer, Silvana Hourcade (new in 2008) in finance, David Lawrey and Cindy Guy. Adel Mitry, a veterinarian by training, has performed very well indeed in his role in charge of our classrooms, practical classes and general infrastructure with the general oversight of Dr Hayden Allbutt. Adel was ably assisted by Clare Winnick until 2009, when Claire left for overseas. Hala Bishay, who replaced Clare has also been a very successful appointment. Vincent Cheung, runs the Electronics Workshop, assists in keeping old, but vital equipment functioning and builds ever more esoteric devices dreamed up for experiments. Our academics and students benefit greatly from membership of the Bosch Institute, whose Director was Nick Hunt in 2008 and Rebecca Mason (acting) in 2009. The Bosch Institute provides access to excellent Molecular Biology, Advanced Imaging and Flow Cytometry facilities, with training workshops and individual project assistance in these areas, as well as Career Development training. The success of the model of semi-autonomous Disciplines like Physiology within a School structure is very much due to the wise counsel and strong support of our Associate Dean, Professor Chris Murphy.

Rebecca S Mason

With thanks to Roger Dampney for the report on the function held in honour of Frank Cotton.

Professor Frank Cotton, 1952
## PHYSIOLOGY STAFF LIST

(as of early 2010)

### Professors
- Maxwell Richard Bennett, AO BE MSc PhD Melb DSc FAA. Appointed 1983
- David Grant Allen, BSc MB BS PhD Lond, FAA. Appointed 1989
- Roger Alan Loftus Dampney, PhD DSc. Appointed 1997
- David Ian Cook, BSc(Med) MD BS MSc, FRACP FAA. University of Sydney Medical Foundation Fellow. Appointed 1998
- Brian James Morris, BSc PhD Adel. DSc, FAHA. Appointed 1999
- John Hearn, MSc PhD Dublin ANU. Appointed 2004
- Rebecca S Mason, MB BS PhD. Appointed 2007
- Jonathan Stone, BSc(Med) PhD DSc FAA. Appointed 2007

### Associate Professor
- Simon Carlile, BSc PhD
- William D Phillips, BSc PhD

### Senior Lecturers
- Margot Day, BSc PhD
- Miriam Frommer, BSc PhD Lond
- Catherine Learney, BSc PhD
- Dario Protti, PhD BAires
- Michael Morris, PhD (Sesqui Senior Lecturer)
- Sam Solomon, BBiotech Filn PhD (Sesquicentenary Lecturer)

### Lecturers
- Haydn Allbutt, BSc Melb PhD
- Isabel Arnaiz, PhD (Casual)
- Stephen Assinder, BSc East Anglia MSc Bristol PhD Bristol
- Sharon Herkes, PhD (Casual)
- Bronwyn McAllan, BSc Macq MSc Adel PhD UNE
- Meloni Muir, BSc Purdue PhD McG
- Atomu Sawatari, PhD UCSD

### Research Fellows
- David Alais, PhD QEII Fellow
- Anuwat Dinudom, BSc Prince of Songkla MS Mahidol PhD NHMRC Senior Research Fellow
- Clare Gordon-Thompson, PhD Natal (South Africa)
- Mark Rybchyn, BSc(Adv) PhD

### Associate Research Fellows
- Craig Jin, BSc Stanford MS Caltech PhD
- Andre van Schaik, MSEE Twente (Netherlands) PhD Lausanne (Switzerland)
- Richard Sheppard, BSc PhD

### Postdoctoral Research Fellows
- Virginia Best, PhD
- Aaron Camp, PhD Newcastle
- Vadim Dedov, PhD
- Il Ha Lee, PhD Seoul
- Yan Li, PhD
- Michael Lovelace, PhD
- Guo Jun Liu, MD Changchun China PhD Gifu
- Andrea Markus, BSc PhD Mainz (Germany)
- Stefano Di Marco, PhD
- Marco Morsch, PhD
- Sander Pietersen, PhD
- Patricia Ruma-Haynes, PhD

### Senior Research Officers
- Yi Chu, MD Shanghai PhD UWA
- Othon Gervasio, DDS PhD UFMB Belo Horizonte, Brazil
- Jouj Horiuchi, BSc PhD Yamanashi
- Yue-Kun Ju, MD Xian PhD ANU
- Permsak Komwatana, BSc Chulalongkhon MS Virginia PhD Virginia
- Nicholas Whitehead, BSc PhD

### Research Officers
- Nereda Christian
- Nazanin Ghazanfari
- Kamon Iigaya, PhD
- Heather Kelly
- Lorraine Kerr
- Johann Leung
- Lachlan McDowall, BSc PhD
- Lilian Morris, DipBiolSc STC DiplIntDes KvB Coll Vis Comm DiplLib Tech TAFE Syd
- Sivaraman Purushothuman, BSc
- Nagarajah Rajini
- Sharon Spana
- Sally Stowe, PhD
- Selina Solomon
- Claire Winnick, BSc Macq

### Programmer
- Peter Farleigh

### Class Laboratory Staff
- Adel Mitry, BVSc Cairo ACC STC
- Hala Bishayz
Electronics Workshop Staff
Vincent HW Cheung, HND HK Polytechnic CEI Part 2 UK

Computing Staff
Peter Celay, BCompSc
John WA Dodson, HNC Lond MIET I Eng
Li Jin, MInfTech

Department Manager
Lali Jacob, BAEcon MBA

Administrative Officers
Lucinda Guy, GradCertBusMan Deakin
Louise Harrison, BT CSU BED UNSW
Silvana Hourcade
David Lawrey, BVA

Honorary Professors
William (Liam) Burke, BSc PhD Lond
John Hearn, MSc UCD PhD ANU
Paul Korner, AO BSc PhD FAA
Paul Pilowsky, MBMedSc MB BS PhD Flin NHMRC
Anne Sefton, AO BSc(Med) MB BS PhD DSc

Honorary Associate Professors
David F Davey, BSc MSCMed PhD McGill
Arthur V Everitt, BSc PhD
Ann Goodchild, BSc PhD
Joseph FY Hoh, BSc(Med) MB BS PhD ANU DSc

Honorary Senior Lecturer
Annick Ansselin, BA Macq MSc PhD

Honorary Associates
Vlado Buljan, PhD Sarajevo
John F Cossey, BTC STC
Teri Furlong
Suzanne Jennings, BMedSc
Ruby CY Lin, MSc Otago PhD
Geoffrey Manley, PhD
Richard Shephard, PhD
Michael Slater, PhD
Helen JL Speirs, BSc Glas PhD Edin
Andre Van Schaik, PhD
William Wang, MM BS
Peter Wenderoth, PhD

PhD Candidates in 2009
Melissa Barron, BSc
Michael Bourke
Craig Campbell, BSc Gld
Richard Chi
Sze Yan Chung
Francine Zanchetta Coelho Marques, MSc Brazil
Rebecca Cole, BSc Victoria (Wellington, NZ)
Joel Cooper, BSc
Natasha Deters
Kirsty Gardner-Berry, BSc
Rachel Genteles
Kelly Glendining, MSc Otago (NZ)
Yazi Ke
Hyunchul Lee, BSc
Yun-An Lim
Jorge Mejia, BSc
Sam Merlin, BSc Melb
Terence Middleton
Trent Reardon, BSc
Vanessa Sequeira, BMedSc
Sung Song
Nicole Tom
Craig VonHoff, BSc
Timothy Young, BMedSc

MPhil Candidates 2009
Norman Chan, MB BS
Andrew Affleck
Allison Cameron
Roy Hui
Hayssam Sleitini

Honours Candidates 2009
Thomas Burton
Kenneth Cheung
Nathan Coorey
Sarah Dalati
Mohammad Ghalayini
Shail Joseph
Gaven Lin
Evelyn Linardy
John Mitry
Sandy Najem
Alexander Nguyen
Ju Park
Svetlana Poliakov
Dahlia Saroufim
Corey Ta
Victor Tiong
Heidi Tran
Rajiv Wijesinghe
Amanda Young
Alex Chen
Professors >

Maxwell Bennett  David Allen  Roger Dampney  David Cook  Brian Morris

John Hearn  Rebecca S Mason  Jonathan Stone  Simon Carlile

Associate Professor

Senior Lecturers >

Margot Day  Miriam Frommer  Catherinne Learney  William Phillips  Dario Protti

Lecturers >

Michael Morris  Sam Solomon  Haydn Allbutt  Isabel Arnaiz  Stephen Assinder

Sharon Herkes  Bronwyn McAllan  Meloni Muir  Atomu Sawatari
PhD Candidates in 2009:

- Kelly Glendining
- Hyunchul Lee
- Jorge Mejia
- Sam Merlin
- Terence Middleton
- Trent Reardon
- Vanessa Sequeira
- Nicole Tom
- Craig Vonhoff
- Timothy Young
- William Burke
- Paul Pilowsky
- Anne Sefton
- David Davey
- Arthur Everitt
- Suzanne Jennings
- Ruby Lin
- Michael Slater
- Helen Spears
Research Activities

The inaugural year of operation for this Lab was 2008 in which we began our first series of experiments examining possible mechanisms that may be involved in the initiation of the pathologies underlying Parkinson’s disease. Based on evidence from the literature our working hypothesis was that these pathologies are caused by a disruption or loss of astrocyte function. In order to examine whether or not this might be the case we had to develop a new animal model of Parkinson’s disease that would let us examine these very early changes. Thus in 2008 we developed a potential model of early stage Parkinson’s disease whereby Lα-aminoadipate (Lα-AA), a toxin specific for astrocytes, is infused unilaterally into the substantia nigra via an indwelling stainless steel cannula connected to a subcutaneous osmotic infusion pump. This allows us to clear the astrocytes away from a discreet area of the brain, in our case the substantia nigra, and thereby examine what happens to the cells in that area when the support of astrocytes is removed. We found that seven days following the removal of astrocytes there was no change in the number of dopaminergic neurons in the substantia nigra, but the cells appeared more lightly stained than the contra lateral side. By 28 days following injection, there was a significant decrease in the number of dopaminergic cells in the astrocyte lesion group. This appeared to suggest that after removing astrocytes any cellular changes that occur may take time develop.

The toxin, we found, was very difficult to dissolve and thus the concentration we suspect was very low. If we are able to overcome this problem in the future we may see even more pronounced results.

In addition to looking at the effect of astrocyte loss we also developed a test of smell for use in rats. The sense of smell has been reported as one of the earliest symptoms of Parkinson’s disease as there appear to be far fewer compensating mechanisms for the sense of smell than there are for motor disturbances. As it is our aim to examine the very earliest stages of Parkinson’s disease we needed sensitive behavioural measures that could be used to explore these first pathologies as they develop. The test consisted of hiding a food reward (peanut butter) in a chamber below the floor of the apparatus. There are a series of holes drilled into the floor that the rats can explore by poking their head through the holes. The test is performed in darkness to remove visual cues and filmed using an infra red camera. The time taken for the rats to locate the reward is recorded. Rats that have lost the dopaminergic neurons from one side of the substantia nigra appear to take longer to locate the reward.

In 2009 we extended these studies by increasing the survival time following astrocyte lesion to 56 days. In addition to examining the number of dopaminergic neurons we also looked at cytochrome oxidase histochemistry, a marker for metabolic function. We found that there was a significant decrease in metabolic activity following astrocyte lesion compared with control by 56 days following lesion. Unexpectedly there was no significant change in the number of dopaminergic neurons. We continued to have problems dissolving the LαAA and so suspect that the reduced effect of the toxin in these animals was due to the low concentration of the toxin used.

These results and the technical issues we have faced will be addressed as we continue to develop the model into the future.
Journal Articles
2008


2009


Total Annual Citations

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* ‘Lifetime’ = To end of 2009.

Conference Abstracts and Presentations

(O, oral)

2009


2009

Karim S. The development of novel olfactory tests to examine early olfactory changes in a rat model of Parkinson’s disease. 1st Class

Tiong V. Could gliopathy be the ammunition for triggering Parkinson’s Disease. 1st Class

BSc(Hons) Awarded

2008

Chen R. A new animal model for Parkinson’s disease via astrocytic ablation in the substantia nigra. 1st Class

Service to the University

School of Medical Sciences

Member Heritage Committee

Member Teaching and Learning Committee

Grant Funding

<table>
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<th>Description</th>
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<tr>
<td>Ties Teaching Equipment Grant</td>
<td>Improvements in the quality of teaching in the practical component of Physiology Units of Study to students from the Faculty of Science</td>
<td>Allbutt HN</td>
<td>2008</td>
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<td>NHMRC Equipment Grant</td>
<td>Application for the purchase of a stereology setup</td>
<td>Chan-Ling T Allbutt HN</td>
<td>2008</td>
<td>$17,386</td>
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<td>Clive &amp; Vera Ramaciotti Foundation establishment grant</td>
<td>Searching for a cause: Is the loss of astrocytes the initiating trigger for Parkinson’s disease?</td>
<td>Allbutt HN</td>
<td>2008</td>
<td>$29,980</td>
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<td>Rebecca Cooper Foundation Grant</td>
<td>Investigation into the cause of Parkinson’s disease</td>
<td>Allbutt HN</td>
<td>2009</td>
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Research Activities

The main focus of this Laboratory is studies of normal and diseased function in skeletal and cardiac muscle. Dr Ju continued her studies of pacemaker function and is currently focussing on the role of IP$_3$ and its receptors in the mouse sinoatrial node. She has established that the IP$_3$ system operates in the pacemaker cells and may be involved in triggering store-operated calcium currents which act as an additional pacemaker current. Dr Whitehead studied the role of reactive oxygen species in Duchenne muscular dystrophy and has shown that addition of the antioxidant N-acetyl cysteine to the diet of mdx mice reduces many features of this disease. Dr Gervasio completed a major study of the relationship between the gene product TRPC1 and a structural protein caveolin-3. This work has led to a major change in our thinking about Duchenne muscular dystrophy in which channels and proteins in the caveolae appear to function abnormally in the disease. Trent Reardon completed his PhD in 2009 and published the main results, which showed that extracellular iron can cause oxidation products in muscle that accelerate muscle fatigue. We believe that changed skeletal muscle function may be an important and unrecognized feature of haemochromatosis, in which iron metabolism in humans is abnormal. Dr Zhang completed a 6 month visit from Hong Kong in which she extended her work on stretch-induced muscle damage by showing that blockers of the stretch-activated channels could prevent some features of stretch-induced muscle damage.

