

Annual Report

BIO21 MOLECULAR SCIENCE AND BIOTECHNOLOGY INSTITUTE

www.bio21.unimelb.edu.au





Introduction

The University of Melbourne's Bio21 Molecular Science and Biotechnology Institute (Bio21 Institute) is a multidisciplinary research centre specialising in medical, agricultural and environmental biotechnology and nanobiotechnology.

Our vision is to improve health and the environment through innovation in biotechnology and related areas, driven by multidisciplinary research and dynamic interactions with industry.

This vision was built on the premise that multidisciplinary ventures between life sciences, physical sciences and engineering disciplines, including the exploitation of 'omics' technologies, was fundamental to translating biological discoveries into biotechnology outcomes.

Located in the heart of the Parkville Precinct, the Institute accommodates 600 research scientists, students, professional staff and industry participants, making it one of the largest biotechnology research centres in Australia.

Our Goals

The goals of the Bio21 Institute are to

- Achieve biotechnology innovation through worldclass interdisciplinary research in biomedical, agricultural and environmental biotechnology
- Establish core platform technologies available to a wide cross section of the science and industry communities
- Translate research into educational, economic and community benefits
- Enhance research and training programs
- Provide a forum for community debate

As a flagship facility in the heart of the Parkville Biotechnology Precinct, the Bio21 Institute's expertise and state-of-the-art platforms, provide the foundation for collaborative research across the University, Bio21 Cluster organisations and the broader biotechnology community.

History of the Site

- The Bio21 Institute is built in the grounds of the University of Melbourne's Veterinary Precinct (now Western Precinct) which was established in 1908.
- From the late nineteenth century the site was a livestock market. The heritage-listed remains of the market wall stand by the entrance of the Institute. A horse head sculpture from the market entrance stands at the corner of Story Street and Park Drive.
- In 1930, CSIRO established the Animal Health Research Laboratory on the site.
- In 1996, CSIRO Animal Health moved from Parkville to Geelong. One of the former CSIRO buildings now serves as the Bio21 Institute Business Incubator.
- In 2001, the State Government donated the land in the Western Precinct (previously a Crown Lease to the University of Melbourne) as part of their contribution to the Bio21 Project.
- Building of the Bio21 Institute commenced in May 2002 and the first phase was completed in December 2004.
- The major funding contributors to the construction of the Bio21 Institute building were Atlantic
 Philanthropies, The University of Melbourne, State Government and Commonwealth Government.
- The Bio21 Institute was officially opened in June 2005.



The Bio21 Institute logo with its interlocking rings represents the Institute's strategy – to embrace the partnership between the University, industry and the community.



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Director's Message



In 2010, the Bio21 Institute celebrated its five year anniversary. The journey since inception has been exciting spanning the establishment of a world class research facility with high end platform technologies to the co-location of high caliber researchers from multiple disciplines and industry partners. These elements combined are the foundation for achieving our mission to be a world leader in basic and strategic interdisciplinary research and biotechnological innovation that underpins the life sciences sector.

It is timely to recognise the efforts and achievements of our inaugural Director, Professor REH (Dick) Wettenhall. Professor Wettenhall's vision for the Bio21 Institute and his determination to implement the vision provided the foundations for this world class Institute.

Throughout 2010, the Bio21 Institute continued to develop and grow in key strategic areas. These include research and research training, partnerships and engagement, science education and outreach, commercialisation and economic outputs.

The interdisciplinary nature of the Institute, supported by world class infrastructure and the recognised excellence of the research output of our members underpins our standing as an Institute of choice for researchers both in Australia and abroad. In 2010, we celebrated multiple researcher awards and achievements including two ARC Laureate Fellowships awarded to Professor Ary Hoffmann and Professor Paul Mulvaney.

Our commitment to fostering industry partnerships and collaborations has resulted in a number of significant relationships particularly with our anchor tenant, CSL Ltd. This along with the breadth of our interactions with our bio-incubator SME tenants, industry collaborators in Cooperative Research Centres and Centres of Excellence, add to the opportunities that come from bridging the gap between academia and industry. In 2010, the new Centre for Aquatic Pollution Investigation and Management was launched at the Bio21 Institute with the Hon Gavin Jennings, Victorian Minister for Environment, Climate Change and Innovation.

An extension to the Bio21 Institute's portfolio is our leading role in facilitating the University's biotechnology agenda. Building on the organisation's commitment to establishing a range of multidisciplinary institutes to tackle major societal issues, the Bio21 Institute has actively engaged in cross institutional collaborations. These include the Materials, Energy and Neurosciences Institutes. Our complementarities will allow us all to explore the potential synergies and opportunities.

This depth of engagement is also being explored with organisations across the broader Parkville Precinct. For instance, the emerging field of bioinformatics is a key area that has connected Institute researchers with the capabilities provided by the Victorian Life Sciences Computational Initiative and the IBM Collaboratory. In addition the benefits of our location in one of the world's most concentrated areas of biomedical research and our founding role within the Bio21 Cluster provides a significant opportunity for major initiatives, including infrastructure and research programs.

Our reputation and capacity in establishing high level instrumentation across a range of key platform technologies continued throughout 2010 resulting in two successful ARC Large Infrastructure and Equipment Grants. Working alongside fellow technical experts and likeminded organisations, our collective strength will build a stronger network for progressing major initiatives.

The high caliber of our researchers and reputation as a flagship biotechnology research centre, both in Australia and internationally, provides us with the opportunity to showcase our research and facilities to a range of visitors. These include senior delegations from government and industry and members of the broader scientific community. In 2010, the Bio21 Institute hosted more than 35 conferences and major events, 100 seminars and 25 visits and tours. We were also pleased to host a number of high profile visitors including Australia's Chief Scientist, Professor Penny Sackett.

A major achievement for the Institute in 2010 was the announcement of the development of a Science Sub-School to be located at the Bio21 Western Precinct site. A collaboration with the Victorian Government's Department of Education and Early Childhood Development, University High School and Debney Park Secondary College, the initiative involves all the science and technology faculties and the Graduate School of Education from the University. An exciting initiative aimed at inspiring passionate secondary school students and transforming future science curriculum.

Internally the Institute made a significant undertaking to establish three key areas of research specialisation to focus the interdisciplinary research direction and outcomes. These key themes also reflect the

University's, National and State research priorities as well as those of the biotechnology industry sector.

From an operational standpoint, the implementation of a new management structure in 2008 was bedded down in 2010 providing opportunity for the Bio21 Institute to be represented at all levels of the organisation.

Operationally we have been integrated into the Faculty of Science whilst reporting to the Deputy Vice Chancellor (Research) on strategic matters. Opportunities to further enhance our governance are being implemented with the underlying principle of developing a "whole-of-institute" approach.

At the heart of the Bio21 Institute is the community of 600 members, two thirds of who are early career scientists. Our commitment to the development of this future generation will allow us to confidently look towards a bright future that challenges the boundaries of discoveries and knowledge.

Looking forward, the Bio21 Institute will continue to increase its output and impact in key areas of research, research training, infrastructure, industry partnerships and community engagement.

Lastly, the Director's Message provides me with the opportunity to acknowledge the skills and dedication of the Bio21 Institute staff and management. The team provides a seamless operation that enables researchers to conduct world-class research and research innovation.



Professor Tony Bacic Director Bio21 Molecular Science and Biotechnology Institute

Governance, Structure and Operations

The Bio21 Institute is a large and complex multidisciplinary research environment involving a diverse research community, high-end scientific instrumentation and external industry and researcher interactions. To support the operation and management of the Institute, a range of committees representing key stakeholders, areas and functions have been established with membership from across the range of resident groups and affiliated departments.

Committees include:

- Bio21 Institute Governance Group
- Associate Director's / Executive Group
- Bio21 Institute Management Advisory Committee
- Animal House Facility Management Committee
- Stores Facility Management Committee
- Environmental Health and Safety (EHS) Committee
- Information Technology Management Committee
- Microscopy and Nanotechnology Facility
 Management Committee
- NMR Facility Management Committee
- Mass Spectrometry/Peptide/Proteomics Facility Management Committee

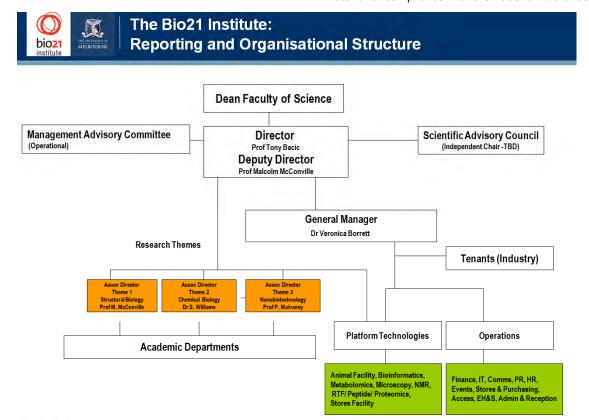
Underpinning the Bio21 Institute's research and technology capabilities is a portfolio of operational, administrative, maintenance and research support activities. These include management of high end laboratory facilities, common areas, communications, event management and conference facilities, meeting spaces, laboratory services, administration and EHS for more than 560 University researchers plus approximately 80 industry members.

Environmental Health and Safety

The Bio21 Institute is committed to creating a safe environment for all staff, students and visitors. This includes developing risk management within its boundaries, safety policy and review compliance with the National Audit Tool, OHS legislation and environmental legislation.

The Bio21 Institute EHS Committee operates as a working group for promulgation of safety standards, ensuring compliance and escalation of issues requiring resolution. Following the Institute review in 2007, a "whole-of-institute" approach to EHS was mandated. The move to this new approach was successfully completed in 2010. This progressive and cooperative approach, ensures policies and procedures within the institute have priority over those of departments.

In 2010, the Bio21 Institute was audited by WorkSafe Victoria for compliance with the National Audit Tool.





Research Excellence



Printable solar cells within reach

Victorian researchers welcomed a \$5 million grant from the Victorian Government to help commercialise their revolutionary technology, potentially opening the door to inexpensive, mass produced solar panels. The grant forms part of Victoria's Science Agenda Strategic Project Fund and was announced at the annual OzBio2010 Conference's Public Forum in October.

Researchers from the University of Melbourne, CSIRO and Monash University teamed up with industry partners including BlueScope Steel, Securency International, Innovia Films and Robert Bosch South East Asia to form the Victorian Organic Solar Cell Consortium (VICOSC).

The technology has the potential to revolutionise the energy industry and will bring Victoria one step closer to achieving a sustainable future. The consortium was also successful in receiving \$1.76 million additional funding from Victoria's Sustainable Energy Research and Development fund plus an additional \$1.76 million of matching funds from the Australian Solar Institute. (Picture: VICOSC)

Huntington disease discovery provides new hope for treatment

Huntington's disease is a genetic disease with no cure, characterised by a steady decline in motor control and the dysfunction and death of brain cells. The cause of the disease has long baffled scientists.

A research study by Dr Danny Hatters and colleagues from the Department of Biochemistry and Molecular Biology identified the behaviour of the mutant protein 'huntingtin' which leads to the fatal Huntington's disease.

Using state of the art technology, Dr Hatters and his colleagues observed how human mutant 'huntingtin' proteins form into large clumps, which kills brain cells and leads to progressed Huntington's disease.

The discovery will help to develop a targeted treatment that shuts down the key processes causing the clusters to form and for the disease to progress.

Their research techniques could also have application in assisting to find drug targets for other neurodegenerative diseases where toxic clusters of proteins play a role in the progression of the disease, such as for Parkinson's disease.

The research was published in the Journal of Biological Chemistry.