Journal Articles

2008


2009
Reardon TF, Allen DG Time to fatigue is increased in mouse muscle at 37°C: the role of iron and reactive oxygen species. *J Physiol* 2009; 587: 4705-4716.

**Total Annual Citations**

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* ‘Lifetime’ = To end of 2009.

**Chapters in Books**

2008

2009

**Editorials**

2009
Murphy E, Allen DG. Why did the NHE inhibitor clinical trials fail?. *J Mol Cell Cardiol* 2009; 46: 137-141.

**Magazine & Newsletter Articles**

2008

**Official for Scientific Societies, including for National and International Conferences**

2008
Organiser and Chair, *ROS and Cardiac Function*, Australian Physiological Society, Melbourne, Nov 2008.

2009

**Conferences and Symposia Organized**

Cardiac Society of Australian and New Zealand/International Society for Heart Research, Joint planning committee, for Sydney 2009.

**Invited Presentations at National and International Conferences**

2008
2009

PhDs Awarded
2009
Reardon TF. Skeletal muscle fatigue and function in-vitro and in-vivo; the role of iron and reactive oxygen species.

BMedSc(Hons) Awarded
2008
Lee B. IP$_3$ receptors and store operated Ca$^{2+}$ channels. 1st class.
2009
Young A. The role of calcium dysregulation in a mouse model of hypertrophic cardiomyopathy. 1st class

Scholarships and Fellowships Awarded
2009
APA – M Stefani

Manuscripts Refereed for Journals
David G Allen (67)

2008 (27)

2009 (40)

Grant & Award Applications Assessed
2008
NHMRC (4)
ARC (2)
Zurich Research Commission (Switzerland) (1)
Health Research Council (NZ) (1)
Neurological Foundation (NZ) (1)
National Institutes of Health (USA) (1)
2009
NHMRC (5)
NHMRC Fellowships (3)
Association Français contra Myopathy (France) (1)
Cure Myopathy (UK) (1)
High Blood Pressure Research Foundation of Australia Fellowship (1)
National Science and Engineering Research Council (Canada) (1)

Membership of Editorial Boards of Journals
Heart Lung and Circulation (2004–)
Journal of Molecular and Cellular Cardiology (2007–)

Services to the University
Faculty of Medicine Committees
Member, Research Committee, 2003–
Member, Rolf Edgar Lake Fellowship Selection Committee, 2008

Bosch Institute
Member, Executive Leadership Group, 2006–
Neuroscience Theme Leader, 2006–

Services to Professional Societies, etc
2008
Member, National Committee for Medical Sciences of the Australian Academy of Science, 2006–
Board Member, Heart Research Institute, 2002–
Chair, Scientific Advisory Committee, Heart Research Institute, 2003–
Member, National Committee, International Society for Heart Research, 2006–

2009
Member, National Committee for Medical Sciences of the Australian Academy of Science, 2006–
Board Member, Heart Research Institute, 2002–
Chair, Scientific Advisory Committee, Heart Research Institute, 2003–
Member, National Committee, International Society for Heart Research, 2006–

Grant Funding

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<th>Organization</th>
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<th>Principal Investigators</th>
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<tr>
<td>NHMRC</td>
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<td>Graham RM, Allen DG, Fatkin D, Harvey R, Fenelly M</td>
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<td>Medical Foundation</td>
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ANDROLOGY RESEARCH GROUP

STEPHEN J ASSINDER

Laboratory Personnel 2008–2009

<table>
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<tr>
<th>Name</th>
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<td>Stephen J Assinder</td>
<td>Lecturer</td>
<td>University</td>
<td>2006-</td>
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Total effective full time personnel 2008: 1.0 2009: 1.0

Research Activities

The Andrology Research Group was established in late 2006 following Dr Assinder’s appointment to the Discipline of Physiology and relocation from the University of Otago, Dunedin, New Zealand. During the reporting period the group has continued work establishing the role of the cytoskeletal protein transgelin in prostate cancer development. It has confirmed in silico analysis of expression libraries that predicted a decrease in expression to occur early in development of prostate cancer in cell models. Furthermore, study of prostate biopsies from patients suffering from this disease has demonstrated that expression of transgelin is lost in 90% of prostate cancer cases. Work is continuing to demonstrate the significance of this loss in cancer development, and to establish the power of this event as a diagnostic marker of prostate cancer. During this work we demonstrated a similar decrease in expression of the actin-associated tropomyosins to occur with prostate cancer progression. In addition a novel splice variant of the TPM2 gene was discovered to be present in prostate cancer cell lines.

The Andrology Research group was a founding member of the Bosch Prostate Cancer Research Group. This extremely valuable venture has initiated a collaborative research programme that combines the research interests of the member groups. The focus of this collaboration is the integration of the biochemical pathways of PI3K/AKT, PTEN and TGF-beta.

Journal Articles

2008

2009

Total Annual Citations

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* ‘Lifetime’ = To end of 2009.

Chapters in Books

2008
2009

Patents

Conferences and Symposia Organized
Member, Scientific organising committee
Bosch Institute Annual Scientific Meeting 2008 and 2009.

BSc(Hons) Awarded
2008
Smith P. The expression of transgelin by transforming growth factor beta in normal prostate epithelial cells and DU145s. Class 2.1
Au E. The role of tropomyosin in TGF beta regulation on the actin cytoskeleton in prostate epithelial cells. 1st Class

Scholarships and Fellowships Awarded
2009
APA Tom N.

Manuscripts Refereed for Journals (12)
2008 (6)
J Endocrinol (1), Planta Medica (1), Biol Reprod (1), Reproduction (1), Int J Androl (2)
2009 (6)
Planta Medica (4), Oncogene (1), Anat Rec (1)

Grant & Award Applications Assessed
2008
Prostate Cancer Charity (UK)
2009
NHMRC
ARC (UK)
Prostate Cancer Charity (UK)

Higher Degree Theses Examined
2008
PhD, Univ of Otago, NZ (1)
PhD, Univ of Sydney (1)

Service to the University
University Committees
Member, Human Research Ethics Committee (2008–)
<table>
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<td><strong>Prostate Cancer Foundation Australia Equipment Grant</strong></td>
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<td>LightCycler 480 Real-Time PCR System for Multi-Disciplinary Prostate Cancer Research in the Bosch Institute.</td>
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Research Activities

This Laboratory is concerned with the plasticity of synapses and in particular of synaptic spines in psychiatric diseases such as clinical depression. Several of our recent reports have been concerned with theoretical models of how malfunctioning synapses could give rise to the diseases, and in particular the role of glial cells in such inappropriately functioning synapses. Experimental research has therefore concentrated on the role of astrocytes and microglia processes in changing the function of synapses. We have established quantitative models of calcium wave propagation amongst both astrocytes and microglia, showing how ATP acts as a principal transmitter between these cells. In addition, we have shown how the principal excitatory transmitter between neurons, glutamate, acts to guide microglia by chemotaxis up concentration gradients of the transmitter. Putative antagonists for receptors on microglia acted on by ATP have been identified.

Journal Articles

2008

2009


Bennett MR. Positive and negative symptoms in schizophrenia: the NMDA receptor hypofunction hypothesis, neuregulin/ErbB4 and synapse regression. *Aust NZ J Psychiat* 2009; 43: 711-21

**Total Annual Citations**

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**Books**

2008


**Invited Presentations at National and International Conferences**

2008

Plenary Lecture, *World Congress in Medical Informatics*, Brisbane
Plenary Lecture, *World Congress of Mental Health Nurses*, Sydney
2009

Jubilee Lecture, *Indian Academy Science*, Bangalore
Grass Lecture, *National Institute of Neuroscience and Mental Health*, Bangalore

**Awards, Prizes and Other Recognition**

2009

Distinguished Senior Advisor, Templeton Foundation
Honorary Fellow, Australian Neuroscience Society

**PhDs Awarded**

2009

E Werry. Identification of novel ATP and interleukin-10 sources in the spinal cord.

**BSc(Hons) Awarded**

2008

E Matar. Modulation of astrocyte function by glucocorticoids: a model for stress-induced synaptic changes in the CNS. 1st Class and University Medal.

**Membership of Editorial Boards of Journals**

*Progress in Neurobiology* (1995–)
*Purinergic Mechanisms* (2004–)
*Autonomic Neuroscience* (1994–)
Service to the University
2009
Opening of the Youth Mental Health building in the Brain and Mind Research Institute by the Chancellor and Vice-Chancellor for which Prof Hickie and Prof Bennett obtained from the Hon Morris Iemma, when he was Premier, $16 million.
Opening of the Ken Parker Research Laboratory in the Brain and Mind Research Institute by the Hon John Howard AC, Kerry Stokes AC and the Vice-Chancellor for which Prof Bennett obtained $6 million in Federal Government funding from the Hon John Howard when he was Prime Minister.
Opening of the Mass Spectrometer facility in the Brain and Mind Research Institute for which Prof Bennett obtained $400,000 from philanthropy.

Service to Professional Societies, Grant-Giving Bodies or Other External Committees
2009
Australian Judges Conference

2008
Judicial Commission of Australia

Grant Funding

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<tr>
<th>Program</th>
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<th>Year 3</th>
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<td>NSW Health Spinal Cord Injury Program</td>
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<td>Bennett MR</td>
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Research Activities

Most of the time during the years 2008 and 2009 have been occupied with the analysis of acuity measurements made on the left eye of William Burke in an attempt to determine whether they reveal any evidence of an influence of the Sun or Moon on visual acuity. This eye has had a long-lasting macular oedema which has reduced acuity considerably in the foveal region. A time-series (harmonic) analysis of the data revealed several statistically significant rhythms, notably rhythms with periods of about 30 days and 27 days. These periods resemble those associated with the synodic lunar rhythm (time from one full moon to the next; 29.53 days), and the sidereal lunar rhythm (time for the Moon to orbit the Earth; 27.3 days). Analysis of acuity data from a normal eye (Dave Davey, right eye) showed no rhythms. Also, analysis of data from the parafovea (a few degrees from central fovea where the oedema is much thinner) of WB’s left eye showed no rhythms. Thus, the presence and extent of the oedema is a critical factor. Further analysis showed a significant correlation between the luminance of the Moon and the acuity of the foveal region of WB’s left eye. Acuity was highest at the full moon and lowest at the new moon. By analogy with the influence of the Moon on the reproductive system we suggest that the Moon exerts an effect on the permeability of the blood-retinal barrier, probably through the endocrine system.

On the other hand we could find no correlation between the acuity and the sidereal lunar system, even though the rhythms were similar. The fact that the Sun rotates with a period of about 27 days encouraged us to investigate a solar link. It turned out that there was a correlation between acuity and the number of sunspots on any given day. The effect of the sunspots is inhibitory. The higher the density of sunspots the lower the acuity. This effect could be due to the high amount of ultraviolet light associated with sunspots because UV light is well known to cause oedema.

Total Annual Citations

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H-index = 37

Date of publication of oldest paper still cited in 2008/2009 = 1954
Research Activities
Research in the Laboratory over 2008–2009 focused on two main areas:

(1) the role of differences in the locations of competing talkers in enhancing speech segregation and

(2) the role of spatial attention in segregation and streaming of target talkers.

Differences in spatial location give rise to acoustic advantages in the ear closest to the signal. We have developed a listening paradigm using virtual auditory space, which enables us to control the “better ear” acoustic advantages and examine the effects of the perception of the differences in location.

Two studies were completed that have teased apart the relative contributions of binaural processing, the perception of externalization and the perception of differences in the spatial locations of the stimuli. Using virtual auditory space stimuli in the first study we demonstrated that only a small component of the spatial release from information unmasking can be attributed directly to binaural processing per se, with a second slightly larger component attributable to the perception of the external location of stimuli. By far the greatest component of spatial release from masking relates to the perception of the stimuli in different locations. This has important implications for the design of hearing aids and indicates the critical role of top-down, as opposed to bottom processes, in informational unmasking. These studies have also confirmed our previous predictions that while the high frequency components of speech contribute very little to the intelligibility of speech per se, they play a very important role in the perception of differences in location of competing talkers and contribute significantly to speech segregation.

In the second study we looked at the role of the perception of difference in distance between target and competing talkers in the near field (≤1 m distance) and showed that the exaggerated interaural level differences that occur in the near field can be exploited by the auditory system in unmasking. Two manuscripts describing these studies have been submitted to the *Journal of the Acoustical Society for publication*.

Work was completed looking at spatial unmasking of speech in the hearing impaired. This demonstrated a significant degradation of performance compared to normal hearing listeners. Most interestingly there were differences in the deficit for left-right spatial segregation compared to front-back segregation that could be related to the details of the audiological deficit. This work has led to 2 conference abstracts and an article in the *International Journal of Audiology*. Further work with hearing-impaired subjects was also completed. This involved comparing the effects of different hearing aid form factors on localization performance, namely, completely in-canal (CIC) aids which preserve some spectral cues to sound location, and more traditional behind the ear hearing (BTE) aids which only preserve interaural differences. Consistent with the reduction
in spectral cues, there were significantly more front-back localization confusions with the BTE device. Performance with the CIC device, while better than the BTE, was, however, still degraded significantly when compared to listeners hearing normally. One manuscript describing this work has been submitted for publication and we have begun a second study looking at the impact of wider frequency bandwidth and a 60 day period of auditory accommodation on localization accuracy and segregation of speech.

In a related study using normally hearing listeners we looked at the role of temporal fine structure in the localization of complex sounds. This work demonstrated that the phase relationships of spectral components in complex broadband sounds play an important role in accurate elevation localization. This was a surprising finding since elevation (cone-of-confusion) and front-back cues have in general been thought to have been related to the amplitude spectral profile. This work was published in the *Journal of the Acoustical Society*.

We also completed a study of the effects of spatial attention on speech intelligibility, demonstrating a spatial gradient of attention such that the effects of spatial masking were decreased as the masker was moved further from the target talker, but only over a relatively limited region of space around the target. This work has now been published. Work was also completed on two projects examining the role of target-masker uncertainty and its interaction with target-masker spatial location for a variable number of the maskers. In the former study it was demonstrated that *a priori* information about locations and number of maskers had a significant effect on the listener’s ability to solve the cocktail party problem. In the latter study, spatial attention was found to be critical for spatial release from masking and that listeners were able to modulate spatial attention to focus on target locations and to withdraw attentional resources from interferer locations. This provided the functional basis for the observations in the former study.

### Journal Articles

**2008**


**2009**


### Total Annual Citations

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* ‘Lifetime’ = To end of 2009.

### Commercial Activities

In 2003 a University of Sydney spin-off company VAST Audio Pty Ltd was created to commercialize patented technology emerging from ARC funded research in the Auditory Neuroscience Laboratory from 1996–2002. Biotech Innovation funding, Aus Industry Commercial Ready funding and Venture Capital investments were obtained over the next 3 years.
The period 2008–2009 saw the successful conclusion of the partnership agreement with the world’s largest manufacturer of in-the-ear hearing aids and the initiation of a phase III clinical trial slated to finish in late 2010. The successful commercialization of VAST Audio’s spatial hearing aid will provide breakthrough hearing and communications support to millions of Australians and hundreds of millions of hearing-impaired listeners internationally. This will significantly improve their communications capability in every-day work and social settings and result in a leap forward in productivity and quality of life.

Conference Abstract and Presentation
2008
(P, poster)
Carlile S, Blackman T, Cooper J. Learning new pinna cues for sound localisation inside and outside the Audio-Visual regions of space. 31st Midwinter Research Meeting, Association for Research in Otolaryngology, Phoenix AZ, USA, 2008.

PhDs Awarded
2008
Ruben Kurilowich. What drives the auditory motion after-effect?

BMedSc(Hons) Awarded
2009
Gavin Lin. 1st Class

Manuscripts Refereed for Journals

Grant & Award Applications Assessed
2008
ARC (3)

Higher Degree Theses Examined
2008
PhD, Deakin Univ
2009
PhD, Univ of Western Australia

Grant Funding

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<td>Acoustic, spatial and informational cues used to solve the cocktail party problem</td>
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Research Activities

In 2008–2009 the Laboratory continued its research into the regulatory mechanisms that control Na⁺ transport and Ca²⁺ signalling in epithelial cells. Our research team discovered that the membrane protein, caveolin-1, that is an important component of lipid rafts, is a negative regulator of the epithelial Na⁺ channel (ENaC). We found that caveolin-1 downregulates the abundance of ENaC at the cell surface membrane via a mechanism that involves the promotion of Nedd4-2-dependent internalisation of the channel.

The Laboratory also investigated the mechanisms underlying the inhibitory effect of purinergic activation on ENaC. We found that stimulation of P2Y₂ receptors at the basolateral membrane of epithelial cells inhibits activity of ENaC by a signalling mechanism that involves the β and γ subunits of a pertussis toxin-sensitive G-protein and phospholipase C(PLC) β4. A similar signalling mechanism is also partially responsible for inhibition of ENaC during activation of apical P2Y₂ receptors. Further, we identified that stimulation of apical P2Y₂ receptors activates an additional signalling mechanism that inhibits ENaC and involves the activated Ga subunit of a pertussis toxin-insensitive G-protein and activation of an unidentified PLC.

In a related study into the mechanism regulating membrane Ca²⁺ influx following purinergic receptor activation, we demonstrated that P2Y₂ receptor activation triggers a cellular signalling system that acts in parallel with depletion of intracellular Ca²⁺ stores to inhibit Ca²⁺ influx across the cell membrane. This signalling process is mediated via Gβγ and involves PLA₂β and arachidonic acid.

In a new interdisciplinary collaboration with researchers across the globe, we contributed to a study attempting to understand the mechanism underlying the pathogenesis of chytridiomyosis, a fungal disease that has caused global declines and extinctions of amphibian species. Our Laboratory discovered that infection of the epidermis by *Batrachochytrium dendrobatidis* (Bd) inhibits ENaC in frog skin. This effect of Bd occurs at the same time as a reduction in plasma Na⁺ concentration in the late stages of chytridiomyosis. Moreover, the reduction of skin Na⁺ absorption coincides with a significant reduction of plasma K⁺ concentration, the most likely cause of asystolic cardiac arrest resulting in death of infected frogs.

Journal Articles

2008
2009
Lee I, Campbell C, Song S, Day M, Kumar S, Cook D, Dinudom A. The activity of the epithelial sodium channels is

Total Annual Citations

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<td>Anuwat Dinudom</td>
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* ‘Lifetime’ = To end of 2009.

PhD Awarded
Lauren O’Mullane

Membership of Editorial Boards of Journals
David I Cook
Cellular Physiology and Biochemistry, 2002–

Anuwat Dinudom
Clinical and Experimental Pharmacology and Physiology, 2007-2009

Service to the University
David I Cook
Associate Dean Finance for the Faculty of Medicine
Ethics committees of University and Royal Prince Alfred Hospital
Coordinator for successful application to Federal Government for $100M in funding for a new Centre for Obesity,
Diabetes and Cardiovascular Disease to be built on campus.

Service to Scientific Societies
Anuwat Dinudom
Member, Local Organising Committee, Australian Neuroscience Society and Australian Physiological Society Joint
Meeting, 2009-

Grant Funding

<table>
<thead>
<tr>
<th></th>
<th>Relationship between cell-cell interactions and disease severity in patients with cerebral malaria (CM)</th>
<th>Grau</th>
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<th>Hunt</th>
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<td>NHMRC</td>
<td>Determining the cellular mechanisms involved in the airway response to topical citrate</td>
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Research Activities

Neurons in the hypothalamus and midbrain mediate the physiological responses associated with various behaviours. In 2008 and 2009 we made a number of new findings concerning the functional properties of these brain regions, in regard to their control of cardiovascular and respiratory function. First, we found that defensive behaviour and voluntary exercise both evoke activation of populations of neurons in various hypothalamic and midbrain regions, particularly the dorsomedial hypothalamus (DMH), perifornical area and midbrain periaqueductal grey (PAG). The pattern of activation, is however different, even though both behaviours are known to be associated with increases in blood pressure and sympathetic and vasomotor activity. This finding suggests that different populations of neurons may be responsible for generating the cardiorespiratory responses associated with these different behaviours.

In another study, we used c-fos expression in combination with retrograde tracing to identify neurons in the hypothalamus that are activated during defensive behaviour and which project to the nucleus tractus solitarius, a brain region that is known to be a critical component of the baroreceptor reflex control of blood pressure. The results of this study indicated that paraventricular neurons in the hypothalamic paraventricular nucleus, but not the dorsomedial hypothalamus or perifornical area, are the main sources of such pathways. Thus, even though the DMH and perifornical area are known to have an important role in resetting the baroreflex during defensive behaviour, this effect must be mediated by indirect rather than direct descending pathways to the lower brainstem.

In other studies, we continued our investigation of the relationship between the midbrain PAG and DMH in regulating cardiorespiratory function. We made two important discoveries. First, we showed that the increases in respiratory activity and sympathetic activity evoked from the dorsal PAG is dependent upon activation of neurons within the DMH. Thus, the pathways mediating these effects first ascend to the hypothalamus before descending to premotor nuclei in the brainstem.

The second major finding was that the functional properties of neurons within different subregions of the PAG differ greatly, particularly with respect to the control of cardiorespiratory function. In particular, the dorsolateral subregion, but not adjacent subregions, exerts a very powerful control of respiratory activity as well as sympathetic vasomotor activity, as illustrated in the Figure. Furthermore, a particularly interesting finding was that the magnitudes of increases in respiratory and sympathetic activity were very highly correlated, raising the possibility that there may a group of “command neurons” within the dorsolateral PAG that simultaneously increases respiratory and sympathetic activity, for example as part of the physiological response to an external threat. Consistent with this hypothesis, previous anatomical studies have shown that the dorsolateral PAG but not surrounding regions receives direct and indirect inputs from visual, auditory and olfactory signals.
Figure. A typical chart recording showing the effects of microinjection of D,L-homocysteic acid (DLH) into a site in the dorsolateral PAG on arterial pressure (AP), heart rate (HR), renal sympathetic nerve activity (RSNA), phrenic nerve activity (PNA) burst rate and respiratory activity (A); location of the center of the injection site (upper panel), and photomicrographs of the neutral red-stained section (middle panel, corresponding to the rectangle in the upper panel) and adjacent unstained section (lower panel) showing the center of the injection marked by Fast Green dye (B); chart recording at faster speed showing recordings before (C) and after (D) microinjection of DLH into this site in the dIPAG. The scale bar in B represents 0.2 mm. (From Iigaya, in press).
Book chapter
2008

Journal Articles
2008

2009

Total Annual Citations

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* ‘Lifetime’ = To end of 2009.

Official for Scientific Societies, including for National and International Conferences 2008-2009

Invited Presentations at National and International Conferences
2008
Dampney RAL. Feedforward control of cardiorespiratory function in stress and exercise. Festschrift for Professor Fred Mendelsohn, Melbourne, Australia, 7 Dec 2008.

2009

PhDs Awarded
2008
McDowall LM. The role of the dorsomedial hypothalamus in cardiovascular and respiratory regulation: relevance to arousal behaviour.
BMedSc(Hons) Awarded
2009
Lam ACB. The neural pathways subserving the cardiorespiratory responses during natural exercise and psychological stress. 1st Class and University Medal.

Manuscripts Refereed for Journals
2008 & 2009

Grant & Award Applications Assessed
2008 & 2009
Approximately 15 each year, mainly for NHMRC, ARC, and National Heart Foundation.

Membership of Editorial Boards of Journals
American Journal of Physiology (2001–)

Higher Degree Theses Examined
2008
PhD, Monash Univ (1), Univ of Newcastle (1)
2009
PhD, Macquarie Univ (1)

Service to the University
Faculty of Medicine Committees
2009
Case Coordinator, Cardiovascular Sciences Block

Faculty of Science Committees
2008
Member, Postgraduate Studies Committee
2009
Member, Postgraduate Studies Committee

Service to Professional Societies, Grant-Giving Bodies or Other External Committees
2008–2009
Member of Board, Prince of Wales Medical Research Institute (1996–2008)
Honorary Life Governor, Prince of Wales Medical Research Institute (2008–)
Member of Board, National Heart Foundation (NSW Division) (2006–2008)
OzReader, Australian Research Council (2005–)
Member, NSW Cardiovascular Health Research Network (2007–)
Co-Chair, Organizing Committee for joint AuPS/ANS conference (2007–)

Grant Funding

<table>
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<th></th>
<th>Hypothalamic regulation of cardiovascular function in hypertension and stress</th>
<th>Dampney RAL</th>
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Laboratory Personnel 2008-2009

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Institution</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margot L Day</td>
<td>Senior Lecturer</td>
<td>University</td>
<td>2004-</td>
</tr>
<tr>
<td>Shannon Chu</td>
<td>BSc(Hons)</td>
<td></td>
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</tr>
<tr>
<td>Sarah Dalati</td>
<td>BSc(Hons)</td>
<td></td>
<td>2009</td>
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<tr>
<td>Sandy Najem</td>
<td>BSc(Hons)</td>
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<td>Sukran Ozsoy</td>
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<td>Peggy Chen</td>
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<td><strong>Total effective full time personnel</strong></td>
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Research Activities

Research in this Laboratory is aimed at understanding the regulation and role of ion transport during preimplantation embryonic development. Ion channels are involved in the processes of fertilization, cell proliferation and differentiation in the embryo. In collaboration with Prof. Chris O’Neill we have studied the regulation of ion channels in survival factor signalling. Platelet-activating factor is a trophic factor that acts on the embryo to induce intracellular Ca\(^{2+}\) transients, which coincide with hyperpolarization of the membrane potential. Simultaneous patch-clamp and Ca\(^{2+}\) imaging of 2-cell embryos showed that the Ca\(^{2+}\) transients caused activation of an outward current that was dependent upon the presence of anions in the extracellular medium. The Cl\(^-\) channel inhibitors DIDS and niflumic acid inhibited this anion current. Furthermore, culture of embryos in these inhibitors from the zygote stage reduced development to blastocysts. In contrast, treatment from the late 2-cell or 8-cell stage had no effect on development to the blastocyst stage. Thus, we have shown that the embryotrophic factor PAF activates a Ca\(^{2+}\)-sensitive Cl\(^-\) channel in the 2-cell embryo and that this current is required for normal embryo development.