New centre to revolutionise waterway pollution management

The Victorian Centre for Aquatic Pollution Identification and Management (CAPIM) was officially launched in 2010. The centre will take a novel approach to tackling aquatic pollution in Victoria's inland waters and estuaries with its main research centre located at the Institute. The University of Melbourne, with CAPIM Research Director Professor Ary Hoffmann and CEO Dr Vincent Pettigrove, lead the centre with experts from Melbourne Water, Department of Primary Industries (DPI) (Vic), Environment Protection Authority (EPA) (Vic), and RMIT. Research activities include identifying pollutants and potential pollution hot spots, identifying sources and impacts of pollutants, developing and deploying mitigation strategies and ongoing monitoring of the waterways.

CAPIM received \$2.94 million of Victorian Science Agenda Investment Funding over three years from 2010, with additional funding being contributed by partners Melbourne Water, DPI Victoria and EPA Victoria. (Picture: CAPIM)



2010 Additional achievements

Professor Suzanne Garland, head of the Women's Centre for Infectious Diseases, Royal Women's Hospital, located at the Bio21 Institute was recognised in the 2010 edition of the 'NHMRC's 10 of the Best Research Projects' publication. Professor Garland was awarded \$372,750 for the project focusing on 'Infectious diseases research in reproductive health: particularly of women and babies' (period 2004-2008).

Professor Richard O'Hair, School of Chemistry, was recognised by leading mass spectrometry journal 'JASMS - Journal of the American Society for Mass Spectrometry - for being one of the top 53 contributors to the journal between 1999-2009. Professor O'Hair was the only Australian scientist to have been included amongst a list of internationally distinguished scientists.

NHMRC Neurodegeneration Program led by Professor Colin Masters was awarded \$14 million. The program includes researchers from multiple disciplines at Bio21 Institute including Professor Roberto Cappai and Associate Professor Kevin Barnham (Pathology Department) and Associate Professor Andrew Hill (Biochemistry and Molecular Biology).

Professor Tony Bacic with colleagues from the School of Botany and the Plant Cell Biology Research Centre at the University of Melbourne were awarded \$6.475 million over seven years for the ARC Centre of Excellence in Plant Cell Walls. Working with collaborators at University of Adelaide, industry and research partners, the Centre of Excellence will build on international research in plant science which includes the central roles of cell walls as renewable sources of transport fuels, as functional foods to improve human health and as a source of raw materials for industrial processes.

Awards and Recognition

ARC Laureate Fellowships

ARC Federation Fellows, Professor Ary Hoffmann (below right) and Professor Paul Mulvaney (below left) were among 15 of Australia's best researchers awarded the prestigious ARC Laureate Fellowships. Worth around \$3.1 million each, the fellowships support team-based research tackling urgent and complex issues delivering significant benefits to Australia and the wider world.

Professor Hoffmann, an international authority on environmental stress monitoring, controlling pests and predicting how species will respond to climate change leads a project focused on maintaining environmental health under the combined stresses of climate change and human population pressures. In particular, the Fellowship will help develop guidelines for sustainable agricultural production as well as biodiversity protection in threatened environments like the Australian Alps and freshwater ecosystems.

Professor Mulvaney, world-renowned for his work in nanotechnology, will lead a project that will explore the practical limits for plasmonics: the manipulation of light using metal nanostructures. In particular, the expected outcomes include the optical detection of single electrons, the detection and monitoring of chemical reactions one molecule at a time, and demonstration of light-driven logic gates.





Australian Academy of Science Fellow

Professor Michael Parker (above) was one of 17 leading Australian scientists elected as a Fellow of the Australian Academy of Science. The prestigious award is one of the country's highest honours recognising a career that significantly contributes to the world's scientific knowledge.

Professor Parker is recognised for his work on protein crystallography of membrane-associated proteins that play a role in infection, cancer and neurobiology. By determining three dimensional structures of medically important proteins using techniques such as X-ray crystallography, we can improve our understanding of how each protein works and contributes to disease. Importantly, these structures are proving very useful in the discovery of potential drugs.



Cancer work wins Chemist a Victoria Fellowship

Dr Michelle Ma (above) from the School of Chemistry was one of six young Victorian scientists to win a prestigious Victoria Fellowship. The Victoria Fellowships are each worth \$18,000 and recognise young researchers with leadership potential. The awards aim to enhance their future careers, while developing new ideas which could offer commercial benefit to Victoria.

Dr Ma used the fellowship to travel to King's College London to research compounds she developed as a postgraduate student for use in early stage cancer detection. Initial work on these compounds led to a patent filing and to the formation of a start-up company: Clarity Pharmaceuticals Pty Ltd. The compounds have attracted international interest from scientists in the area of molecular diagnostics. Clarity Pharmaceuticals will be involved in commercialising the molecular imaging agents that Dr Ma has developed with the assistance of a Kaye Merlin Brutton Bequest. (Photo: Peter Glenane)



ARC Future Fellowship awarded

Associate Professor Andrew Hill (above) from Department of Biochemistry and Molecular Biology was awarded an ARC Future Fellowship for the project: "Investigating the intercellular trafficking of proteins and RNA and its relevance to neurodegenerative diseases". Alzheimer's and prion diseases are neurodegenerative disorders associated with protein misfolding. This project brings together similar features of these diseases using novel cell- and animal-based studies to develop a greater understanding of the molecular basis of these disorders. (Photo: Gavin Blues)



JCU Outstanding Alumnus

Professor Tony Bacic (above) was one of 19 graduates recognised as a James Cook University Outstanding Alumnus in 2010. As part of the University's 40th anniversary celebrations, awards were made to recognise graduates of James Cook University and the University College of Townsville who made an outstanding contribution in their field of endeavour. Professor Bacic graduated his BSc Hons from James Cook University of Nth Queensland in 1975.

2010 Additional Achievements

Major Awards and Prizes

ARC Laureate Fellowships awarded to Professors Ary Hoffmann and Paul Mulvaney

Fellow of Australian Academy of Science, Professor Michael Parker

Honorary Fellow of the Royal Australian College of Dental Surgeons, Professor Eric Reynolds

James Cook University Outstanding Alumni, Professor Tony Bacic

ARC Future Fellowship and NHMRC Senior Research Fellowship (Honorary) awarded to Associate Professor Andrew Hill

NHMRC Senior Research Fellowship awarded to Dr Kevin Barnham

Australian Academy of Science Fenner Award awarded to Dr Brian-Greig Fry

Victoria Fellowship awarded to Dr Michelle Ma

Robertson Award awarded to Professor Frances Separovic

Merck Research Excellence Medal awarded to Associate Professor Andrew Hill

Biota Award for Medicinal Chemistry awarded to Dr Spencer Williams

RACI Birch Medal 2010 awarded to Professor Mark Rizzacasa

RACI Burrows Medal 2010 awarded to Professor Tony Wedd

RACI Rennie Medal 2010 awarded to Dr Paul Donnelly

Research Facts and Figures

- Total grants income \$30 million
- Research Higher Degree students in 2010 >220
- Postdoctoral Research Fellows > 170
- More than 400 Publications increase of 13% compared with 2009
- Research group leaders 36
- Independently funded research fellows 34%

New major funding success

- Victorian Organic Solar Cells Consortium \$13.25 million – Victorian Science Agenda Strategic / SERD2 / Australian Solar Institute with involvement from the Energy Institute
- Victorian Centre for Aquatic Pollution Identification and Management \$2.94 million (2010-13)
- NHMRC Neurodegeneration Program grant \$14 million
- Oral Health Sciences CRC \$10.2 million (2010-16)
- ARC Centre of Excellence in Plant Cell Walls \$6.475 million (2011-2017)

New grants

- ARC Discovery Projects 8
- NHMRC 8
- ARC Large Infrastructure & Equipment Funding 2
- University of Melbourne Interdisciplinary Grants 2010 – 5
- University of Melbourne Interdisciplinary Grants 2011 – 6

The Bio21 Institute 2010 Annual Report Appendix provides a comprehensive list of grants received and publications as part of our researcher profiles. The Appendix is available on our website at www.bio21.unimelb.edu.au



Multidisciplinary participation

The Bio21 Institute's three research themes and the multiple centres and programs are built on the strong foundation of our diverse disciplinary expertise that underpins the basic and applied research within our individual groups. Their individual excellence and success combined with their commitment to develop cross disciplinary interactions are the catalyst for the future programs that tackle some of society's issues

More than 15 departments are directly engaged with the Institute, either as resident researchers, or users of the Institute's core platform technology facilities. Current occupants of the Institute include 36 research groups from three faculties – Medicine, Dentistry and Health Sciences, Engineering and Science.

Research groups from additional departments of the Faculties of Veterinary Science and Melbourne School of Land and Environments are collaborating with institute based researchers and are users of the platform technology facilities.

In 2010, 600 researchers were located at the Bio21 Institute with the largest groups from the School of Chemistry, Department of Biochemistry and Molecular Biology, Genetics/Zoology and Dental Science. In addition, more than 30% of the Institute members are either BSc Honours, Masters or PhD students. Together with the population of research assistants and postdoctoral research fellows at Bio21 Institute, more than 65% of researchers at Bio21 Institute are early career scientists.

(Refer to the end of this section for the Bio21 Institute's Research and Management profile.)

Excellence in Research Australia

The high quality of Bio21 Institute research was highlighted in the Excellence in Research Australia (ERA) benchmarking exercise.

Researchers located at the Bio21 Institute performed at well above world standard in five disciplines. These include: Macromolecular and Materials; Physical Chemistry including structural; Evolutionary biology; Medicinal Biochemistry and Metabolomics; Dentistry.

We performed above world standard in three disciplines Genetics; Biochemistry and Cell Biology; Inorganic Chemistry.

Lastly, we achieved world standard in the remaining four disciplines: Analytical Chemistry, Theoretical and Computational Chemistry, Medicinal and Biomolecular Chemistry and Organic Chemistry.

Pictured: The community of Bio21 Institute researchers. (Photo: M Silver.)



Bio21 Institute based interdisciplinary collaborations

Many of the interdisciplinary research collaborations based within the Bio21 Institute have arisen since the establishment and co-location of researchers, many resulting in new grant success and industry engagement. More than twenty interdisciplinary research collaborations are currently underway. These include:

Chemistry - Pathology

Separovic / Barnham – Neurodegenerative diseases Donnelly / Barnham – Therapeutics in neurodegeneration

Pathology - Biochemistry & Molecular Biology

Cappai/Barnham / Hill – Structure function relationships that cause neurodegeneration Barnham / Hutton – Dityrosine cross linked A beta peptide dimmers in Alzheimer's disease

Chemistry / Biochemistry & Molecular Biology

Williams / McConville – Synthetic carbohydrate chemistry, chemical approaches to the study of mycobacterial and leishmania glyconjugates

Hutton / Perugini – Inhibitors of enzymes in the lysine biosynthetic pathway as potential new antibacterial agents

White / Dobson – Structural studies on DNA drug complexes

Donnelly / Hill – Therapeutics in neurodegeneration

O'Hair / Purcell - Mass spectrometry of proteins

O'Hair / Gooley - Structure of amyloid fibrosis and their oligomeric intermediates

Perugini / Mulvaney - Size and stoichiometry of liganded nanoparticles

Perugini / O'Hair – Gas phase fragmentation of protein-protein, lipid-lipid and lipid-metal complexes

Perugini / Separovic –Self assembly of peptide nanoparticles

Chemistry / Bio21 Institute / Medicine

Williams / Stapleton /Kelly – Medicinal chemistry for the treatment of fibrosis in Type 1 diabetes

Chemical & Biomolecular Engineering / Chemistry

Gras/Wedd - DNA assembly

Chemical & Biomolecular Engineering / Biochemistry & Molecular Biology

Gras / Gooley - Effect of prebiotics on intestinal microbiota

Genetics / Zoology / Biochemistry & Molecular Biology / Bio21 Institute

Robin / Gooley / Parker / McConville / Batterham – Structural analysis of a glutathione S-transferase implication in insecticide resistance

Chemistry / Zoology / Genetics

Wille / Hoffmann – development of Drosophila based biomarker assay for atmospheric pollutants

Genetics / Chemistry

Batterham / O'Hair - Insecticide resistance

Genetics / Bio21 Institute

Batterham / Parker – Structural analysis of ligand gated ion channels as targets of insecticides

Biochemistry & Molecular Biology / Bio21 Institute (Bioinformatics)

Likic / McConville – Systems biology of Leishmania parasites

Bio21 Institute Interdisciplinary Research

The Bio21 Institute has established research capabilities and activities that focus on exploring interdisciplinary opportunities in biotechnological innovation.