Journal Articles

2009


Lee IH, Campbell CR, Song SH, Day ML, Kumar S, Cook DI, Dinudom A. The activity of the epithelial sodium channels is regulated by caveolin-1 via a Nedd4-2-dependent mechanism. *J Biol Chem* 2009; 284: 12663-12669

Total Annual Citations

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<th>Year</th>
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* ‘Lifetime’ = To the end of 2009.

Conference Abstracts and Presentations

(P, poster)

2008


Li Y, Day ML, O’Neill C. Indirect activation of a chloride channel by a trophic ligand is required for development of the preimplantation mouse embryo, *Royal North Shore Hospital Research Conference.*
2009
Ozsoy S, Morris M, Day ML. The role of L-proline in preimplantation mouse embryo development in vitro. Bosch Young Investigator Symposium.
Dalati S, Day ML. The role of calcium activated chloride channels at fertilisation. Bosch Young Investigator Symposium.

Invited Presentations at National or International Conferences
Invited speaker, ionic homeostasis in the pre-implantation embryo. Downunder Embryo Symposium, Gold Coast, Aug 2006.

BMedSc(Hons) Awarded
2008
Shannon Chu. Role of Cl- channels in the survival of pre-implantation mouse embryos. Class 2.1

Graduate Diploma (Hons) Awarded
2009
Sarah Dalati. The role of ion channels in membrane potential changes during fertilization of the mouse oocyte. 1st Class.
Sandy Najem. The role of PAF- induced chloride channel activity in inducing changes in [Cl-]i in mouse preimplantation embryos at the 2-cell stage. 1st Class.

Higher degree theses examined
2009
MPhil, Monash Univ (1)

Service to University
Sub-Dean (Honours) Sydney Medical Program (2007–)
Post-graduate Co-ordinator, Discipline of Physiology (2007–)

Service to Professional Societies etc
Member, NHMRC Biomedical Scholarships Assessment Panel (2004–)
Research Activities
The main activity during the past two years has been the writing of a book for Springer, entitled “Calorie Restriction, Aging and Longevity”. This book of 18 chapters was written by 46 authors, with the guidance of 4 editors; Prof. Suresh Rattan from the University of Aarhus, Prof. David Le Couteur from the Centre for Education and Research on Ageing at Concord Hospital, Dr Rafael de Cabo from the National Institute on Aging, Baltimore, USA, and Honorary Associate Professor Arthur Everitt, who was invited in 2008 by Dr Max Haring from Springer to produce this volume.

Journal Articles
2009

Radio Interviews
2009
ABC 24 July 2009, diet and ageing

Newspapers
2008
Eat less to live longer. St George & Sutherland Shire Leader, 16 Sep 2008.
Eat less, live longer. ANZAC Research Institute Division, issue 4, Oct 2008.
2009

Conference Abstracts and Presentations
2008
2009

Invited Presentations at National or International Conferences
2008
2009
Everitt AV. Will eating less make you live longer, or will it just feel that way? The Perfect Diet: The Reality Check. Institute of Obesity, Nutrition & Exercise, Univ. of Sydney, 30 Jun 2009.

Awards

Manuscript Refereed for Journal
2009 (1)
Biogerontology (1)
TEACHING AND RESEARCH REPORT

MIRIAM I FROMMER

Face-to-Face Teaching Hours 2008–2009

<table>
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<td>13/8</td>
<td>9/9</td>
<td>-</td>
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<tr>
<td>PBL Tutorials</td>
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<td>-</td>
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<td>Practicals/Tutorials</td>
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<td>-</td>
<td>-</td>
<td>30/30</td>
<td>4/6</td>
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<tr>
<td>Total</td>
<td>103/101</td>
<td>36/31</td>
<td>13/8</td>
<td>39/39</td>
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Total = 286/285

Time was also spent on setting and marking assessments for all courses (50 hours per year). In 2008 time was spent on management of one unit of study in the BMEdSci each semester, as well as all physiology practicals in that degree (editing notes, training demonstrators) (50 hours). These duties were handed over to other staff in semester 1 of 2009, but the role of physiology liaison was resumed in semester 2 (10 hours).

Total for other teaching activities averaged 80 hours per year.

Teaching-related Research

As detailed below, my research projects have continued in 2008 and 2009. I also began compiling two new resources for web access. The No Frills Statistics Guide will attempt to bridge the gap between what students have been taught in previous statistics courses and their ability to understand the concepts and apply them in a physiological framework. The need for this has become apparent when marking practical assessments in both second and third year. PHLEX, a Physiology Logic Exercise manual, will be a follow-up to the No Frills Generic Skills Guide, and will utilize the same blood pressure experiment example as in the earlier guide to build up a set of 5 different exercises which will then be applied to all the practicals in the 2nd year course. The aim of this resource is to progressively build up students’ understanding of the theoretical framework of each topic area and provide links to its experimental application so that consolidation can occur.

USyd Medical Program

As well as continuing my tutoring activities in Blocks 7 and 8, I was involved in tutoring in the new Block 1, which was introduced as the first step in a major revision of the medical program. The assessment process was also changed to multiple choice questions only, and I continued to contribute to the setting and evaluation of questions.

Teaching research interests – Grants and Publications

Research continued on the following Strategic e-Learning Development Project: Development of an interactive tutorial to assist post-graduate markers in learning how to provide written feedback.

Samples of students’ respiration practical reports were annotated with both helpful and unhelpful feedback, with two examples being provided for each section – Introduction, Methods, Results, Discussion. With the input from eLearning staff, this was transferred to an online tutorial format, with appropriate user instructions. A quiz and feedback exercises were also written and included in the tutorial, and the whole package was made available to post-graduate students who would be marking practical reports at the end of semester 2 of 2009. Further evaluation remains to be done.

Research was commenced in 2009 on the following TIES project: Feedback in the Sciences: what is given, and how it can be improved amongst a diverse student population.
## Laboratory Personnel 2008–2009

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<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<th>Years</th>
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<tr>
<td>Catherine A Leamey</td>
<td>Senior Lecturer</td>
<td>University</td>
<td>2003–</td>
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<tr>
<td>Patricia Ruma-Haynes</td>
<td>Research Officer</td>
<td>NHMRC/Simons Foundation</td>
<td>2007–</td>
</tr>
<tr>
<td>Sam Merlin</td>
<td>PhD student</td>
<td>APA</td>
<td>2006–</td>
</tr>
<tr>
<td>Kelly A Glendining</td>
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<td>APA</td>
<td>2006–</td>
</tr>
<tr>
<td>Timothy R Young</td>
<td>PhD student</td>
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<td>2007–</td>
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<tr>
<td>Nuwan Dharmaratne</td>
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<tr>
<td>Heidi Tran</td>
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<td><strong>Total effective full time personnel</strong></td>
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## Research Activities

During 2008 and 2009 the Lab continued studies into the molecular mediators of neural connectivity. In particular, we built on our previous work which showed that Ten-m3 is critical for the generation of functional binocular visual circuits. PhD student Kelly Glendining and postdoctoral researcher Patricia Ruma-Haynes performed an investigation into the molecular interactions of Ten-m3. Promising candidate genes have been identified and are the subject of further study. PhD student Sam Merlin investigated the anatomical and physiological basis of the remarkable behavioural phenotype observed in these mice, which appear to have profound visual deficits unless inputs from one eye are silenced. In collaboration with Dr Atomu Sawatari, Dr Lauren Marotte (ANU) and Prof. Mriganka Sur (MIT) we showed that this is due to misalignment of the inputs from the 2 eyes in the primary visual cortex. Furthermore, we made the exciting finding that the mismapping of uncrossed inputs results in the emergence of ocular dominance domains, common in carnivores and primates but never before seen in rodents. The advantageous developmental model provided by the wallaby is being further used to elucidate the mechanisms by which Ten-m3 regulates neural connectivity; this work is performed in collaboration with Dr Lauren Marotte and PhD student Owen Carr at the ANU.

We also investigated whether other members of the Ten-m family also play a role in visual development. PhD student Tim Young has shown that Ten-m2 and Ten-m4 are expressed in the developing visual pathway and their deletion results in complementary defects in the organisation of the binocular visual pathway. Honours student Heidi Tran commenced an investigation into the role Ten-m3 plays in the formation of thalamostriatal projections. This was performed in collaboration with Atomu Sawatari.

### Journal Articles 2008

2009

**Total Annual Citations**

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<td>Catherine A Leamey</td>
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* ‘Lifetime’ = To end of 2009.

**Chapters in Books**

**2008**

**2009**

**Conferences Organised**
Local member for organizing the 2010 Joint ANS/AuPS meeting to be held in Sydney, Jan 2010.

**Invited Presentations at National and International Conferences**

**2009**

**Awards, Prizes and Other Recognition**

**2008**
Sir Zelman Cowen Universities Fund Prize for Medical Research, 2008: Awarded to Catherine Leamey for the discovery of Ten-m3 and the elucidation of its role in vision.
Australian Neuroscience Society Student Poster Prize: Awarded to Nuwan Dharmaratne (Honours student, 2007)

**2009**
Society for Neuroscience International Student Travel Award. Awarded to PhD student Sam Merlin.

**BSc(Hons) Awarded**

**2009**
Heidi Tran, Result 1st class.

**Higher Degree Theses Examined**

**2009**
PhD, MIT, Cambridge, MA, USA
Service to the University
Faculty of Science Committees
Member, School of Medical Sciences Teaching committee

Bosch Institute
Deputy Leader, Nervous System, Senses and Movement Theme

Grant Funding

| University of Sydney NHMRC near-miss bridging support | Molecular mediators of brain wiring | Leamey CA | 2008 | $50,000 |
| University of Sydney NHMRC near-miss bridging support | Making neural maps | Leamey CA | 2009 | $50,000 |
| Rebecca L. Cooper Foundation | Neural mechanisms underlying functional recovery from central blindness | Leamey CA, Sawatari A | 2008 | $19,200 |
Laboratory Personnel 2008–2009

<table>
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<th>Name</th>
<th>Position</th>
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<th>Years</th>
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<tr>
<td>Rebecca S Mason</td>
<td>Professor</td>
<td>University</td>
<td>1988–</td>
</tr>
<tr>
<td>Mark Rybachyn</td>
<td>Postdoctoral Research Fellow</td>
<td>Servier, France</td>
<td>2005–</td>
</tr>
<tr>
<td>Clare Gordon-Thomson</td>
<td>Research Fellow</td>
<td>NHMRC</td>
<td>2008–</td>
</tr>
<tr>
<td>Katie M Dixon</td>
<td>PhD student</td>
<td>APA/Cancer Institute</td>
<td>2004–2008</td>
</tr>
<tr>
<td>Henry Huang</td>
<td>PhD student</td>
<td></td>
<td>2004–</td>
</tr>
<tr>
<td>Melissa L Barron</td>
<td>PhD student</td>
<td>UPA (Co-funded)</td>
<td>2007–</td>
</tr>
<tr>
<td>Vanessa B Sequeira</td>
<td>PhD student</td>
<td>APA</td>
<td>2007–</td>
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<tr>
<td>Bree Davies</td>
<td>BSc(Adv)(Hons) student</td>
<td></td>
<td>2008</td>
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<tr>
<td>Wendy Green</td>
<td>BSc(Adv)(Hons) student</td>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Mary Jane Kwan</td>
<td>BMedSc(Hons) student</td>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Tan Luu</td>
<td>BMedSc(Hons) student</td>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Svetlana Poliakov</td>
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<td>2009</td>
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<td><strong>Total effective full time personnel</strong></td>
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</table>

Research in 2008 & 2009

This Laboratory has two major areas of interest – Vitamin D physiology generally with a particular interest in protection from UV irradiation by vitamin D compounds; and the physiology of bone remodelling, with relevance to the prevention and treatment of osteoporosis. We studied how strontium, a new agent for the prevention of osteoporotic fractures, affects bone cells. This work, in collaboration with Prof Arthur Conigrave, showed that strontium seems to affect bone cell function by mimicking the activities of the natural ion, calcium, to which strontium is related on the periodic table. Strontium is more potent in bone cells than in other tissues, and we identified some new pathways of action. The role in bone cell function, of a major phosphate regulating hormone, FGF23, which we previously reported was principally produced by bone cells, was studied in collaboration with Dr Rory Clifton-Bligh. In work carried out with Prof David Fraser evidence was obtained for a role of muscle as a store for the major vitamin D metabolite. Further studies on the mechanism of action of vitamin D compounds in photoprotection, carried out in collaboration with Prof Gary Halliday, A/Prof Diona Damian and A/ Prof Vivienne Reeve, showed that these compounds protect skin cells in humans and mice from UV-induced sunburn cell formation and DNA damage, and, in mice, protect from UV-induced immunosuppression and UV-carcinogenesis. Signalling pathways were identified. We also showed that vitamin D-like compounds, which have less capacity to cause hypercalcaemia, and which can only activate non-genomic steroid response pathways, have identical effects to the parent vitamin D hormone.