With in-depth capability in protein and gene technology, analytical and synthetic chemistry, nanomaterials science and engineering and biological test systems, as well as access to key platform technologies, researchers have the opportunities to develop interdisciplinary research programs offering synergies and the potential to contribute critical mass in strategically important areas.

In line with the Bio21 Institute's research strategy, three broad research themes were established in 2010 along with the appointment of three Associate Directors to help steer these themes.

Underpinning the Institute's vision, these themes will provide the focus to build on the synergies and programs that align our basic and strategic research strengths across medicine, science and engineering and with our key platform technologies.

Bio21 Institute Interdisciplinary Research Themes

- Structural Biology, which provides an understanding of the organisation of complex biological systems and molecular processes that underpin normal cellular development and disease
- Chemical Biology, the small molecules that impact on biological systems and environmental ecosystems or can be used to manipulate biological processes to provide the basis of novel therapeutics and insect control agents
- Nanobiotechnology that brings together the physical and life sciences with engineering, working at the sub-nano scale, to provide a new level of health, agricultural and environmental research

Structural Biology



Theme Leader
Deputy Director, Professor
Malcolm McConville

The Structural Biology theme covers a wide range of projects directed at understanding cellular processes that underpin normal cellular development and important human diseases. Many projects also focus on processes in microbial pathogens and insect pests with the view of developing new anti-infectives and agrochemicals.

Bio21 Institute platform technologies underpin these projects including NMR Spectrometry which helps determine protein structures, biomolecular mass spectrometry which allows for analysis of proteins, peptides and other small molecules, and high resolution microscopy for imaging of cells and protein dynamics *in vivo*. To complement the significant in-house technology, strong links have been established with key facilities including the Australian Synchrotron, the new Supercomputer Facility and the IBM Collaboratory being established at the University of Melbourne, the latter of which is being used to develop computational approaches for identifying new drugs for diseases such as malaria.

Chemical Biology



Theme Leader Associate Director, Dr Spencer Williams

Nanobiotechnology



Theme Leader Associate Director, Professor Paul Mulvaney

The Chemical Biology theme covers many of the existing research activities in the Institute with more than \$4million of competitive project grant funding awarded to research group leaders across multiple disciplines. These grants will enable research to continue in significant areas including bioactive small molecule synthesis and analysis and development activities for a broad range of therapeutics including antimicrobials, neurodegenerative disease as well as studies into the fundamentals of disease and novel interventional approaches.

Investing in our platform technologies is a key part of the institute's strategy. The success in a substantial ARC equipment grant that will enhance the materials characterisation capabilities of the Bio21 Institute NMR facility will enable the Institute to remain at the forefront in this field.

The Nanobiotechnology theme is focused on developing new materials for biology and new nanoscale instrumentation and techniques and their application to biotechnology. The theme brings together research groups from a range of disciplines including Chemical and Biomolecular Engineering, Chemistry and Pathology. A key project supported by Prof Paul Mulvaney's ARC Laureate fellowship is research into plasmonics, which will strive for single biomolecule detection

The Institute's range of high end electron microscopes, coupled with the expertise of the facility specialists, provide vital resources that underpin the range of projects in the field. A new Leica SP5 confocal microscope commissioned in 2010 expands the suite of high end microscopes at Bio21 Institute.

In addition to exploring the synergies and opportunities for collaboration within themes, cross thematic research interactions are also being developed. With the success of funds received for a Sustainable Research Excellence project 'Bioconjugations for chemical biology", researchers across the Chemical Biology theme and Nanobiotechnology theme are joining forces.

University Interdisciplinary seed funding

The University of Melbourne's commitment to tackling society's big picture issues is the aim of the Interdisciplinary Seed Funding Scheme. Launched in 2009 by the Deputy Vice-Chancellor (Research) Professor Peter Rathjen, the scheme provides funding for highly innovative, small to medium scale research projects that engage research from across disciplines and address complex societal challenges. The seed funding is expected to enhance future funding proposals to promote the broad research objectives of one or more of the research institutes.

Seven projects were supported by the Bio21 Institute and the University's Melbourne Research Office for commencement in 2010.

Projects focused on the development of new therapeutics including novel compounds for treating neurodegenerative diseases, antibacterials and novel therapeutics for preventing brain damage during trauma. Advanced analytical and computation approaches are also being developed to identify the metabolic fingerprint of drug like compounds to facilitate the identification of new drugs with minimal side effects.

Other projects involved human health including the use of NMR to study prebiotics and gut health, and new methods to increase the bioavailability of key nutrients in biofortified cereals. Funding to develop a special ophthalmoscope to image structures and different cell types in normal and diseased eyes provided new insights into normal eye development and disease progression.

In the 2010 round, funding for six projects was awarded, due to commence in 2011.

2010 Projects

- Integration of computationally demanding technologies to develop novel approaches to drug discovery – Dr A Stewart, Department of Pharmacology - \$50,000
- New therapeutics to minimize brain damage following trauma: new molecular agents for the upregulation of the neuroprotective protein Ndfip1 – Dr P Donnelly, School of Chemistry/Bio21 Institute -\$50,000
- Membrane recognition of antimicrobial peptides Professor F Separovic, School of Chemistry/Bio21 Institute, \$40,000
- Novel antioxidant drugs to treat neurodegeneration
 Dr S Williams, School of Chemistry/Bio21 Institute \$50,000
- Soluble fibre for increased gut health Dr S Gras, Department of Chemical and Biomolecular Engineering/Bio21 Institute - \$30,000
- Human nutrition and biofortification can micronutrient dense crops make an impact? – Dr A Johnson, School of Botany - \$50,000
- Multi-spectral adaptive optics retinal imaging using super-continuum laser light and novel nanocrystalline materials (with Materials Institute and Neurosciences Institute) – Dr A Metha, Department of Optometry and Vision Sciences -\$63,500

External collaborations

Cross institutional, national and international collaborations

High calibre research conducted within close proximity to the Bio21 Institute provides a major catalyst for researchers to come together and explore opportunities beyond their immediate research interests. In 2010, researchers at Bio21 Institute were actively collaborating with researcher colleagues from universities, institutes and hospitals across Victoria. They include the Ludwig Institute for Cancer Research, Walter and Eliza Hall Institute of Medical Research, CSIRO, LaTrobe University, Deakin University, Monash University, RMIT University, St Vincent's Institute for Medical Research, Royal Melbourne Hospital, Women's Hospital, Royal Children's Hospital and the Murdoch Children's Research Institute, Peter Mac Institute and Swinburne University.

Across the country and internationally, research collaborations continue to flourish building on the strength of existing relationships. Many new collaborations and strategic research projects have also been developed. These include opportunities fostered from mobility grants offered from organisations including the Australian Academy of Science.

The breadth of our international reach includes research collaborations across a number of organisations and countries. These include:

Austria - Innsbruck University; Graz University

Brazil - Ludwig Institute

Canada – McGill University; University of Toronto; University of Calgary;

China - Chinese Academy of Biophysics; Nanjing Agricultural University;

Czech Republic - Czech Academy of Sciences

Denmark – University of Copenhagen; Aarhus University **France** – Curie Institute

Germany – University of Munster; Liebniz-Inst of Plant Genetics and Crop Plant Research; Max Planck Institute; University of Ulm; University of Karlsruhe;

India - University of Kolkata;

Italy - University of Padova; CERM Florence;

Japan – Tohoku University; University of Nagasaki;

Korea - Hallym University; Kyunpook University

New Zealand – Massey University; Canterbury University;

The Netherlands - University of Groningen

UK - York University; Scottish Crop Research Institute; University of Dundee; Cornell University; Cambridge University; Reading University; University of Leicester; Durham;

USA – Energy Biosciences Institute; Virginia Tech; University of California; University of Pittsburgh; National

Institute of Health Bethesda; Scripps Institute; North Carolina University; Ohio State University; Stanford University; Vanderbilt University; University of Arkansas for Medical Sciences;

Sweden - Lund University

In 2010, the Bio21 Institute hosted more than 50 visiting scientists from industry and academia. This included scientists from both Australia and overseas ranging from short visits and meetings to sabbatical programs with participating research groups and departments. (Refer to the list of Visiting Scientists for further information.)

Strengthening international links

In 2010 a Memorandum of Understanding (MoU) was signed between the Bio21 Institute and Soon Chun Hyang (SCH) Center for Biopharmaceutical Research and Human Resources Development at SCH University in Korea.

Signed by the Bio21 Institute Director, Professor Tony Bacic and Chief Executive Director of SCH Centre for Biopharmaceutical Research and Human Resources Development, Professor Sang-Ki Rhee (pictured below), the agreement aims to promote and enhance cooperation for the mutual interest of both Centres.

Relations between the two centres have progressively developed during reciprocal visits by centre directors. During his visit to Korea in 2010, Professor Bacic had the opportunity to meet a number of students and faculty staff and to see first-hand the high caliber of the centre's research and training programs and facilities.

In 2010, 60 undergraduate students from SCH University visited the Bio21 Institute. Led by Professor Rhee and fellow senior faculty members, these excursions allowed students to discover the breadth of the research, industry engagement, technical expertise and technologies at the Bio21 Institute. (*Photo: Bio21 Institute.*)



Industry and Government Collaborations

Research projects with industry groups and government collaborators are steadily increasing. Many of the larger research programs are well positioned in their industry and or government interactions including the ARC COE for Free Radical Research, Victorian Organic Solar Cell Consortium and work conducted by the Neurodegenerative research program.

In 2010, new opportunities were recognised and awarded research funding for collaborative programs within Bio21 Institute. These include the new Oral Health Sciences CRC and Centre for Aquatic Pollution Investigation and Management.

Research opportunities for investigation with government departments have also been developed. These include the Defence Science and Technology Organisation, Australian Nuclear Science and Technology Organisation, Department of Primary Industries and Department of Sustainability and Environments, Melbourne Water, Environmental Protection Authority, Parks Victoria, CSL Ltd, Novartis, Dairy Innovation Australia, IBM.

Supporting the broader scientific community

The Bio21 Institute is an active member within the broader biotechnology community supporting a number of organisations. This includes Corporate Memberships, sponsoring events and programs and participating at and hosting events and conferences for the broader scientific community. In 2010, the Bio21 Institute participated in the Annual Ausbiotech Conference held in Melbourne. Australia's premier biotechnology event, Institute platform technologies were showcased as part of the Victorian Platform Technologies display.

Our memberships include:

- Ausbiotech
- BioMelbourne Network
- Bio21 Australia Ltd (Bio21 Cluster)
- Victorian Platforms Technology Network
- ANZAAS The Australian & New Zealand Association for the Advancement of Science

New Institute to focus on world leading defence research

The University of Melbourne has joined the Defence Science and Technology Organisation (DSTO) and the Victorian Government to establish a Defence Science Institute (DSI) that will use cross-disciplinary research to solve complex, long-term challenges for the Australian Defence Force (ADF). The DSI – which will engage researchers from the Bio21 Institute, Melbourne's Materials Institute, the DSTO, National ICT Australia, other Victorian universities and industry partners – will work towards future-proofing the nation's defence sciences which includes building awareness, knowledge and analysis of current and future 'on the ground' issues faced by the ADF.

A number of key themes have been established that will be led by co-theme leaders from DSTO and the University. Bio21 Institute based research group leader, Associate Professor Matt Perugini, co-led the theme focused on 'Innovation in biological and chemical systems'.

An important strategic partnership between the Department of Defence, the University of Melbourne and the Victorian Government, the Institute will help create smarter defence solutions for a safer Australia, and deliver the benefits of increased academic engagement together with the training and mentoring of PhD students.

Developing breakthrough approach to drug metabolism studies of biopharmaceuticals

The University of Melbourne announced a joint technology development project with life science analytical technologies company AB Sciex that could help to better determine the effectiveness and safety of biopharmaceuticals that are advanced through regulatory processes and ultimately sold on the consumer market.

The joint project is focused on developing standardised testing methodology based on a breakthrough mass spectrometry approach that Senior Research Fellow, Associate Professor Tony Purcell (Biochemistry and Molecular Biology) and Bio21 Institute Mass Spectrometry and Proteomics Facility Manager, Dr Nicholas Williamson pioneered on the AB Sciex QTRAP ® 5500 System.

2010 Research and Management Profile

Resident Departments and Research group leaders

Bio21 Institute

Dr Vladimir Likic (joint Metabolomics Aust)
Dr David Stapleton
Professor Michael Parker (joint Biochemistry)

Faculty of Medicine, Dentistry and Health Sciences

Biochemistry and Molecular Biology

Associate Professor Marie Bogoyevitch Associate Professor Heung-Chin Cheng Professor Paul Gleeson Associate Professor Paul Gooley

Dr Brian Grieg-Fry Dr Danny Hatters

Associate Professor Andrew Hill Associate Professor Geoff Howlett

Dr Terry Mulhern

Associate Professor Matthew Perugini Associate Professor Anthony Purcell

Dr Stuart Ralph

Associate Professor Ian van Driel

Dental Science

Professor Eric Reynolds

Obstetrics and Gynaecology

Professor Suzanne Garland (with Women's Hospital)

Pathology

Professor Roberto Cappai Associate Professor Kevin Barnham

Faculty of Science

Chemistry

Dr Paul Donnelly

Professor Andrew Holmes (joint Bio21 Institute)

Dr Craig Hutton

Professor Paul Mulvaney

Professor Richard O'Hair

Professor Mark Rizzacasa

Professor Carl Schiesser

Professor Frances Separovic

Professor Tony Wedd

Associate Professor Jonathan White

Dr Spencer Williams

Associate Professor Uta Wille

Genetics

Professor Philip Batterham

Zoology

Professor Ary Hoffmann (joint Genetics) Dr Charles Robin

Melbourne School of Engineering

Chemical and Biomolecular Engineering

Dr Sally Gras

Profiles of our research group leaders and their research interests, are available in the Bio21 Institute Annual Report Appendix available on our website at www.bio21.unimelb.edu.au

Affiliated departments

University of Melbourne departments and centres participate in Bio21 Institute programs and research collaborations. These include:

Anatomy and Cell Biology

Botany

Centre for Animal Biotechnology (Vet Science)

Centre for Nanoscience and Nanotechnology (Chemical

and Biomolecular Engineering)

Chemistry (main campus research groups)

Chemical and Biomolecular Engineering

Genetics (main campus research groups)

Medicine

Microbiology and Immunology

Pathology (main campus research groups)

Physics

Physiology

Surgery

Veterinary Science

Zoology (main campus)

Key Centres and Programs

The Bio21 Institute accommodates a number of research centres and programs including:

ARC Centre of Excellence for Plant Cell Walls (from 2011)

ARC Centre of Excellence Free Radical Chemistry and

Biotechnology

NHMRC Program for Neurodegeneration Diseases

NHMRC Program for Pathogen Research

Oral Health Co-operative Research Centre

Victorian Organic Solar Cell Consortium

Victorian Centre for Aquatic Pollution Identification and

Management

Women's Centre for Infectious Diseases

Bio21 Institute Platform Technologies

Electron Microscopy

Dr Eric Hanssen Dr Sergey Rubanov Mr Roger Curtain

Nuclear Magnetic Resonance

Dr David Keizer Dr Hamish Grant

Mass Spectrometry and Proteomics and Peptide Technology

Dr Nick Williamson Mr Paul O'Donnell Mr John Karas

Biological Research Facility

Mr Max Walker Ms Shiralee Whitehead Mr Carlos Chahine Mr John Borg Ms Shasta Brown Ms Tabatha Lovelace Ms Amy Lambalk Ms Lan Ta

Ms Samantha Zahra

NCRIS Metabolomics Australia (with School of Botany)

Professor Tony Bacic Professor Malcolm McConville Dr Uta Roessner (Botany) Dr Dedreja Tull (Bio21 Institute)

Dr Vladimir Likic (Bioinformatics)

Dr Saravanan Daylan Dr Amsha Nahid Dr Andrew Isaac

Dr Moshe Olshansky

Dr Qiao Wang Mr David De Souza

Dr Thusitha Rupasinghe

Mr James Pyke Mr John Sheedy

(Profiles of participating research centres, programs and individual researchers are available in the Appendix section of the 2010 Annual Report available on our website www.bio21.unimelb.edu.au)

Management, Administration and Operations

Professor Tony Bacic Dr Veronica Borrett Mr Michael Blake Mr Chris Bunney

Mr Ross Campbell

Mr Ben Edward

Mr Sam Eshtiaghi

Ms Annetta Jensen

Dr David Keizer

Ms Esther McConnell

Mr Victor Iwanov Mr Thu Nguyen

Mr Peter Riak

Mr Mark Robbins

Mr Vladimir Tikhomandritskiy

Mr Zlatan Trifunovic

Ms Helen Varnavas

Mr Manuel Zacharias

Honorary Members

Professorial Fellows

Professor REH (Dick) Wettenhall Professor Michael Parker (joint Biochemistry) Professor Steven Dower (CSL)

Principal Fellows

Dr Nick Birbilis (Monash University)
Dr Vic Ilag (Patrys Ltd)
Professor Darren Kelly (St Vincent's / School of Medicine)
Dr Eugene Maraskovsky (CSL)
Associate Professor Peter Meikle (Baker Institute)
Dr Andrew Nash (CSL)
Dr Martin Pearse (CSL)

Honorary Senior Fellows

Dr Henry Butt (Bioscreen)
Dr Suzanne Fiel (St Vincent's Institute)
Dr Mark Hinds (Walter and Eliza Hall Institute)
Professor Ian Macreadie (Sienna Cancer Diagnostics)
Dr Janette Norman (Museum Victoria)

Honorary Fellows

Dr Luke Miles (St Vincent's Institute) Dr Jack Parsons (Prana Biotechnology) Dr Scott Watkins (CSIRO)

In addition, senior research staff with CSL hold Honorary Appointments.



Enabling Platform Technologies

Underpinning contemporary biotechnology research is core platform technologies which help us to understand the composition, structure and interaction of molecules and then use this knowledge in industrial applications and biological processes.

The Bio21 Institute has made significant investment in platform technologies and the intellectual capital necessary to maintain such capabilities at the cutting edge. In particular we have created critical mass in the areas of nuclear magnetic resonance (NMR) spectroscopy, mass spectrometry and proteomics, electron microscopy, metabolomics and peptide synthesis making them accessible to a range of users from across academia, government and industry.

In addition, the opportunity to build critical mass in key areas is of major importance allowing for stronger collaborations, sharing of expertise and benefiting from economies of scale. The Bio21 Institute has strong connections with University departments and affiliated research institutions including the Walter and Eliza Hall Institute, the Australian Synchrotron, Victorian Life Sciences Computational Initiative and NCRIS platforms.

More broadly, the Bio21 Institute's key platforms are also part of the Victorian Platform Technology Network – a Victorian Government initiative which aims to connect Victoria's biomedical and biotechnology capabilities and to capture opportunities and benefits of the concentration of capability across Victoria.



Nuclear Magnetic Resonance

Nuclear Magnetic Resonance (NMR) spectroscopy determines the structures of molecules ranging from small chemicals to macromolecular proteins and nucleic acids. It is particularly useful for the analysis of proteins that cannot be crystallised, and for investigating interactions between proteins, biological membranes and ligands, including potential new drugs.

Incorporating instruments from the University of Melbourne Departments of Biochemistry and Molecular Biology and Chemistry and the Walter and Eliza Hall Institute, the Bio21 Institute facility houses nine NMR spectrometers ranging from 300 to 800 MHz, making it the largest high field facility in Australia.

Instruments include:

- 400 MHz NMR Varian INOVA system equipped with broadband probe
- 500 MHz NMR Varian INOVA system and Bruker Avance II with cryoprobe
- 600 MHz NMR Bruker Avance III with cryoprobe and autosampler, Varian VNMRS system and Bruker DRX
- 800 MHz NMR Bruker Avance II with cryoprobe and autosampler (pictured left)
- 300 and 600 MHz NMR Varian INOVA solid-state spectrometers.

Key applications include:

- Superior ligand screening using cryogenic probes
- Methods development including protein (macromolecular) structure elucidation (solution, solids)
- Screening for novel drug leads
- Range of nuclei including ¹H, ¹³C, ¹⁵N, and ³¹P and low gamma nuclei
- Metabolomics
- Methods for examining peptides in biomembranes

Highlight for 2010

In 2010, the University of Melbourne, Bio21 Institute in collaboration with RMIT University were successful in an ARC LIEF grant totalling \$1.23 million. The project focusing on advanced characterisation of materials by NMR will support a broad range of research possibilities for development of advanced materials for medical, industrial and environmental applications. Funding will allow for upgrades to NMR capability including an upgrade to the Bio21 Institute 500 MHz and 600 MHz spectrometers and purchase of a new 400 system with associated robot.

Electron Microscopy

The Bio21 Institute Electron Microscopy (EM) Facility provides high quality facilities for physical sciences, life sciences and engineering applications. The EM Facility is also part of a broader collaborative facility at the University of Melbourne in conjunction with the EM Unit at the School of Botany. The Bio21 Institute node comprises high end electron microscopes available to academic and industry users on a subscription or fee for use basis.

The Electron Microscopes include:

- Tecnai F30 Transmission electron microscope a key Victorian high-resolution cryo-electron microscope for structural investigation of biological molecules. The cryo TEM is equipped with an anti-contaminator and cold stage which allows imaging of quick frozen samples as well as tomography in either room temperature or cryo conditions. The main application of this microscope is in the structural investigation of biological macromolecules, cells and tissue in 3D. It can also be used for material science when 3D data or cryogenic conditions are necessary.
- Tecnai F20 Transmission electron microscope. A high-resolution TEM for materials science applications with HAADF (STEM) detector and EDAX system.
- FEI Quanta scanning electron microscope (ESEM) An Environmental Scanning Electron Microscope fitted with a Peltier cold stage operating from -25 to + 40°C.
- FEI Nova dual beam, focussed ion beam system. The Nova Combined SEM and gallium ion beam instrument is equipped with EDAX, Pt-deposition system and micromanipulator. Suitable for device cross-sectioning, TEM sample preparation, nanofabrication and 3D reconstruction using the Slice and View system.
- Philips XL-30 Scanning Electron Microscope equipped with an X-ray microanalysis system for elemental analysis.