Journal Articles

2008

Javeri A, Huang XX, Bernerd F, Mason RS, Halliday GM. Human 8-oxoguanine-DNA glycosylase-1 protein and gene are expressed more abundantly in the superficial than basal layer of human epidermis. *DNA Repair* 2008; 7: 1542-1550.


2009

Total Annual Citations

<table>
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<th>Year</th>
<th>2005</th>
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<th>2008</th>
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<tr>
<td>Rebecca S Mason</td>
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<td>1,860</td>
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</table>

* ‘Lifetime’ = to end of 2009.

Research student completions:
2008
PhD – Tara Brennan
PhD – Katie Dixon
PhD – Inge Stewart (co-supervisor Rory Clifton-Bligh)
BSc(Adv)(Hons) – Bree Davies
BSc(Adv)(Hons) – Wendy Green
BMedSc(Hons) – Tan Luu
BMedSc(Hons) – Mary Jane Kwan

2009
PhD – Henry Huang
BMedSc(Hons) – Svetlana Poliakov

Conference Abstracts and Presentations
(O, oral; P, poster; P+O, poster with short oral)
2008
Sequeira VB, Rybchyn MS, Reeve VE, Halliday GM, Mason RS. Signalling pathways involved in photoprotection by 1α,25 dihydroxyvitamin D, Mutagenesis and Experimental Pathology Society of Australasia, Australian Health and Medical Research Congress, Brisbane, Australia, Nov 2008. O
Brennan TC, Rybchyn MS, Conigrave AD, Mason RS. Strontium ranelate decreases osteoblast-induced osteoclastogenesis through the involvement of the calcium-sensing receptor. American Society for Bone and Mineral Research Annual Conference. Montreal, Canada, 14-16 Sep 2008. P
2009


Sequeira VB, Dixon KM, Rybchyn MS, Reeve VE, Halliday GM, Malloy P.J, Feldman D, Mason RS. Photoprotective effects of 1α,25 (OH)2D can be mediated by a VDR with a defective DNA binding domain, Bosch Young Investigators Symposium, Sydney, Dec 2009.

Sequeira VB, Dixon KM, Rybchyn MS, Reeve VE, Halliday GM, Malloy, P.J., Feldman, D., Mason, R.S. Photoprotective effects of 1α,25 (OH)2D can be mediated by a VDR with a defective DNA binding domain. 5th Joint meeting of the Societies for Free Radical Research Australasia and Japan & Molecular and Experimental Pathology Society of Australasia, Sydney, Dec 2009.

Sequeira VB, Dixon KM, Reeve VE, Halliday GM, Malloy P.J, Feldman D, Norman AW, Mason RS. Photoprotective, rapid response effects of 1α,25 (OH)2D can be mediated via a VDR with a defective DNA binding domain. 14th International Vitamin D Workshop, Brugge, Belgium, Oct 2009.


Official for Scientific Societies, including for National and International Conferences
Member, Program Organizing Committee, Fourteenth International Workshop on Vitamin D, Brugges, Belgium.

Invited Presentations at National and International Conferences
2008

2009
Role of 1,25D and its analogs in protecting against UV mediated DNA damage in skin Fourteenth Workshop on Vitamin D, Brugge, Belgium, Oct 2009.
In newspaper and magazine articles

2008
Vitamin D Live it Up magazine, Stephanie Oley, Oct 2008.

2009
Fat linked to vitamin deficiency. Sun-Herald, Julie Robotham, 11 Jan 2009
Vitamin D. Catalyst, ABC TV1, Norman Swan, 12 Mar 2009
Vitamin D and sun exposure. Abc.net.au/healthyliving, Cathy Johnson, 26 May 2009
High PTH & mortality. Australian Doctor, Kirrily Burton, 2 Jun 2009
more Vitamin D. Girlfriend Magazine, Pulse communications, Jul 2009
Side effects zolendronic acid. Medical Observer, Catherine Hanrahan, Jul 2009
Vitamin D. Sydney Morning Herald, Paula Goodyer, 30 Jul 2009
Vitamin D. Radio 2UE, George and Paul, 12.30pm 1 Aug 2009
Vitamin D. Radio Eastside Paddington, Ben (C Fellner –producer), 4.35pm 28 Aug 2009
Vitamin D. NTDTV (New York based), Sheridan Harvey filming 9 Sep 2009
Catch some rays for vitamin D. Daily Telegraph, Emma Watson, 14 Sep 2009
Vitamin D. Sunday Telegraph, Christine Larmer, 11 Oct 2009
Vitamin D. BRW, Gina McColl, 10-16 Sep 2009
Vitamin D. Sunday Telegraph, Paula Goodyer, Sep 2009
Vitamin D. Daily Telegraph, Erica Watson, 21 Sep 2009

Awards, Prizes and Other Recognition

2008
Katie Dixon, Premier’s Award for Outstanding Cancer Research Scholar for work on how vitamin D compounds protect skin from UV damage. Cancer Institute of NSW, Sydney.
Vanessa Sequeira, Kumar Young Investigator Award, Molecular and Experimental Pathology Society of Australasia, awarded at Australian Health and Medical Research Congress, Brisbane.

2009
Rebecca S Mason, Career Award for Contributions to Vitamin D Research, 14th International Workshop on Vitamin D, Brugges, Belgium.
Katie Dixon, Young Investigator Award, 14th International Workshop on Vitamin D, Brugges, Belgium.

Scholarship Awarded

2008
Australian Post-graduate Award – Katie Dixon
Cancer Institute Research Scholarship – (APA top-up and project costs) – Katie Dixon
Australian Post-graduate Award – Vanessa Sequeira
University Post-graduate Award – Melissa Barron

2009
Australian Post-graduate Award – Vanessa Sequiera
University Post-graduate Award – Melissa Barron

Manuscripts Refereed for Journals

2008 (5)
Nanotechnology (1), Bone (1), J Invest Dermatol (1), Int J Biochem Cell Biol (1), J Ag Food Chemistry (1)

2009 (10)
Grant & Award Applications Assessed
2008
NHMRC (4), Member of Assigners Panel for NHMRC; New Zealand Health Research Council (1), ARC (1), Cancer Research UK (1).
2009
NHMRC (4), Cancer Research UK (1).

Higher Degree Theses Examined
2009
PhD, Univ of Melbourne (1), Univ of Western Australia (1).

Service to the University
Deputy Director 2008, Acting Executive Director, 2009, Bosch Institute.

Service to Government, and the Profession
Board Member, Osteoporosis Australia.
Member, Working party, Sun and Health, Cancer Councils of Australia (2004–).
Co-chair, Working party, revision of Clinical Practice Guidelines for the Management of Cutaneous Melanoma – Prevention Chapter (2005–).
Member, Commission Internationale de l’Eclairage (International Commission of Illumination) – Technical Committee 6-58 (Sunlight, Health and Vitamin D) (2005–).

Grant Funding

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Principal Investigator(s)</th>
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<tr>
<td>Servier, France</td>
<td>Post-menopausal testing of strontium ranelate in bone cells</td>
<td>Mason RS, Conigrave AD</td>
<td>2005</td>
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<td>NHMRC</td>
<td>The FREEDOM study: A randomized controlled trial of sunlight and calcium supplementation to reduce vitamin D deficiency in older people in residential care</td>
<td>Sambrook P, March L, Cameron I, Cumming R, Seibel M, Simpson J, Mason RS</td>
<td>2006</td>
<td>$247,000</td>
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<td>NHMRC</td>
<td>Mechanisms of photoprotection by vitamin D and analogs</td>
<td>Mason RS, Reeve VE, Halliday GM</td>
<td>2008</td>
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<td>ARC</td>
<td>Drug-delivery coating for a new generation of orthopaedic implants</td>
<td>Rohanizadeh R, Mason RS, LeGeros RZ</td>
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<td>2010</td>
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</table>
Laboratory Personnel 2008–2009

Bronwyn M McAllan  
Lecturer  
University  
2006–

Nereda Christian  
Research Assistant  
University  
2006–07

Total effective full time personnel  
2008: 2.0  
2009: 2.0

Research Activities

During 2008 and 2009 we continued work on the environmental control of reproduction and thermoregulation in marsupials, especially the dunnarts (*Sminthopsis* spp). In collaboration with Dr Adam Munn (School of Veterinary Sciences) we found that dietary restriction and unpredictability affect metabolism and torpor use in *Sminthopsis crassicaudata* (fat-tailed dunnart). Other work included the analysis of cerebral architecture in *Sminthopsis macroura* and *S. crassicaudata* (striped-faced dunnart) in collaboration with Prof. Ken Ashwell (Univ of NSW). We are continuing work on the neuroanatomy and thermal physiology of marsupials using dunnarts in collaboration with Prof. Ashwell, Prof. Jürgen Götz (Brian and Mind Research Institute) and Prof Fritz Geiser (Univ of New England).

Journal Articles

2008

McAllan BM, Westman W, Körtner G, Cairns SC. Sex, season and melatonin administration affects daily activity rhythms in a marsupial, the brown antechinus, *Antechinus stuartii*. Physiol Behav 2008; 93: 130–138


2009

McAllan BM. Reproductive parameters of post “die-off” male *Antechinus flavipes* and *Antechinus stuartii* (Dasyuridae: Marsupialia). Aust Mammal 2009; 31: 17-23

Total Annual Citations

<table>
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<td>Bronwyn M McAllan</td>
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* ‘Lifetime’ = to end of 2009.
Conference Abstracts and Presentations  
(O, oral; P, poster; P+O, poster with short oral)  

2008  
McAllan BM. Photoperiodism and reproduction in marsupials, the “other mammals”. Mammalian Reproductive Physiology and Ecology, 4th International Conference for Comparative Physiology and Biochemistry, Masaai Mara, Jul 2008.  

2009  

Official for Scientific Societies, including for National and International Conferences  
2009  
Member, Governing committee of Asia and Oceania Society for Comparative Endocrinology, 2009–2012 (sole Australian representative).  

Conferences and Symposia Organized  
Member, Organising committee for the 25th Meeting of the Australian and New Zealand Society for Comparative Physiology, Univ of Sydney, 6–8 Dec 2008.  

Manuscripts Refereed for Journals  
2008 (12)  
2009 (4)  
Aust Mammal (3), J Reprod Fertil (1)  

Membership of Editorial Boards of Journal  
Associate Editor, Australian Mammalogy (2007–)  

Service to the University  
Faculty of Medicine Committees  
Member, Occupational Health and Safety Committee (2006–08)  

University Committees  
Member, Animal Ethics Committee Category B Member (2008–)
## Laboratory Personnel 2008–2009

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<th>Name</th>
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<th>Period</th>
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<tr>
<td>Brian J Morris</td>
<td>Professor</td>
<td>ARC (1998–2008) NHMRC (0.5) &amp; 1998–09 Cure Cancer (0.5)(2009)</td>
<td>1978–</td>
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<tr>
<td>Andrea Markus</td>
<td>Research Officer</td>
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<tr>
<td>Francine Marques</td>
<td>PhD student</td>
<td>Endeavour International Postgrad Research Sch'shp</td>
<td>2008–</td>
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<tr>
<td>Helena Mangs</td>
<td>PhD student</td>
<td>APA (2005–08)</td>
<td>2001–08</td>
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<tr>
<td>Christine Goy</td>
<td>Technical Officer (0.5)</td>
<td>ARC</td>
<td>2007–08</td>
</tr>
<tr>
<td>Lilian J Morris</td>
<td>Res Assist (0.2)</td>
<td>ARC</td>
<td>2001–</td>
</tr>
<tr>
<td>William YS Wang</td>
<td>Hon Assoc (01–)</td>
<td>Concord Hosp</td>
<td>1995–00</td>
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<td>Ruby CY Lin</td>
<td>Hon Assoc (04–)</td>
<td>UNSW</td>
<td>1998–03</td>
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<td>Helen Speirs</td>
<td>Hon Assoc (06–)</td>
<td>UNSW</td>
<td>2003–05</td>
</tr>
<tr>
<td><strong>Total effective full time personnel</strong></td>
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<td><strong>2008: 4.5</strong></td>
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## Research Activities

The Laboratory has had a long-standing interest in the molecular genetic cause of hypertension, as well as the function of factors that control alternative splicing of pre-mRNAs.

**Hypertension:** During this period we performed genome-wide expression profiling of hypothalamic tissue from high blood pressure (BPH/2J) and normal blood pressure (BPN/2J) strains of the Schlager mouse, a model of neurogenic hypertension. Tissues were obtained as part of a collaboration with Prof Geoff Head at the Baker Heart Research Institute in Melbourne, and arrays were performed at the Ramaciotti Gene Function Analysis Centre at Univ of NSW. Results to date for the established phase of hypertension have revealed 324 genes whose expression differed between each strain. Highlights included lower expression of genes for antioxidant proteins and increases in expression of genes for ATP production, which would facilitate increased sympathetic outflow. In collaboration with Dr Jean Yang and her PhD student Anna Campain in the School of Mathematics & Statistics we performed a meta-analysis of genome-wide expression data obtained from microarrays of tissues of the spontaneously hypertensive and Lyon hypertensive rat strains, and their controls. This led to the identification of 36 genes whose expression differed between the pre-hypertensive and hypertensive phases, and 102 genes whose expression was altered in the maintenance phase of hypertension. The findings will appear in Hypertension in 2010.