Highlight for 2010

Dr Eric Hanssen was appointed as the new Manager of the Electron Microscopy Unit and Research Fellow at Bio21 Institute. He comes to us after four years at La Trobe University spent working on developing new whole cell imaging techniques (Structural Illumination, Electron and X-ray tomography), using the *Plasmodium* malaria parasite as a model. He also has experience with whole tissue or cell culture through different ongoing collaborations and from a "previous life" in the extracellular matrix field of research.

(Pictured: one of five electron microscopes available to access. Photo: VPTN Bio21 Cluster)



Mass spectrometry and proteomics

The Bio21 Institute's Mass Spectrometry and Proteomics Facility is an open access research laboratory providing access to instrumentation that is either unavailable or unaffordable to the general biotechnology community. With five mass spectrometers and three HPLC systems primarily setup for peptide/protein and small molecule research, this forms the basis for the mass spectrometry and proteomics platform at Bio21 Institute.

The facility offers mass analysis of small molecules to large proteins, as well as proteomics for the analysis of individual proteins up to high throughput of complex tissue samples using spot picking and digestion robots, and bioinformatic analysis.

Instruments include:

- HPLC-CHIP LC / Ion Trap XCT Plus Mass spectrometer
- Bruker MALDI-TOF Mass spectrometer
- NanoLC / Q-TOF Mass spectrometer
- NanoLC/QTRAP Mass spectrometer
- LC/ESI-TOF mass spectrometer

In house specialists operate instruments and provide technical expertise for users of the facility in chemical and biological mass spectrometry, HPLC and bioinformatics. This includes training users to run their own samples. This has resulted in a significant increase in the total number of samples that can be run through the facility.

Highlight for 2010

- 36 HPLC users
- 110 esiTOF users
- 46 nanoCHIP 3D Trap users
- 7 peptide chemistry students
- 90 fee for service peptides produced
- A total of 16,406 samples were run on the RTF instruments
- 3D TRAP -4,913 samples (98% gel spots)
- esiTOF 5,610 samples
- MALDI-TOF 891 samples
- HPLC 4,992 samples

Investing in our technologies

The Bruker Microflex MALDI-TOF is a benchtop instrument that can be used to determine masses on small molecules, oligonucleotides, polymers, peptides and intact proteins. The instrument is fast, efficient and easy to use providing results in minutes as opposed to hours.

(Pictured Dr Nicholas Williamson Mass Spectrometry and Proteomics Facility Manager. Photo: VPTN Bio21 Cluster)



Peptide Technology

An extension of the Mass Spectrometry facility is a high end Peptide Technology facility, which specialises in the design, synthesis and purification of modified and/or unusual peptide-based products offered on a fee for service basis.

Key capabilities include:

- Microwave-assisted Peptide Synthesis (CEM Liberty)
- RP-HPLC & ESI-MS Analysis
- Sequences up to 100 residues possible
- Peptide-Protein Conjugates
- Alanine Scanning
- Fluorescent and Isotopic Labelling
- Disulfide & Lactam Cyclisation

The purification laboratory contains three HPLC systems, which offer users both high throughput and a flexible methodology, ideal for the isolation of a wide range of compounds such as peptides, proteins and organic molecules.

Key resources and capabilities include:

- One 1100 and two 1200 Agilent HPLC Systems
- From Analytical to Semi-Prep scale (up to 200mg)
- Reversed-phase & Size Exclusion chromatography
- Normal-phase & Chiral chromatography
- Lyophilisation (Virtis)

In addition, the Peptide Technology facility provides valuable training and education for post graduate students from a range of disciplines at the Bio21 Institute.

The facility has also developed strong links with industry and fostered existing and new collaborations, both internally and externally. Some of these include research collaborations from departments including Pathology, Biochemistry and Molecular Biology, Chemistry and the Oral Health CRC and more broadly with the Howard Florey Institute and Monash University.

(Pictured: Mr John Karas of the Peptide Technology Facility. Photo: VPTN Bio21 Cluster)



Metabolomics Australia

The Metabolomics Australia (MA) Facility located at the Bio21 Institute and the School of Botany at the University of Melbourne is a key national research service facility. As part of the Australian Government's National Collaborative Research Infrastructure Service Bioplatforms Australia investment into 'omics' technologies, researchers at the University of Melbourne node work with node partner organisations including the University of Western Australia, the Australian Wine Research Institute, Murdoch University and the University of Queensland to provide infrastructure and expertise to the wider Australian research community.

A major focus of the MA facility is small molecule (metabolome) analysis on bio-medical looking at fundamental processes in disease and developing new diagnostics for both disease health as well as in environmental and agri-food related research.

Supported by a dedicated team of analytical chemists/biochemists and bioinformaticians, MA provides a comprehensive end to end service. Analysts work closely with clients and collaborators providing advice on the design of projects, experiments, developing methods specific to their biological system and questions, as well as training in sample preparation, instrumentation and data processing.

Specifically, the Metabolomics Facility provides both targeted and untargeted analysis of polar and lipidic small molecules on a variety of different biological systems including microbes, biofluid and tissues using LC-MS, GC-MS and NMR technologies.

To complement the analytical service, a sophisticated Metabolomics Australia Bioinformatics capability is also part of the overall platform. Bioinformaticians work alongside analytical researchers to develop tools enabling more efficient data processing, statistical analysis, data visualisation and information management leading to improve biological interpretation.

Services include:

- Variety of sample types (cells, media, biofluids, tissues)
- Sample preparation & tissue extraction
- Untargeted metabolite analysis
- Targeted metabolite analysis
- Bioinformatics data analysis and visualisation
- Methods development
- Skills training
- Research hotel

Highlight for 2010 (Bio21 Institute node)

- More than 40 users made contact in 2010 ranging from concept design to delivery of projects.
- Type users range from local, national and international researchers from academic, government departments and industry.
- Projects range from biomedical, environmental and nutrition fields.

Australasian Metabolomics Conference

The MA team based at the Bio21 Institute and School of Botany organised and hosted the 2010 Australasian Metabolomics Conference. With more than 120 attendees, the conference provided delegates with a diverse program with international speakers including Dr Jules Griffin from Cambridge Systems Biology Institute from UK and Professor Edward Dennis from University of California San Diego USA. To complement the conference, a three day workshop was held with a program showcasing our expertise and facilities with hands on training in a variety of analytical and bioinformatics methods and specialist seminars.

(Pictured: Metabolomics Australia's Mr David De Souza in the Bio21 Institute laboratories of the MA facility. Photo: VPTN Bio21 Cluster)





Dynamic industry engagement

The Bio21 Institute is dedicated to dynamic interactions with industry that advance Australia's biotechnology community and turn ideas into outcomes.

This commitment that focuses on developing industry networks and partnerships has resulted in a number of substantial collaborations. These include collaborations with major instrument companies, industry R&D partnerships, space for start-up companies and the partnership with anchor tenant, CSL Limited.

By facilitating these strong industry links, the Institute can add value and provide opportunities for members, particularly in developing early career researchers and students, along with the identification of potential technology transfer and commercialisation outcomes that benefit the broader community.

Collaborative research and development projects

Strong strategic links with industry and associated partners, particularly with our industry tenants, provide opportunity to increase number of ARC Linkage Project grants. In 2010 three new ARC Linkage Project grants were successful. These included researchers across multiple disciplines at Bio21Institute.

The projects also provide invaluable research training opportunities for the postgraduate students due to proximity with industry members.

In addition a number of our researchers receive industry R&D funding. This includes funding in cooperative research centres and programs.

Industry use of platform technologies

The Bio21 Institute's Platform Technologies not only provide critical research infrastructure for the University and Government sectors but are also widely used to support industry research requirements. This includes users from both within the Institute (industry members) as well as external companies that tap into this valuable source of high-end infrastructure and expertise, that would otherwise not be available to them as a single entity. Industry usage of these platforms also provides the Institute with some income to assist in the support and development of these technologies.

(Pictured: Metabolomics Australia Facility Manager at the Bio21 Institute, Dr Dee Tull. Photo: VPTN Bio21 Cluster)



Events and Training

Bringing together Melbourne's biotech community to explore frontiers in research, technology and commercialisation is an important aspect of our operation. A range of activities include industry focussed events, seminars and conferences, practical training workshops targeting new instrumentation and frontier areas of technology.

In 2010 the Bio21 Institute hosted more than 20 industry focused events and seminars. These included seminars, presentations and demonstrations from companies including: GSK, Tecniplast, ABSciex Aust and NZ.

A series of 10 Suppliers Morning Tea events were also held at the Bio21 Institute in 2010 providing more than 100 companies the opportunity to engage with researchers and provide visibility and discussion on new products and services.



Business Incubator

The Bio21 Institute's business incubator was created with the vision to provide opportunities for strategic alliances with established companies and to assist promising biotech start-ups to grow.

In addition the proximity to research groups in the wider Bio21 Cluster community in the heart of the Parkville Precinct helps foster relationships and explore research opportunities.

2010 industry members

Al Scientific
Bioscreen
Bruker Daltonics
CSL Ltd – Research and Development Group
Prana Biotechnology
Patrys Ltd
Sienna Cancer Diagnostics
Tecniplast

Picture right: The Bio21 Institute Business Incubator is linked to the main Bio21 Institute building. (Photo: M Silver.)

A message from Bruker Biosciences

"The Bio21 Institute Business Incubator provided Bruker Daltonics, a division of Bruker Biosciences Pty Ltd, the perfect opportunity to establish the company's Melbourne-based Mass Spectrometry Demonstration and Training Facility.

In addition, the Bio21 Institute Business Incubator allowed for Bruker Applications Scientists to engage with researchers within the Bio21 precinct during its early growth phase, and this engagement with Bio21 Institute researchers has lead to a number of successful on-going scientific collaborations.

The ability to access the Bio21 Institute Business Incubator has assisted Bruker Daltonics to become established in Melbourne, and due to the company's growth, Bruker Daltonics moved to a purpose built facility in Preston to consolidate with the other operations of Bruker Biosciences."

Bruker Biosciences Pty Ltd - 2010

Translating research into outcomes

In 2010 there were 32 active patent cases with a Bio21 Institute inventor. These include the Bio21 Institute spinout companies Fibrotech Therapeutic, Clarity Pharmaceuticals and ProCypra.

Radiopharmaceutical Diagnostic Imaging of Alzheimer's Disease

ProCypra

Research led by Institute based researchers Associate Professor Kevin Barnham and Dr Paul Donnelly in collaboration with Dr Tony White (Pathology, University of Melbourne) into new therapeutic approaches for the treatment of neurodegenerative diseases including Alzheimer's disease, amyotrophic lateral sclerosis and Parkinson's disease has led to the formation of a start-up company called ProCypra.

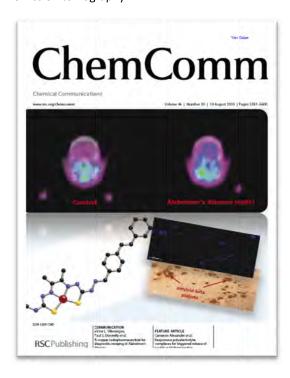
Clarity Pharmaceuticals

Research led by Institute based researcher Dr Paul Donnelly into the synthesis of new chemicals to enable non-invasive diagnosis of diseases such as cancer and Alzheimer's disease has led to three patents that have been licensed to Clarity Pharmaceuticals. The new agents developed by the team are now commercially available.