**Splicing factors:** The primary transcript of mRNA must undergo a splicing process to remove introns. The exons are then joined by the splicing machinery to form mature mRNA. We had identified RBM4 as a new splicing factor capable of modulating alternative splicing, and had shown that it binds the well-known tumour suppressor WT1 to suppress splicing. We had also shown that RBM4 binds to the cell death regulatory protein GRIM-19, suggesting a role for RBM4 in programmed cell death (apoptosis). We went on to address the hypothesis that RBM4 is involved in cellular transformation, apoptosis and development. In a collaboration with Joel Mackay in the School of Molecular and Microbial Biosciences, use of the technique of SELEX led to discovery of two specific oligonucleotide sequences to which RBM4 binds. We found that RBM4 is differentially expressed in many tumours when compared to matching normal tissue. Two out of ten Wilms tumours expressed aberrant levels of RBM4. Sequencing of these samples found no mutations in the WT1 gene. By proliferation and migration assays we found no significant involvement of RBM4 in transformation. Knockdown of RBM4 resulted in a decrease in apoptosis. By use of a new technology – whole-genome exon arrays – we completed a genome- wide search that led to the identification of the specific pre-mRNA targets of RBM4. We had earlier done exon-arrays for ZRANB2 identified originally by us as a novel splicing factor (published in *J Cell Biol*). Joel Mackay’s group, showed that ZRANB2 interacted directly with the 5’ splice site of pre-mRNAs and this
was published in PNAS in 2009. Confirmation by qPCR was performed to validate the splicing changes seen on the arrays in the RBM4 and ZRANB2 studies. Jean Yang in the School of Mathematics and Statistics assisted us with the bioinformatic analysis of the enormous volume of data generated from the exon array work. Finally, we demonstrated for the first time that the well-known red wine polyphenol, resveratrol, was able to modulate alternative splicing of half of the pre-mRNAs we tested, and we showed that at least part of this effect involved resveratrol’s ability to alter the expression of genes for proteins that affect processing of primary RNA transcripts.

Journal Articles

2008


2009


Total Annual Citations

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<tr>
<td>Brian J Morris</td>
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* ‘Lifetime’ = to end of 2009.

H-index = 40

Letters to the Editor (Journals)

2008


2009

**Articles in Scholarly Magazines**

2008

2009

**Website development**


**Conference Abstracts and Presentations**

(O, oral; P, poster; P+O, poster with short oral; I/O, invited talk)

2008

2009
Lumbers ER, Pringle K, Marques FZ, Hirst J, Markus A, Morris BJ, Zakar T. Levels of expression of components of the renin-angiotensin system (RAS) in fetal membranes, decidua and placenta and the effects gender and labour. *Annual Scientific Meeting of the Endocrine Society of Australia* P
Lumbers ER, Pringle KG, Marques FZ, Hirst J, Markus MA, Morris BJ, Zakar T. Identification of renin-angiotensin


Official for Scientific Societies, including for National and International Conferences
Member, Executive Committee, High Blood Pressure Research Council of Australia, 2005–10 (Treasurer, Dec 2007–)

Invited Presentations at National and International Conferences
2009
Australasian Academy of Anti-ageing Medicine 3rd Annual Conference, 3-4 Oct 2009 (Opening address and plenary lecture)

Seminar
2008
Confronting circumcision for genital health (NTEU forum) Univ of Sydney 6 pm Wed 5 Mar 2008

Letter to the Editor (magazine)

Letters to the Editor (newspapers)
Morris BJ. To cut or to keep: baby boy dilemma divides parents. Sydney Morning Herald 9 Jun 2009 p 10.

In monograph

In magazine articles
2009 (4)


News Media
In newspaper articles
2008 (2)
Not such an unkind cut, after all. The Weekend Australian 16-17 Aug 2008 p15.

New test could encourage more women to get pap smears. Daily Telegraph 18 Dec 2008.

2009 (5)


On-line forums
2008 (2)

On-line news
2008 (2)
2009 (2)

TV
2009 (2)

Radio
2008 (7)
Circumcision
Broadcast in German in Germany (by Vivien Marx in New York) 7 Jan 2008: http://www.br-online.de/umweltgesundheit/artikel/0701/06-beschneidung-maenner/index.xml
5AA Adelaide (Ally Rudder) 7 pm Sat 12 Jan 2008.
ABC Radio Australia, to Asia & Pacific (by Sam Lam) 10.45 am Tue 5 Feb 2008 http://www.radioaustralia.net.au/connectasia/stories/s2154727.htm
ABC National, 2.15 pm Fri 15 Feb 2008.
ABC Longreach, Western Qld, 10.10 am Thu 14 Feb 2008
2007 (47).
Radio stations Australia-wide, Cervical screening by HPV test and self-sampling, Mon 4 Jun 2007 – 42 pieces:
2009 (4)
Anti-ageing and diet
2UE, Ross Walker’s show Sat evening 22 Aug 2009.
ABC Newcastle, 3.10 pm Tues 6 Oct 2009.
Manuscripts Refereed for Journals

2008 (26)

2009 (21)

Membership of Editorial Boards of Journals

*Hypertension* (2002–)

Service to NHMRC

2008
Member, Grant Review Panel 6F Cardiovascular/Renal/Sports Medicine, Melbourne, 28 Jul–1 Aug 2008.

2009

Grant Applications Assessed

2008
*NHMRC* (9)

2009
*NHMRC* (10)

Higher Degree Theses Examined

2008
PhD, *Univ of Melbourne* (1)

2009
PhD, *Univ of Sydney* (1)

External referee for Chair

2009
*Univ Sains Malaysia*

Grant Funding

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<td>ARC</td>
<td>Function of a new splicing factor, RBM4</td>
<td>Morris BJ</td>
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<td>NHMRC</td>
<td>The role of the intrauterine (pro)renin/(pro)renin receptor system in prostaglandin synthesis in pregnancy</td>
<td>Lumbers, Zakar T, Hirst J, Morris BJ</td>
<td>2005</td>
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EMBRYONIC STEM CELL LABORATORY

MICHAEL B MORRIS

Laboratory Personnel 2008-2009

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<tr>
<td>Michael B Morris</td>
<td>Sesqui Senior Lecturer in Embryonic Stem Cells University</td>
<td>2008-2009</td>
</tr>
<tr>
<td>Mariana Todorova</td>
<td>Visiting Fellow, Miguel Hernandez Univ Spain</td>
<td>2008-09</td>
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<tr>
<td>Evelyn Linardy</td>
<td>BSc(Hons) student</td>
<td>2009</td>
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<tr>
<td>David Collett</td>
<td>BSc(Med)(Hons) student</td>
<td>2009</td>
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<tr>
<td>Jung-Yoon Huh</td>
<td>Faculty of Medicine Summer Scholarship student</td>
<td>2008-09</td>
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<tr>
<td>Annie Linebarger</td>
<td>Faculty of Medicine Summer Scholarship student and Research Assistant</td>
<td>2009</td>
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<tr>
<td>Radu Zamfirescu</td>
<td>Research Assistant</td>
<td>2009</td>
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Total effective full time personnel 2007: 2.0 2008: 2.0

Research Activities

The Laboratory, established on the Royal North Shore Hospital campus, is investigating the signalling and gene expression circuitry controlling neural-cell fate using arrays. The Lab collaborates closely with the following researchers: (i) Prof D. Winkler (Biomaterials & Regenerative Medicine, CSIRO Molecular and Health Technologies, Clayton) to generate coarse-grained models of the circuitry driving differentiation by applying novel neural network algorithms; (ii) Dr Margot Day (Physiology and Bosch Institute) to examine signalling pathways controlling preimplantation mouse embryo development; (iii) Prof Don Martin (Univ Technology Sydney) to examine the use of biocompatible surfaces for directing cell fate.

This Lab along with other stem-cell and developmental biology groups on the Hospital campus formed the Sydney Centre for Developmental and Regenerative Medicine, opened by the NSW Minister for Science and Medical Research, Jodi Mackay, in July 2009. The labs in the Centre now also comprise the new theme of Developmental and Regenerative Medicine within the Kolling Institute.

The Lab continues its research in developing computational tools for predicting, refining, and comparing the 3D structures of integral-membrane proteins, with a particular focus on the use of our new tool, REPIMPS, applied to G protein-coupled receptors (GPCRs). This work is performed in collaboration with Dr B. Church (Faculty of Pharmacy) and Dr S. Dastmalchi (Tabriz Univ, Iran).

Journal Article

2008

2009

Total Annual Citations

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* ‘Lifetime’ = to end of 2009.
Conference Abstracts and Presentations
(O, oral)
2009


Morris MB. Novel signalling mechanisms directing the differentiation of ES cells. 1st Annual Regenerative Medicine Symposium at Sydney University, 2009, p 3.


Conferences and Symposia Organized
Member, Organising Committee, Sydney Centre for Developmental and Regenerative Medicine Symposium, Jul 2009.

BSc(Hons) Awarded
Evelyn Linardy

Manuscripts Refereed for Journals
J Chem Inf Model (1), Int J Biochem Cell Biol (1)

Membership of Editorial Boards of Journals
Journal of Pediatric Biochemistry

Service to Professional Societies, Grant-Giving Bodies or Other External Committees
Committee Member, Scientific Staff Council, Royal North Shore Hospital
Committee Member, Sydney Centre for Developmental and Regenerative Medicine

Grant Funding

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<th>Morris MB</th>
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<td>North Shore Hospital Area Research Grant</td>
<td>Platform technologies for directed differentiation of human ES cells</td>
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<td>2009</td>
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<td>University of Sydney Bridging Support Grant</td>
<td>Gene circuitry and signalling mechanisms driving neurogenesis of embryonic stem cells</td>
<td>Morris MB</td>
<td>2009</td>
</tr>
<tr>
<td>NHMRC Equipment Grant</td>
<td>Laser microdissection microscope with a unique pressure-catapulting technique allows isolation of pure samples for subsequent downstream molecular analyses</td>
<td>Halliday et al.</td>
<td>2009</td>
</tr>
<tr>
<td>Ramaciotti Foundation</td>
<td>Laser capture microdissection instrument</td>
<td>Mason et al.</td>
<td>2008</td>
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RESEARCH AND TEACHING REPORT

MELONI M MUIR

Research

Education in Science: My education research has focused on student learning and in particular on how understanding in science is communicated in writing. This research has expanded to encompass feedback - namely student and staff perceptions of what it is and how students interpret and use it to improve their learning. I also contributed to the research of the Bone & Vitamin D Laboratory.

Teaching

2008
Coordinator, PHSI2005 & PHSI2006 – Integrated Human Physiology
Coordinator, PSPC2602 – Physiology and Pharmacology
PBL tutor, Graduate Medical Program

2009
Coordinator, PHSI2005 & PHSI2006 – Integrated Human Physiology
Coordinator, PSPC2602 – Physiology and Pharmacology
PBL tutor, Graduate Medical Program

As unit of study coordinator for PHSI2005 and PHSI2006, I am involved in both teaching and administrative roles for this undergraduate unit of study in which approximately 260 Science students are enrolled each semester. My research in education in science is integrated into these responsibilities. To enhance students’ written communication skills, I have added a scientific report writing tutorial to the curriculum along with an option for students to obtain formative feedback on draft practical reports. The Flexible Electronic Report-Writing Tool (FLERT), developed with colleagues in 2007, has continued to be a valuable resource for supporting student writing and has become the prototype for an ALTC grant on writing in the sciences. The outcome of this grant, an online tutorial entitled Writing Reports in Science and Engineering (WRISE), is now in use across Australian universities. To improve consistency across markers I have developed written guidelines to complement the face-to-face training sessions for the report markers. The inquiry based learning (IBL) activity, implemented in 2006, continues to be a popular component and content was reviewed and modified in 2008. The IBL activity is designed to extend students’ discipline-specific knowledge beyond the lecture material and develop graduate attributes such as critical thinking, evidence integration from multiple sources, and oral and written skills, by providing the students with a scaffolded approach to problem solving and independent learning.

Journal Article

2009
Conference Abstracts and Presentations
(O: Oral, P: Poster, P+O: poster with short oral)

2008

2009

Conference and Symposia Organized

2008
Program Committee Member, Annual International Conference of the Higher Education Research and Development Society of Australasia, Rotorua, NZ, Jul 2008.
Program Committee Member, International Society for the Scholarship of Teaching and Learning Conference, Edmonton, AL, Canada, Oct 2008.

2009
Program Committee Member, International Society for the Scholarship of Teaching and Learning Conference, Bloomington IN, USA, Oct 2009.

Grant and Award Applications Assessed

2008 (5)
Science Faculty Education Research Group

Service to the University
Sydney Medical School
Admissions Interviewer (2005–)

School of Medical Sciences
Deputy Chair, School of Medical Sciences Teaching Committee (2008–)
School Representative, Faculty of Science Teaching Committee (2005–)

Faculty of Science
Sub-dean of Student Affairs (2009–)
Teaching Committee (2005–)
Member, Unit of Study Evaluation Working Group (2005–)
Member, Science Faculty Education Research Group (2000–)
MOLECULAR NEUROSCIENCE & SYNAPTIC BIOLOGY LABORATORY

WILLIAM D PHILLIPS

Laboratory Personnel 2008–2009

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Institution</th>
<th>Years</th>
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<tr>
<td>William D Phillips</td>
<td>Senior Lecturer</td>
<td>University</td>
<td>1993–</td>
</tr>
<tr>
<td>Marco Morsch</td>
<td>Postdoctoral researcher</td>
<td>NHMRC</td>
<td>2009–</td>
</tr>
<tr>
<td>Jennifer Brockhausen</td>
<td>PhD student</td>
<td>NHMRC</td>
<td>2003–2008</td>
</tr>
<tr>
<td>Rebecca N Cole</td>
<td>PhD student</td>
<td>UPA</td>
<td>2004–2009</td>
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<tr>
<td>Nazanin Ghazanfari</td>
<td>BSc(Hons) student</td>
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<td></td>
<td>Research Assistant (0.5)</td>
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<td>2008: 4.0</td>
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**Right panels:** Three amigos. Drs Jennifer Brockhausen, Shyuan Ngo and Rebecca Cole gained their PhDs in 2008, 2009 and 2010 (left to right, respectively) studying different aspects of nerve-to-muscle signalling in health and disease. Jenny and Shyuan have moved on to postdoctoral medical research positions while Bec is training to be a physician.
Research Activities

This Lab focuses on the intimate relationship between nerve and muscle at the neuromuscular synapse. Motor nerves control muscle contraction by releasing acetylcholine on to acetylcholine receptor proteins on the muscle cell membrane immediately beneath the nerve ending. The connection is established at the embryonic stage of life when nerve fibres growing out from the spinal cord first contact the immature muscle cells. Each muscle cell is at first courted by several nerve suitors. A stable paired relationship is finally established after the muscle fibre rejects contacts from all but one of the nerves. We have learnt much about the genes and interactions involved in the earliest stages of this synaptic relationship but comparatively little about the challenges to the synaptic relationship that occur much later in life. This is important because loss of neuromuscular synapses (and muscle control) occurs in a variety of diseases and may also contribute to the creeping muscle weakness and frailty of old age.

Myasthenia gravis is a muscle weakness disease caused by failure of the neuromuscular synapse. The cause of some cases of myasthenia gravis has remained a mystery. However, the muscle side of the synapse contains a second signalling protein called muscle specific kinase (MuSK). In 2008 our Lab reported that patient autoimmune antibodies bind to MuSK and cause myasthenia gravis when injected into laboratory mice. The weakness in the mice could be partly explained by loss of acetylcholine receptors from the muscle fibre membrane. Moreover, there was a wholesale breakdown of the synaptic relationship. The nerve terminals withdrew from their normal intimate association with acetylcholine receptors on the muscle cell surface. MuSK (the target of the harmful antibodies) would appear to be crucial for maintaining healthy neuromuscular synapses.

So precisely what role does MuSK play at the healthy, adult neuromuscular synapse? Embryonic nerve terminals are thought to secrete a sugar-rich signalling protein called agrin that can turn on the protein tyrosine kinase function of MuSK. We found that treatment of mouse neuromuscular synapses with extra agrin caused acetylcholine receptors to become packed more tightly together beneath the nerve ending. Agrin acted to stabilize acetylcholine receptors by first stabilizing a protein called rapsyn that binds to the receptors. We are currently extending these studies to gain a clearer understanding of how the MuSK and other natural signalling systems help maintain healthy synapses.

Journal Articles

2008

Total Annual Citations

<table>
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</table>

* ‘Lifetime’ = to end of 2009.

Magazine & Newsletter Articles

2009


Phillips WD. The agrin/MuSK signaling system and maturation of the neuromuscular junction. *NSW Cell & Developmental Biology Meeting*, Univ of Sydney, 18 Sep 2008.


Ghazanfari N. Inhibition of agrin/MuSK signalling pathway by patient anti-MuSK autoantibody. 1st Class.

**Manuscripts Refereed for Journals**

2008 (5)

2009 (3)

**Grant & Award Applications Assessed**

2008 (2)
- NHMRC (1)
- ARC (1)

2009 (8)
- NHMRC (6)
- ARC (1)
- Marsden Fund NZ (1)

**Service to the University**

**University Committees**
- Expert member, University Biosafety Committee (1995–)

**Faculty of Medicine Committees**
- Chair, School of Medical Sciences Teaching Committee (2003–)

**Faculty of Science Committees**
- School of Medical Sciences Representative, Faculty of Science Undergraduate Studies Committee (2001–)

**Service to Professional Societies, Grant-Giving Bodies or Other External Committees**

2009
- Member, NHMRC Grant Review Panel 4b.

**Grant Funding**

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Author(s)</th>
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<th>Funding Amount</th>
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<tr>
<td>MDA (USA)</td>
<td>Anti-MuSK antibodies and the mechanism/s of ‘seronegative’ Myasthenia Gravis</td>
<td>Phillips WD</td>
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<td>Reddel SW</td>
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<td></td>
<td></td>
<td>Noakes PG</td>
<td>2011</td>
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Research Activities

During this period, our Lab investigated how neural networks in the retina are organized functionally and what role different neurotransmitter systems play in the neuronal responses to light stimulation. We also investigated the role of early sensory experience in the function of retinal neural networks.

Role of early visual experience in shaping retinal circuits: We continued our studies in collaboration with Prof. Silvia Bisti from Univ de L’Aquila, Italy, looking into the long-term effects of visual deprivation. Our results showed that early visual experience is crucial for the normal development and/or establishment of retinal signalling pathways. Raising animals under continuous darkness from birth until one or three months of age induced lasting, long-term changes in the response properties of retinal ganglion cells. In particular, we found that the strength of ganglion cell light responses in dark-reared animals was weaker than in animals raised in normal conditions. Furthermore, the receptive fields of ganglion cells from dark-reared animals were smaller than that of control animals. Lack of visual experience was shown to modify light-responses by increasing the ratio of inhibitory to excitatory inputs on to ganglion cells and by disrupting the spatial organization of excitatory and inhibitory inputs.

Lateral inhibition in the primate retina: We expanded our studies on the characterization of the spatial organization of retinal ganglion cells in the primate retina in collaboration with Dr Sam Solomon, who is another member of the Discipline of Physiology. We found that, overall ON and OFF ganglion cells display different synaptic mechanisms responsible for their excitability. Contrary to current models based on indirect measurements, we found that an important component of lateral inhibition in ganglion cells originates from the activity of amacrine cells in the inner plexiform layer.

Cannabinoid modulation of spontaneous neurotransmitter release and light responses in the retina: The endocannabinoid system is a strong modulator of signal transmission in the central nervous system. Although endogenous cannabinoids and their receptors have been found in the retina, their functional role is still unknown. We recorded spontaneous synaptic activity from retinal ganglion cells and found that both inhibitory and excitatory inputs are under regulatory control by cannabinoids. Furthermore, cannabinoids modulate the strength of the responses of ganglion cells to light stimulation as well as their receptive field organization, suggesting that this neurotransmitter system plays a role in the control of the transmission of visual signals.

Contrast adaptation in the mammalian retina: We are investigating the different synaptic mechanisms involved in the adaptation to different levels of contrast in ON and OFF cells.

Dopamine action on light signalling: We continued our studies on the effect of dopamine on ganglion cell light-responses. Our results showed that dopamine reduces the strength of light responses in ganglion cells and modifies their receptive fields, consistent with a role of dopamine as a switch between night-time and day-time vision. Studies looking at the excitatory inputs on to ganglion cells are unveiling the underlying synaptic mechanisms responsible for this reduction.
Journal Article
2009

Total Annual Citations

<table>
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<tr>
<th>Year</th>
<th>2005</th>
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<tr>
<td>Dario A Protti</td>
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* ‘Lifetime’ = to end of 2009.

Chapter in Book
2008

Conference Abstracts and Presentations
(O, oral; P, poster)
2008

2009
Middleton TP, Protti DP. Spontaneous synaptic activity in retinal ganglion cells is modulated by endocannabinoids. Proceedings of Australian Neuroscience Society, Canberra, Jan 2009 P
Protti DA. Spatial tuning of excitatory and inhibitory synaptic inputs onto primate retinal ganglion cells. NVRI Symposium on Visual Processing, Melbourne, Sep 2009 O

Official for Scientific Societies, including for National and International Conferences
2008
Session Chair, Visual Processing in Small and Bigger Brains, Australian Neuroscience Society, Hobart, Jan 2008.

Conferences and Symposia Organized
Member of Local Organising Committee, Australian Neuroscience Society and Australian Physiological Society Joint Meeting, Sydney, 2007–

PhDs Awarded
2009
Stefano Di Marco, University of L’Aquila, Italy.

BSc(Hons) Awarded
2008
Terence Middleton, Cannabinoids modulate synaptic signalling onto mouse retinal ganglion cells. 1st Class.

Scholarships and Fellowships Awarded
2009
Australian Post-graduate award – Terence Middleton

Manuscripts Refereed for Journals
2008–2009 (5)

Grant & Award Applications Assessed
2008
Argentinean National Science Agency (2)

2009
ARC (1), Argentinean National Science Agency (1)

Service to the University
University Committees
Member, Animal Ethics Committee (2008–)

Grant Funding

<table>
<thead>
<tr>
<th>Grant Scheme</th>
<th>Project Description</th>
<th>Investigator(s)</th>
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<tr>
<td>Univ Bridging Grant</td>
<td>The role of synaptic currents in shaping spatial and temporal tuning in retina ganglion cells</td>
<td>Protti DA, Solomon SG</td>
<td>2008</td>
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<td>ARC Discovery grant</td>
<td>Inhibitory control of retinal sensitivity</td>
<td>Solomon SG, Protti DA</td>
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Laboratory Personnel 2008-2009

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Affiliation</th>
<th>Year</th>
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<tbody>
<tr>
<td>Atomu Sawatari</td>
<td>Lecturer</td>
<td>University</td>
<td>2006-</td>
</tr>
<tr>
<td>Hyunchul Lee</td>
<td>PhD student</td>
<td>0.5</td>
<td>2006-</td>
</tr>
<tr>
<td>Michael Bourke</td>
<td>BSc(Hons) student</td>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Michael Bourke</td>
<td>PhD student</td>
<td>APA</td>
<td>2009-</td>
</tr>
<tr>
<td>Teresa Simonetti</td>
<td>BSc(Hons) student</td>
<td></td>
<td>2008</td>
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<tr>
<td>Teresa Simonetti</td>
<td>Honorary Assoc</td>
<td></td>
<td>2009</td>
</tr>
<tr>
<td>Bhavneet Singh</td>
<td>BSc(Hons) student</td>
<td></td>
<td>2008</td>
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<tr>
<td>Thomas Burton</td>
<td>BSc(Hons) student</td>
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<td>2009</td>
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Total effective full time personnel 2008: 4.5 2009: 4.5

Research Activities

During 2008 and 2009 two projects, both relating to the initial characterization of a putative ‘critical period’ of postnatal development in the mouse striatum, were completed and published. The first examined the expression of chondroitin sulfate proteoglycan (CSPG) structures, a known marker for neuronal circuit maturation, in the developing caudate/putamen of mice across the first few postnatal weeks. Our results revealed not only the presence of structures consisting of CSPGs in the striatum, but that they undergo a massive reorganization between the first and third postnatal weeks. This period is of particular importance, as many behaviours associated with striatal function, including goal directed exploratory behaviour and coordinated movements emerge during this time. As a follow up, the second study examined the effects of environmental enrichment (EE), an animal-friendly manipulation known to positively affect the rate of maturation of neural circuits, on the developing striatum, measured via the expression of these same CSPG structures, and the emergence of exploratory and coordinated motor behaviours. We found that when enriched from birth, pups exhibited both accelerated expression of perineuronal nets (PNNs), as well as a precocious emergence of striatum dependent activity. Both these studies were published in PLoS ONE.

Based on these findings, several new projects were initiated focusing on elucidating the role PNNs play in mature as well as developing cognitive neural circuits. In order to accomplish this, several new anatomical procedures as well as behavioural tasks have been introduced to the Lab.

Continuing collaborative work with the Leamey Lab has also led to some groundbreaking discoveries. Physiological examination using in vivo recording methods in mice missing the axon guidance protein Ten-m3, has revealed that the visual deficits exhibited by these knock out animals can be attributed to the fact that input from the two eyes are misaligned at the level of the primary visual cortex (V1). Binocular activation leads to a suppression of V1 activity, while activation of a single eye results in full recovery of cortical responsivity, mirroring previously published behavioural results. A start was made on a manuscript focused on this and further characterization of Ten-m3 KO mice.

Journal Articles

2008
2009

**Total Annual Citations**

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
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<tr>
<td>Atomu Sawatari</td>
<td>36</td>
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</table>

* ‘Lifetime’ = to end of 2009.

**Conferences and Symposia Organized**

2009
Member, local organizing committee for the 2010 *Joint Australian Neuroscience Society and Australian Physiological Society Meeting* to be held in Sydney in Jan 2010.