Alzheimer's disease (AD) is a progressive neurodegenerative disease that leads to synaptic failure and neuronal death. AD is the most common form of dementia. One of the major characteristic pathological hallmarks of the disease is the presence of extracellular senile plaques in the brain. The plaques are comprised of insoluble aggregated peptide amyloid- β (A β), a 39-43 amino acid peptide derived from the amyloid precursor protein (APP). Histopathological studies show extensive cortical amyloid- β deposition in post-mortem analyses in AD patients and this is the current accepted definitive diagnosis for AD. Researchers at the Bio21 Institute have

been investigating non-invasive methods using radiopharmaceutical compounds that provide early diagnosis of AD and the ability to monitor the Aβ plaque burden and following emerging treatments.

The research groups led by Institute based researchers, Dr Paul Donnelly and Associate Professor Kevin Barnham have developed radiopharmaceuticals that bind copper-64, a positron emitter with a half-life of 12.7 hours. The novel compounds are designed to image and quantify the major pathological hallmarks of AD using positron emission tomography.



The Royal Society of Chemistry 2010 Chem. Commun., 2010, 46, 5437–5.



Research Education and Training

More than half of Bio21 Institute members are early career researchers and the Institute is committed to facilitating programs that aid in their training and career development. This includes support (financially and advisory) for programs to help strengthen our internal community driven by our dynamic member groups.

Our overall aim is to provide breadth to their experience and skill base that complements the depth of their disciplinary research expertise in order to graduate a broadly skilled scientist attractive to the biotechnology sector.

Opportunities and programs are available across Honours, Masters and Postgraduate levels. In addition, initiatives and programs that foster interactions and developments across our strong postdoctoral community are also key to the Institute's undertakings.

Bio21 Institute Vacation Studentships

The Bio21 Institute offers a limited number of summer research studentships for suitably qualified students with an interest in pursuing future studies in an honours program. The program provides students with an opportunity to gain invaluable laboratory and research experience within one of our resident groups at the Bio21 Institute. Projects run between six to eight weeks during the summer vacation period.

In 2009/10 two Institute supported studentships were placed. For the 2010/11 period, a further two students were supported.

Hirra - recipient of a Bio21 Institute Vacation Studentship

Hirra (pictured below) was set to complete her 4th and final year of a Chemical and Biomolecular Engineering degree at the University of Melbourne in 2010. With a keen interest in undertaking PhD studies preferably relating to the biomolecular aspect of her degree, the opportunity to undertake a summer project at the Bio21 Institute provided her with an insight into what she can expect from a research based career.

Working within Dr Sally Gras' group, Hirra's project involved looking at the effect of pH on Cheddar Cheese properties. Various batches of cheese were made and evaluated to see the effect of pH on the microstructure, composition and textural properties of cheddar cheese. The properties were analysed through the use of various techniques including electron microscopy, texture analysis and spectroscopy to determine the optimal pH that will produce cheese of a high quality; a result that can be used by dairy industries. The research project was funded in part by Dairy Innovations Australia Limited. (Photo: Bio21 Institute)



Research and laboratory skills training for secondary school students

Since 2008, research group leaders from the Biochemistry and Molecular Biology Department located at Bio21 Institute, have participated in hosting secondary school students from Coburg Senior High School as part of the Victorian Employer Chamber of Commerce (VECCI) Australian School-based trainee/apprenticeship program. Associate Professor Heung-Chin Cheng has been a supporter of this program from its beginning. Over the years, the program has proven to be a great success with many of the students inspired to pursue science in Year 12 and furthering their studies by enrolling in undergraduate Engineering and Science degrees. Given the success of this program, the Bio21 Institute will manage the administration of the program on behalf of all participating departments, providing opportunities for other research groups within Bio21 Institute to participate. This ultimately provides more students with the opportunity to be part of the program and expands the range of disciplinary and research experience.

Contributing to undergraduate and graduate teaching programs

The Institute focuses on research and research training and although not directly involved in undergraduate teaching (which is provided through home departments), Institute staff contribute by delivering a range of lectures and modules at both the undergraduate and masters level. This includes the Masters in Biotechnology program, Proteomics and Metabolomics Masters courses.

RAPD and student associations

Commitment to developing a whole of institute approach is demonstrated by the new generation of scientists, our Research Assistant and Postdoctoral Fellows (RAPD) and Postgraduate members. Members of the Students' Societies and RAPD Association have initiated a number of institute-wide programs that have focused on learning about the research conducted by our diverse member base with the objective of fostering networks and potential collaborations. A key event organised each year by our dynamic RAPD Association is the annual Bio21 Institute Research Symposium. This full day symposium includes oral and poster presentations by postdoctoral fellows. The opportunity to continue these forums and interactions is facilitated throughout the remainder of the year with poster sessions, professional development sessions and social events.

The Institute's student members are similarly active in facilitating networks and interactions across their member groups and collectively. A key focus for this group is facilitating forums to explore career opportunities within the biotechnology sector.

Pictured below: Bio21 Institute 2010 RAPD Association members (Photo: Bio21 Institute)



Bio21 Institute Student Travel Awards

The Bio21 Institute encourages postgraduate students to broaden their experience and education. To support these programs, travel awards are intended to contribute towards students interested in attending a cross-disciplinary conference, visit laboratories to learn techniques or to enhance industry collaborations and outcomes. In 2010, the institute awarded 17 student travel awards.

Award recipients for 2010

Nicole Rijs (Chemistry) International Chemical Congress of Pacific Basin Societies, USA.

Brandon MacDonald (Chemistry / Nanoscience)
Materials Research Society Fall meeting USA. Visit QD
Vision Inc USA and University of Toronto.

Pei Zhi Cheryl Chia (Biochemistry and Molecular Biology) 50th American Society of Cell Biology Annual Meeting, USA. Visits to NIH, Albert Einstein College of Medicine and Harvard University.

Florian Ehlgen (Biochemistry and Molecular Biology) Molecular Parasitology annual meeting, USA. Visited malaria research laboratories in USA and Canada.

Dhana Gorasia (Biochemistry and Molecular Biology) Islet Keystone Conference, Canada. Visit Benaroya Research Institute and University of Washington Diabetes Centre, USA.

Laura Gianni (Biochemistry and Molecular Biology) Visiting graduate student with University of Toronto, Canada.

Shahid Ali (Genetics)

13th European Drosophila Research Conference, UK. Visit laboratories in UK.

Sarah Atkinson (Biochemistry and Molecular Biology) International School of Crystallography, Italy.

David Fernandez (Chemistry) International Workshop on Antimicrobial Peptides. Visits to University of Split, Croatia. Natalie Gunn (Biochemistry and Molecular Biology)
EMBO Workshop "Structural Characterisation of
Biological Macromolecules" France. Phosphorylation and
G Protein mediated Signaling Networks part of the
Gordon Research Conference. Visit Howard Hughes
Medical Institute, USA.

Sing Chun Lim (Chemistry) 39th International Conference on Coordination Chemistry, Australia.

Inam UI Haq Raja (Chemistry) Materials Research Society Conference, USA. Visit Stanford University.

Helena Safavi-Hemami (Biochemistry and Molecular Biology) American Society for Mass Spectrometry Conference, USA. Visit Salt Lake City Utah laboratories.

Lisa Smith (Chemistry / Nanoscience) NaNaX4 Conference, Germany. Visit Grenoble, Germany laboratories.

Jeremy Tan (Chemistry) EUCHEM Conference, Italy.

Ben Woodcroft (Biochemistry and Molecular Biology) International Society of Computational Biology Latin America Conference. 'Working with pathogen genomics' workshop. Visit Buenos Aires Argentina laboratories.

Gojko Buncic (Chemistry) 39th International Conference on Coordination Chemistry, Australia.



Communications, Events and Outreach

The Bio21 Institute's communications, events and outreach programs engage a broad range of audiences and stakeholder groups from the corporate, academic and community sectors.

The key areas for engagement include internal and external communications, stakeholder communications, public relations and industry liaison, marketing, events and outreach including hosting tours and visits.

Each year the Bio21 Institute hosts a range of community events that promote science and showcase the Institute's research and industry engagement programs. We are also aligned with initiatives across the University and broader biotechnology sector, including participating and hosting a range of scientific conferences and seminars

A key objective of the Bio21 Institute's public relations and outreach programs is engaging the community including secondary school students, teachers and the general public. In 2010, the Bio21 Institute was successful in our bid to manage the Australian Government's TechNyou Outreach program. The initiative is well aligned with our own aims and objectives and provides a conduit for raising awareness of the emerging science and technology matters.



Successful tender announcement for TechNyou Outreach Program

In 2010 the Bio21 Institute was successful in a tender to manage the Australian Government's TechNyou Outreach Program. An initiative of the Australian Government's Department of Innovation, Industry, Science and Research (DIISR), TechNyou was established to provide information to the Australian public on emerging technologies such as bio- and nanotechnologies. Given the Bio21 Institute's ongoing commitment to community engagement and the opportunity to facilitate this important community program provided a logical fit with the Institute's goals and activities. TechNyou provides balanced and factual information on the science and associated issues, along with opportunities for the public to engage with scientists and other experts on the potential uses for these technologies.

Pictured: In conjunction with TechNyou, the Bio21 Institute hosted a visit and tour by a Victorian Probus group. Dr Nick Williamson explains the operation of the Institute's Mass Spectrometry and Proteomics Facility. (Photo: Bio21 Institute.)

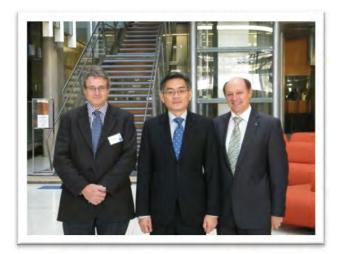


Local and International Visitors and Delegations

The Bio21 Institute's international standing has established us as a key destination to visit for many international visitors and delegations. In 2010, the Bio21 Institute continued to host a range of VIPs and delegations from here and abroad including UK, USA, Korea, Germany, Canada, Singapore and Malaysia.

In addition we were pleased to host tours and briefings for key figures including Australia's Chief Scientist and a delegation of State Chief Scientists, the Chief Minister of Johor, the CEO of BIO USA Mr James Greenwood and the Singapore High Commissioner.

Pictured L-R: Professor Dick Strugnell University of Melbourne Pro-Vice-Chancellor (Graduate Research), Singapore High Commissioner, His Excellency Mr Albert Chua and Bio21 Institute Director, Professor Tony Bacic. (Photo: Bio21 Institute)



Conferences and seminars

The Bio21 Institute's 200 seat auditorium and central atrium provide an ideal setting for small to medium scientific conferences, events and seminar programs. In 2010, the Institute hosted more than 40 major events and conferences and 100 seminars including 19 international speakers. These include institute organized events, key University events and external events.

Some of the key events and conferences held in 2010 included the Nossal Institute Conference, the Tall Poppy's awards, the World Health Organisation Influenza Conference, Ataxia Friedrich Research Association Forum, the Huntington's Disease Research Forum and the Cervical Cancer 'Not Yet Beaten' Conference. Internal events include the annual Bio21 Institute Research Symposium and monthly Research Forums, Defence Science Institute Workshop, OptiPoral seminars and the Faculty of Medicine, Dentistry and Health Sciences Research Domains forums.

A series of regular seminar programs continued to be held at the Bio21 Institute. This included more than 100 research, PhD and industry seminars held throughout 2010.

(A list of conferences, events, visits and seminars held at the Bio21 Institute in 2010 please refer to the Bio21 Institute 2010 Annual Report Appendix available for download from our website at www.bio21.unimelb.ed.au).

Pictured: Women's Hospital 'Cervical Cancer Not Yet Beaten' Conference. (Photo: Women's Hospital.)



Grimwade Labs Officially Named

Laboratories in the Department of Biochemistry and Molecular Biology section at the Institute have been officially named 'Grimwade Research Laboratories' in recognition of Sir Russell and Lady Grimwade who provided a significant donation of 50,000 pounds to construct the original Biochemistry Building (Russell Grimwade School of Biochemistry) and support for the funding of the Grimwade Research Fellowship.

The event was attended by the University's Provost, Deputy Vice Chancellor, Members of the Miegunyah Bequests Committee, staff, students and colleagues of the Department of Biochemistry and Molecular Biology. Official proceedings included speeches by Head of Department Professor Paul Gleeson, Deputy Dean Professor Bruce Singh representing the Faculty of Medicine Dentistry and Health Sciences and past and current Grimwade Fellowship recipients, Associate Professor Tony Purcell and Dr Danny Hatters.

Sir Andrew Grimwade from the Grimwade family formally unveiled the plaque that is now a feature at the entrance to the level two south laboratories.

Pictured: Unveiling the commemorative plaque, Deputy Dean, Professor Bruce Singh (left) with Sir Andrew Grimwade (Photo: Bio21 Institute).



Outreach, Visits and Tours

A number of tours and visits are run by the Bio21 Institute as part of our outreach activities providing members of the community, particularly secondary school students, with an insight into a research centre of excellence. The opportunity to view a state-of-the-art facility such as Bio21 Institute is encouraging to many young budding scientists. We aim to continue to provide the inspiration and opportunity to inspire our future generation.

The constant stream of tours and visits to Bio21 Institute also provides the Institute with the opportunity to showcase the state of the art facility and technologies and allows visitors to find out more about the cutting edge research undertaken at Bio21 Institute. In 2010, the range of visitors included University of Third Age and Rotary Groups, secondary school students, teachers, local and international graduate and undergraduate students and members of the general public.

Pictured: In 2010, the Bio21 Institute hosted a delegation of international medical students as part of the US International Scholars Laureate Program. The visit included a briefing from Associate Professor Matthew Perugini, followed by a tour of the Institute's facilities. (Photo: Bio21 Institute).



Science Outreach at Bio21 Institute

The Bio21 Institute, in conjunction with TechNyou held a 'Science Outreach Event' to engage, inspire and inform secondary students and teachers about research and careers in science.

More than 40 secondary students from years 10 and 11 accompanied by their teachers attended the half day event.

The program included presentations and laboratory tours hosted by Institute based postdoctoral fellows who talked about their research work and inspiration that led them to a career in science.

The positive feedback from discussions held and survey responses indicated the event was a great success amongst the group. This included 91% of the participants indicating the event provided them with more knowledge of biotech and nanotech than they had prior to the event.

The Institute hosted a number of outreach activities during 2010 for students from Years 10, 11 and 12 and their teachers. A group of Year 12 students from Hawthorn Secondary College visited Bio21 Institute to find out more about NMR – a focus of their curriculum. This was complemented by a visit to the Chemistry School where students discovered more about techniques such as chromatography and mass spectrometry.

The 2010 RACI Hartung Youth Lectures were hosted at the Bio21 Institute during National Science Week. Professor Peter Tregloan from the School of Chemistry provided an exciting lecture and demonstration in his seminar 'Carbon Dioxide: Air, Earth, Fire and Water. More than 380 year 10 and 11 secondary school students from schools across Victoria took part in this special event.

Engaging within the community

Bio21 Institute researchers are actively engaged within the scientific community and with the general public to promote their research and raise awareness about science via a range of activities. This in turn raises the reputation of the Bio21 Institute within the community.

Key activities undertaken by researchers and students include attending and presenting at local and international conferences and scientific meetings. Many of our research group leaders are also invited speakers at key international conferences and events. (Refer to the Bio21 Institute 2010 Annual Report Appendix for a list of invited presentations and seminars.)

Within the community researchers and students are also engaged with secondary school students, teachers and parents. This includes participating in programs such as Scientists in Schools and In2Science.

University of Melbourne's Vice Chancellor's Engagement Award

In 2010, the ARC Centre of Excellence for Free Radicals in Chemistry and Biotechnology were awarded a University of Melbourne Vice Chancellor's Engagement Award for their Health Educational Video project with partners Aquinas College and Quit Victoria. The program engaged 24 students from Year 10 providing them with the opportunity to learn about free radicals and their effects on health through a range of laboratory based exercises.

Pictured: Dr Yvonne Kavanagh (foreground) with Aquinas College students. (Photo: Free Radicals COE)



Science sub school to inspire the next generation of scientists

Inspiring the next generation of scientists will be the focus of an innovative education initiative – the Bio21 science sub school to be located at the University of Melbourne Western Precinct. The science sub school is a partnership between the Victorian Government, the University of Melbourne, led by the Bio21 Institute and the Melbourne Graduate School of Education, University High School and Debney Park Secondary College. Year 11 and 12 students will have access to state of the art facilities at the new sub school and will gain exposure to an environment that fosters interest in science.

The project will support advancements in the development and delivery of science curricula that is grounded in cutting-edge science and supported by robust pedagogical research to:

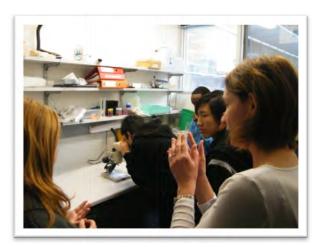
- Deliver up-to-date science curricula to students in purpose built science facilities, <u>inspiring students to</u> <u>undertake and continue Science education</u>;
- Provide a 'laboratory' for research into science education, <u>exploring new ways of delivering effective</u> science education;
- Build the capability of in-service and pre-service science teachers, *lifetime learning*.
- Expand the links between science in schools, research and industry, <u>science in context</u>.

The science sub school will play a key role in helping to keep Victoria competitive in the scientific world, by increasing the number and quality of people in science. Students will gain insight into a wide range of science disciplines. The Bio21 Institute, in association with the Faculties of Science, Veterinary Science, Engineering and Medicine, Dentistry and Health Sciences, as well as the Melbourne School of Land and Environment, will contribute through access to expertise.

The science sub school will also provide outstanding professional development opportunities for science teachers. Scientists from the University will pass on leading edge techniques to the teachers, enabling them to take knowledge of the latest developments back to their classrooms.

A new model of delivering science learning and teaching, the initiative aims to transform the science education experience through a 'school-bench-workplace' concept, which ultimately is an investment in the future growth and sustainability of Australia's science and biotechnology sector.

Pictured: Institute researchers are involved in a range of outreach programs that aim to inspire secondary students. In 2010, visiting students find out more about CAPIM's research with Dr Sara Long (foreground). (Photo: Bio21 Institute.)



The Bio21 Institute 2010 Annual Report has been produced by Bio21 Institute Communications and published by the Bio21 Institute Director's Office.

Hard copies of the 2010 Annual Report can be requested by contacting the Bio21 Institute.

An Appendix to the Bio21 Institute 2010 Annual Report is available as a downloadable PDF document on the Bio21 Institute website. It provides a comprehensive list of: Profiles of Bio21 Institute based Researchers including publications and grant listings, outreach activities and profiles of key Centres and Programs located at the Bio21 Institute, Key Conferences, Events and Visits, Research and Industry Seminars, PhD completion seminars and Visiting Scientists.

The Bio21 Institute 2010 Annual Report and associated Appendix is available on the Bio21 Institute website at www.bio21.unimelb.edu.au

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Annual Report 2010
BIO21 MOLECULAR SCIENCE AND BIOTECHNOLOGY INSTITUTE



Annual Report Appendix

BIO21 MOLECULAR SCIENCE AND BIOTECHNOLOGY INSTITUTE







Introduction

The University of Melbourne's Bio21 Molecular Science and Biotechnology Institute (Bio21 Institute) is a multidisciplinary research centre specialising in medical, agricultural and environmental biotechnology and nanobiotechnology.

Our vision is to improve health and the environment through innovation in biotechnology and related areas, driven by multidisciplinary research and dynamic interactions with industry.

This vision was built on the premise that multidisciplinary ventures between life sciences, physical sciences and engineering disciplines, including the exploitation of 'omics' technologies, was fundamental to translating biological discoveries into biotechnology outcomes.

Located in the heart of the Parkville Precinct, the Institute accommodates 600 research scientists, students, professional staff and industry participants, making it one of the largest biotechnology research centres in Australia.

Our Goals

The goals of the Bio21 Institute are to

- Achieve biotechnology innovation through worldclass interdisciplinary research in biomedical, agricultural and environmental biotechnology
- Establish core platform technologies available to a wide cross section of the science and industry communities
- Translate research into educational, economic and community benefits
- Enhance research and training programs
- Provide a forum for community debate

As a flagship facility in the heart of the Parkville Biotechnology Precinct, the Bio21 Institute's expertise and state-of-the-art platforms, provide the foundation for collaborative research across the University, Bio21 Cluster organisations and the broader biotechnology community.

The Bio21 Institute 2010 Annual Report Appendix

The Bio21 Institute 2010 Annual Report Appendix provides information including:

- profiles of Bio21 Institute based researchers including publications and grant listings
- profiles of key centres and programs located at the Bio21 Institute
- outreach activities
- key conferences
- · events and visits
- · research and industry seminars
- PhD completion seminars
- Visiting Scientists.

The Bio21 Institute 2010 Annual Report and associated Appendix are available on the Bio21 Institute website at www.bio21.unimelb.edu.au.

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Visiting Scientists

In 2010, the Bio21 Institute hosted visiting scientists from industry and academia from both Australia and overseas. Visits ranged from short visits and meetings to sabbatical programs with participating research groups and departments. Some of these include:

Dr Isao Matsuura, National Institute of Health Research, Taiwan. Host: Assoc Prof Heung-Chin Cheng.

Dr Hemant Paudel, Department of Neurology, Lady Davis Institute for Medical Research, McGill University. Host: Assoc Prof Heung-Chin Cheng.

Dr Jacques Bouvier, Novartis Animal Health, Switzerland. Host: Prof Philip Batterham.

Dr David Heckel, Max Planck Institute for Chemical Ecology, Germany. Host: Prof Philip Batterham

Dr John Oakeshott, CSIRO Division of Entomology, Canberra, Australia. Host: Prof Philip Batterham.

Dr Karl Gordon, CSIRO Division of Entomology, Canberra, Australia. Host: Prof Phil Batterham.

Dr Ryuichi Harada, Tohuku University, Sendai Japan (PhD student). Host: Prof Roberto Cappai.

Dr Katja Seme, Institute of Microbiology and Immunology, Slovenia. Host: Prof Suzanne Garland.

Dr Qiaoxia Li, Heibi, China. Host: Prof Suzanne Garland.

Professor Pamela Stanley, Horace W Goldsmith Professor Dept of Cell Biology, Albert Einstein College of Medicine, New York USA. Hosts: Prof Paul Gleeson, Prof Malcolm McConville.

Professor Chris Dobson, Chemistry Department University of Cambridge, UK. Host: Dr Sally Gras.

Professor Tao Yi, Chemistry Department, Fudan University, China (part of the ATSE Young China Exchange Scheme). Host: Dr Sally Gras.

Professor Eric Spinnler, Paris AgroTech, Paris, France. Host: Dr Sally Gras.

Professor Beate Koksch, Institute of Chemistry and Biochemistry, Organic Chemistry, Freie University, Berlin, Germany. Host: Dr Sally Gras. George Zhao, Department of Chemical and Biomolecular Engineering, National University of Singapore. Host: Dr Sally Gras.