**Awards, Prizes and Other Recognition**

2009
Hyunchul Lee, Student poster prize, Australian Neuroscience Society.

**BSc(Hons) Awarded**

2008
Teresa Simonetti, 1st Class
Michael Bourke, 1st Class
Bhavneet Singh, 2nd Class

2009
Thomas Burton, 1st Class

**Service to the University**

*Faculty of Science Committees*
Member, School of Medical Sciences Teaching committee

**Grant Funding**

<table>
<thead>
<tr>
<th></th>
<th>Neural mechanisms underlying functional recovery</th>
<th>Leamey CA</th>
<th>Sawatari A</th>
<th>2008</th>
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<td>Rebecca L. Cooper Foundation</td>
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LABORATORY OF VISION AND COGNITION

SAMUEL G SOLOMON

Laboratory Personnel 2008–2009

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Funding</th>
<th>Years</th>
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<tbody>
<tr>
<td>Samuel G Solomon</td>
<td>Senior Lecturer</td>
<td>University / NHMRC</td>
<td>2006–</td>
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<tr>
<td>Aaron Camp</td>
<td>Postdoctoral fellow</td>
<td>NHMRC</td>
<td>2007–2009</td>
</tr>
<tr>
<td>Stefano Di Marco</td>
<td>Postdoctoral fellow</td>
<td>ARC</td>
<td>2009–</td>
</tr>
<tr>
<td>Chris Tailby</td>
<td>Postdoctoral fellow (0.2)</td>
<td>NHMRC</td>
<td>2007–</td>
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<tr>
<td>Selina Solomon</td>
<td>Research Assistant</td>
<td>ARC Centre of Excellence</td>
<td>2009–</td>
</tr>
<tr>
<td>Peter Farleigh</td>
<td>Programmer (Casual)</td>
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<tr>
<td>Cindy Guy</td>
<td>General Assistant (0.2)</td>
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<td>2006–</td>
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<tr>
<td>Erin Goddard</td>
<td>PhD Candidate</td>
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<td>2007–</td>
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<td>Lucy Parakhina</td>
<td>BSc(Hons)</td>
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<td>2008–</td>
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<tr>
<td>Nathan Coorey</td>
<td>BSc(Hons)</td>
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<td>Rajiv Wijesinghe</td>
<td>BSc(Hons)</td>
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<td><strong>Total effective full time personnel</strong></td>
<td><strong>2008: 5.2</strong></td>
<td><strong>2009: 10.2</strong></td>
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Research Activities

During 2008–09 our Laboratory studied the functional properties of nerve cells in the mammalian visual pathway. Previous projects were extended as follows.

With Aaron Camp, Mr Cheong and Chris Tailby we used extracellular recordings from nerve cells in the lateral geniculate nucleus (LGN) of the primate thalamus to show that the visual sensitivity of cells in the magnocellular pathway, but not those in the parvocellular pathway, is reduced by a very brief exposure to an effective visual stimulus. This shows that the sensitivity of visual pathways will change even within the normal duration of stable eye position, such as occurs when reading a word in a book, or looking at a street sign while driving. In the same experiments we were able to show that a small extension to a major model of visual processing is able to capture most of the response properties of nerve cells in the retina and LGN, including much of this adaptive processing.

In collaboration with Dr Stefano Di Marco and Dr Protti’s Laboratory we used whole-cell recordings from retinal ganglion cells in mouse in vitro to determine if this adaptive processing is generated by the changes in excitatory inputs to ganglion cells or the inhibitory inputs. Unexpectedly we found that both are adaptive, but what adapts differs between the distinct subclasses of ganglion cells. This has major implications for understanding the signals that the retina provides, and in developing a bionic eye. With Rajiv Wijesinghe we then used whole-cell recordings in mouse brain slices to see how the retinal signals might be transformed by nerve cells in the LGN. We found that the sensitivity of the LGN is set by variability in background activity (that does not normally lead to the generation of action potentials) – with more variability the sensitivity increases. This may provide a simple account of why the functional properties of the thalamus seem to depend on arousal level – so that as the overall activity of the brain increases, so the transmission of sensory signals will improve.

With Dr McDonald, Nathan Coorey, and Prof. Clifford from the School of Psychology, we have started to measure the responses of nerve cells in an area of the primate visual cortex that is exquisitely sensitive to visual motion. We have been measuring the properties of small ensembles of nerve cells and learning how the brain may decode their signals to retrieve the motion of objects in the external world. This is important to understand because deficits in motion sensitivity are an early indicator of many retinal diseases – including glaucoma – but we do not know why.
Journal Articles

2008

2009

Total Annual Citations

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<tr>
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* 'Lifetime' = to end of 2007.

Conference Abstracts and Presentations

(O, oral; P, poster; P+O, poster with short oral)

2008

2009
Official for Scientific Societies, including for National and International Conferences
Member, Australian Neuroscience Society Scientific Program Advisory Group (2008–).
Co-Chair, Local Organising Committee, Australian Neuroscience Society Annual General Meeting 2010 (co-conference with the Australian Union of Physiological Sciences) (2008–).

Conferences and Symposia Organized
2008
Early Career Researcher Forum
2009
Early Career Researcher Forum

Invited Presentations at National and International Conferences
2008
2009
Workshop on Gain Control, Normalization, and Canonical Neural Computation, La Pietra Conference Center, Italy, Apr. 2009,
 Eccles Neuroscience Institute, Australian National Univ, Mar 2009.
 Bosch Institute Annual Scientific Meeting, Jun 2009, Sydney.

Awards, Prizes and Other Recognition
2008
Biomedical (R.D. Wright) Career Development Award, National Health and Medical Research Council of Australia

BSc(Hons) Awarded
2008
Parakhina L. Interaction of colour and shape in the perception of contours. 1st Class.
2009
Coorey N. Functional organisation and motion integration in the middle temporal visual area of the marmoset monkey. 1st Class.
Wijesinghe R. The state dependent firing properties of thalamocortical relay cells. 1st Class.

Manuscripts Refereed for Journals
2008 (15)
2009 (7)

Grant & Award Applications Assessed
2008
 National Science Foundation (1)
 ARC Discovery Projects (2)
2009
 ARC Discovery Projects (2)
Service to the University
University Committees
Co-organiser, Early Career Researcher Research Showcase (2008–09)

Faculty of Medicine Committees
Deputy Coordinator, Discipline of Anatomy & Histology Honours Research Program (2007–)

Faculty of Science Committees
Treasurer, Member of Council, Centre for Human Aspects of Science and Technology, Univ of Sydney (2007–)

Grant Funding

<table>
<thead>
<tr>
<th>Source</th>
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<td>Large Equipment Fund</td>
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LABORATORY OF RETINAL AND CEREBRAL NEUROBIOLOGY

JONATHAN STONE

Laboratory Personnel 2008–2009

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<td>Charean Adams</td>
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<tr>
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Total effective full time personnel 2008: 4.0 2009: 8.0

Research Activities

In October 2007, Professor Stone re-joined Physiology, after a term at the Australian National University where he was the Director of the Research School of Biological Sciences. Prof Stone had previously been the Challis Professor of Anatomy at the University of Sydney from 1987–2003, and Lecturer in Physiology in 1966. He completed his PhD in the then ‘Department’ of Physiology in 1965.

During this current period his Laboratory undertook studies in models of retinal and cerebral degeneration. In the retina, the group’s work demonstrated the ability of retinal cones to self-repair in a rod-mutant model of retinal dystrophy. This was an important step to clinical translation, using light restriction. The group also analyzed signalling mechanisms involving gene expressions induced in the retina by oxygen, and by two major neuroprotectants (saffron and photobiomodulation). Evidence was also produced showing that, in vivo, mitochondria migrate along oxygen gradients to adopt characteristic, and physiologically important, locations in the cells. Other retinal work involved analysis of the rate-dependence of cone-rod survival interactions.

In the brain, the group explored the formation of senile-like plaques in a rat model, showing the key role played by haemorrhage in plaque formation. This is now under active experimental testing and provides a basis for translation. The group also contributed to evidence that photobiomodulation delivered transcranially can provide neuroprotection against Parkinson-inducing pathology.

Lastly the therapeutic potential of photobiomodulation in retinal diseases was studied.

Prof. Stone set up neuropathological and electroretinography laboratories with Professor Mitrofanis (Anatomy & Histology). They also set up animal holding and testing facilities adjacent to the Edward Ford Building (A27A) on campus and are establishing transgenic mouse holding and breeding setups in the new Bosch Animal House. The Lab is developing microscope and stereology facilities jointly with Prof. Dampney’s group, taking some pressure off the over-subscribed Bosch Advanced Microscopy Facility.

The translation of the Lab’s scientific findings into clinical trials began with a successful trial of saffron in age-related macular degeneration. This was a rigorous (double-blind, cross-over, placebo-controlled) trial, which demonstrated a remarkable recovery of macular function in 23 of 25 patients. Follow-on trials are underway, and being planned (below). The result gained wide publicity for the Univ of Sydney, as well as for the Italian universities involved (the Catholic University of Rome and the University of L’Aquila).

At the University of Sydney, collaborations were formed with Prof. Peter McCluskey and Dr John Grigg at the Save Sight Institute, together with Dr Benedetto Falsini (Rome) and Prof. Silvia Bisti (L’Aquila). We plan on applying for ethical approval for a series of trials, extending the Italian observations to the Save Sight Institute context, and extending the ideas conceptually.
Journal Articles
2008
2009

Chapters in Books
2008
2009

Magazine Articles
2008

Invited Presentation at International Conference
2009
**Total Annual Citations**

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*‘Lifetime’ = to end of 2009.

**H-index** = 54

**Service to the University Community**

Convenor, Anderson Stuart Heritage Committee (2008–)

Prof Stone’s work to improve the heritage aspects of the Anderson Stuart Building began in the 1990s, when a successful appeal to graduates was initiated. Working with the interest on the funds donated (currently value $1.1 million) the Committee has overseen numerous small jobs, which amount to a detailed refurbishment of heritage aspects of many corridors and windows, surfaces and vestibules. The Committee has formulated 4 major refurbishment projects, of which one (the liberation of the eastern stained windows) is expected to become possible soon in the context of classroom reconstruction in the Discipline of Anatomy.

**Service to the research community**

Trustee of the private charitable trust, the Sir Zelman Cowen Universities Fund, representing the Univ of Sydney (1995–). The Trust has awarded every second year the Sir Zelman Cowen Universities Prize for Discovery in medical research; a total of three awards so far (2006, 2008, 2010).

**Collaborations within the University of Sydney**

Prof John Mitrofanis – use of transcranial photobiomodulation as a neuroprotectant in models of Alzheimer’s and Parkinson’s diseases (2007–)

Prof Peter McCluskey and Dr John Grigg - clinical trials of light restriction, saffron and photobiomodulation in age-related macular degeneration (2007–)

Prof Jürgen Götz – neuroprotection in a mouse model of Parkinson’s disease (2007–)

**International collaborations and visits**

Prof Janis Eells, Univ of Wisconsin, Milwaukee, USA, who is a pioneer of photobiomodulation

Prof Eli Keshet, Hebrew Univ of Jerusalem, who is a major contributor to the field of angiogenesis

Prof Silvia Bisti, Univ of L’Aquila, who discovered the therapeutic potential of saffron

Prof Benedetto Falsini, Catholic Univ of the Sacred Heart, Rome; who is leading our clinical trials.

**Research students**

Prof Stone supervised 3 Talented Student Programme students and 4 medical students undertaking small research projects.

Three PhD students from Prof Bisti’s Lab have spent extended periods in the Stone Lab (Stefania Romeo, Fabiana di Marco and Linda Colecchi). The visits of 2 of the students were assisted by the School of Medical Sciences, in response to the damage to Professor Bisti’s Labs caused by the 2009 earthquake.

**Grant Funding**

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## JOURNALS OF PUBLICATION

Number in each, and ranking for Discipline of Physiology in the last five years

From SCI® Journal Citation Reports: based on source items in 2009

The rankings of journals are made according to the 2009 SCI® Science Citation Index ‘impact factor’, which is a measure of the frequency with which the ‘average article’ in a given journal in a given year has been cited in a given year. It is a ratio between citations and citable items published. The 2009 impact factor for a journal has been calculated by dividing the number of all the SCI® Science Citation Index source journals’ 2009 citations of articles that journal published in 2008 and 2009 by the total number of source items it published in 2008 and 2009. For all journals covered by the Index, a plot impact factor score vs number of journals with that score gives a distribution skewed towards the higher scores and having a median of 0.6 and a mode of 0.1. (In the left column below NL means that the journal has not been listed in the index.)

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5 Year Total: 267

Mean ± SD of impact factors for journals of publication:

- 2008: \(4.05 \pm 2.67\)
- 2009: \(3.97 \pm 1.70\)
- Five years of publication (2005—2009): \(4.03 \pm 2.93\)

% published in top 5% of journals (i.e., impact factor > 3.5) = 48% over the five years of publication
## Grant Funding Totals

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### Abbreviations

- **ARC**: Australian Research Council
- **CancerAus**: Cancer Australia
- **CFA**: Cystic Fibrosis Australia
- **MDA (USA)**: Muscular Dystrophy Association - USA
- **NHF**: National Heart Foundation
- **NHMRC**: National Heath & Medical Research Council
- **Ramaciotti**: Ramaciotti Foundation
- **RCMRF**: Rebecca L. Cooper Medical Research Foundation
- **RIBG**: Research Infrastructure Block Grant
- **Sesqui**: University of Sydney Sesquicentenary Research Grants
- **Simons**: Simons Foundation
- **USRG**: University of Sydney Research Grant
- **USYD**: University of Sydney