Dwaipayan Sen, Department of Chemical Engineering, Javapur University, India. Host: Dr Sally Gras.

Professor Rafael Jimenez-Flores, California Polytechnic State University, U.S.A. Host: Dr Sally Gras.

Dr Nidhi Bansal, California Polytechnic State University, U.S.A. Host: Dr Sally Gras.

Dr Elizabeth Bromley, Department of Physics, Durham University, U.K. Host: Dr Sally Gras.

Prof Sangkot Marzuki, Director of Eijkman Institute for Molecular Biology in Jakarta, Indonesia. Host: Dr Sally Gras.

Professor John Carver, University of Adelaide, Australia. Host: Dr Sally Gras.

Professor Juliet Gerrard, Canterbury University, New Zealand. Host: Dr Sally Gras.

Dr Sarah Meehan, Department of Chemistry, Cambridge University. Host: Dr Sally Gras.

Dr Andrew Barber, SARDI, Adelaide, Australia. Nuffield Scholar – Mr Malcolm Fewster, England, U.K. Host: Dr Sally Gras.

Ms Danielle Williams, Carver Laboratory, Adelaide University, Australia. Host: Dr Sally Gras.

Ms Shanna Isaacson, Oxford University, U.K. Dr Jennifer Becker, US Army Research Office, U.S.A. Host: Dr Sally Gras.

Dr Michael Turelli, University of California, USA. Host: Prof Ary Hoffmann.

Dr Jason Sexton, University of California, USA. Host: Prof Ary Hoffmann.

Professor Will Skene, Professor of Chemistry, University of Montreal, Canada. Host: Prof Andrew Holmes.

Professor Neil Greenham, Professor of Physics, University of Cambridge, UK. Host: Professor Andrew Holmes.

Ms Aline Plappert, Stuttgart University Germany. Host: Dr Terry Mulhern.

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Mr Gustavo Sandivo, State University of Campinas, Brazil (PhD student). Host: Prof Richard O'Hair.

Prof Juliet Gerrard (Co-Director of the Biomolecular Interaction Centre, University of Canterbury, New Zealand. Host: Assoc Professor Matt Perugini.

Dr Katy Wood (Neutron Scattering Expert, Bragg Institute, ANSTO). Host: Assoc Professor Matt Perugini.

Dr Wallace Buchholz (Manager of the "Microbiology" Program, U.S. Army Research Office). Host: Assoc Professor Matt Perugini.

Dr Jennifer Becker (Manager of the "Chemistry" Program, U.S. Army Research Office). Host: Assoc Professor Matt Perugini.

Prof Kirill Alexandrov (ARC Future Fellow, IMB, University of Queensland). Host: Assoc Professor Matt Perugini.

Dr Carl Brown (Outreach Programs, Defense Threat Reduction Agency, U.S.A.). Host: Assoc Professor Matt Perugini.

Prof Geoffrey Jamieson (Massey University, New Zealand). Host: Assoc Professor Matt Perugini.

Associate Professor Neal Johnson, Loma Linda University. Host: Prof Eric Reynolds.

Dr Orit Oettinger-Barak, The Hebrew University of Jerusalem. Host: Prof Eric Reynolds.

Associate Professor Hiroshi Matsubara, Osaka Prefecture University, Japan. Host: Prof Carl Schiesser.

Professor Chaozhong Li, Shanghai Institute of Chemistry, Chinese Academy of Sciences, China. Host: Prof Carl Schiesser.

Professor Margaret Brimble, University of Auckland, New Zealand. Host: Prof Carl Schiesser.

Ms M Laneville, Universite Laval, Canada (MSc Student). Host: Prof Frances Separovic.

Mr MJ Klein, Karlsruhe Institute of Technology, Germany. Host: Prof Frances Separovic.

Professor Dr Henning Hopf, Technical University Braunschweig, Germany. Host: Assoc Prof Uta Wille.

Ms Ilaria Proietti Silvestri (PhD student) Sapienza University Rome, Italy. Host: Dr Spencer Williams.

Ms Roisin O'Flaherty (PhD student) National University of Ireland. Host: Dr Spencer Williams.

Key conferences, events and visits

The Bio21 Institute hosted a range of key conferences, events, visiting delegations and distinguished visitors in 2010. Some of these include:

February

Visit by Dr Sang- Ki Rhee – Chief Executive Director, SCH Center for Biopharmaceutical research and Human Resources Development, Soon Chun Hyang University, Korea. Accompanied by a group of undergraduate students. (3 February)

Solutions Scattering Workshop (4-5 February)

Visit by German Scientific Delegation interested in Organic Photovoltaics, with ATSE (15 February)

Hawthorn Secondary College Year 10 visit to NMR Facility (18 February)

GSK Paediatrics Roadshow (26 February)

Visit and tours by University of Melbourne Science Study Abroad students (26 February)

March

ARCS Australia – What is happening globally with biologics – Industry focus forum (1 March)

Visit by Australian Education International North America (AEI) (USA and Canada) (2 March)

Neurodegenerative NHMRC Program meeting (5 March)

Bio21 Institute Suppliers Morning Tea (10 March)

Bio21 Institute Annual RAPD Research Symposium (19 March)

Proteomics and Metabolomics Victoria Meeting (25 March)

Visit by Delegation of Chinese Journalists (25 March)

Dental Science Continuing Professional development program for Dentists "Minimal Intervention Dentistry" (26 March)

Visit by University of Eindhoven, Netherlands. Study Tour of 27 Biomedical Engineering students (Bachelors and Masters students). The Netherlands (30 March)

April

Diagnostics Technologies HPV Seminar (14 April)

Bio21 Institute Suppliers Morning Tea (14 April)

Faculty of Veterinary Science Student Presentations forum (15 April)

AAHL Information Session (19 April)

Bio21 Institute Research Forum/Poster Session (22 April)

Roche Training Session "Principles and practice of quantitative RT-PCR" workshop (29 April)

Faculty of Medicine, Dentistry and Health Sciences Cancer Domain Forum (30 April)

May

Visit by University of Birmingham Senior Executive Delegation, UK (4 May)

AVID Conference (5-7 May)

Bio21 Institute Suppliers Morning Tea (12 May)

Visit by High Commissioner for Singapore in Australia, HE Mr Albert Chua, Singapore (19 May)

Bio21 Institute Research Forum/Poster Session (20 May)

Tecniplast – Introduction to new Technology forums (27-28 May)

Visit by Johor delegation led by Chief Minister A.B. Dato' Haji Abdul Ghani bin Othman, Malaysia (31 May)

Huntington's Disease Researchers Forum (31 May)

June

CSL Student Outreach event (1 June)

Grimwade Research Laboratories – official opening event (3 June)

Bio21 Institute Suppliers Morning Tea (9 June)

Centre for Aquatic Pollution Identification and Management – launch with Minister for Environment, and research symposium (17 June)

Visit by Probus Club Group (in conjunction with TechNyou) (24 June)

Visit by Dr Sang- Ki Rhee – Chief Executive Director, SCH Center for Biopharmaceutical research and Human Resources Development, Soon Chun Hyang University, Korea – Signing of the Memorandum of Understanding. (29 June)

July

7th International Symposium on Industrial microbiology and biotechnology hosted by Bio21 Institute (2-3 July)

Bio21 Institute Suppliers Morning Tea (14 July)

Visit by University of Third Age Waverley (in conjunction with TechNyou) (20 July)

VICOSC Research Meeting (23 July)

CSIRO Public Lecture – Stem Cell Therapies: Now and in the future (27 July)

Visit and tours by University of Melbourne Science Study Abroad students (23 July)

August

Bio21 Institute 'Science Outreach Event' – Year 10 and 11 Students (4 August)

RACI Annual Hartung Lecture (2 lectures) (10 August)

Visit by Design Inc Architects with project managers, designers (12 August)

Royal Women's Hospital Annual Tracey Maund Lecture (12 August)

Bio21 Institute Research Forum/Poster Session (16 August)

ABSciex Aust and NZ Launch event for Triple TOF 5600 (20 August)

DSSI Workshop - Chemical and Biological Defence Workshop (26 August)

September

Nossal Institute for Global Health Annual Research Conference (2 September)

Faculty of Veterinary Science Public Lecture and launch of Pre-Vet Club – lecture and reception (8 September)

Bio21 Institute Suppliers Morning Tea (8 September)

Mass Spectrometry 101 Lecture series (Bio21 Institute Platform Technologies Program) (9 September)

Bio21 Institute Research Forum/Poster Session (16 September)

Tall Poppy's Awards ceremony and reception (23 September)

GE Healthcare Life Sciences – Research Horizons Roadshow (27-28 September)

Visit by Professor Donald (Don) Brooks, Associate Vice-President Research & International, University of British Columbia, Canada (21 September)

Bio21 Cluster presentations by Dr J Rosen (29 September)

University of Melbourne Advancement Office event (29 September)

October

Royal Women's Hospital Obstetrics Satellite Conference (7 October)

Bio21 Institute Suppliers Morning Tea (13 October)

Visit by Mr James Greenwood – CEO BIO, USA (21 October)

Visit by Professor John Flygare – Genentech and Stanford Uni, USA (October)

Royal Women's Hospital Women's Centre for Infectious Diseases, Cervical Cancer Not Yet Beaten Conference (14 October)

Bio21 Institute Research Forum/Poster Session (21 October)

Veterinary Science Faculty, Information Session for students (21 October)

Free Radicals COE – educational video launch with Aquinas College and Quit Victoria (26 October)

Optiportal Demonstration Session (link with Australian Synchrotron) (15 December)

November

Bio21 Cluster Systems Biology Workshop (4 November)

Bushfire Intelligence and Communication Workshop (Knowledge Partnerships and IBES event, utilizing Optiportal technology) (5 November)

Bio21 Institute Suppliers Morning Tea (10 November)

Telemedicine/health: Improving access to better outcomes symposium (12 November)

Visit by delegation with the Knowledge Cities World Summit (part of City of Melbourne initiative) (16 November)

Royal Women's Hospital Neonatal 'Cool Topics" Conference (17 - 18 November)

Bio21 Institute Research Forum/Poster Session (18 November)

School of Chemistry Continuing Education program (23 November)

What is the Optiportal? Information session (26 November)

Friedreich Ataxia Research Association Symposium (29 November)

December

Visit by the Chief Scientist of Australia, Professor Penny Sackett and a delegation of State Chief Scientists (2 December)

Faculty of Medicine, Dentistry and Health Sciences "Biosciences / Infection and Immunity Domains and Technology Update" Forums (2 December)

Chemical Synthesis Annual Symposium (3 December)

Centre for Aquatic Pollution Investigation and Management (CAPIM) Summit (10 December)

Bio21 Institute 'State of the Nation' Director's General Meeting and end of year event (13 December)

Research, PhD Completion & Industry Seminars

A series of regular seminar programs were held at the Bio21 Institute with speakers from Australia and overseas. They included more than 100 research, industry and PhD completion seminars.

Professor Richard M Caprioli, School of Medicine, Vanderbilt University, USA 'Assessing spatial and temporal proteomics: molecular profiling and imaging of tissues by mass spectrometry' (04 February)

Professor Ian Paterson, Department of Chemistry, University of Cambridge, UK 'Recent Progress in the Synthesis of Bioactive Polyketide Natural Products' (12 February)

Professor Ian Paterson, Department of Chemistry, Cambridge, UK and Wilsmore Fellow, School of Chemistry 'Total Synthesis of Anticancer Natural Products - boron aldol reactions in action' (16 February) Part of Bio21 Institute Seminar Series

Professor Larry Overman, Chemistry, School of Physical Sciences, University of California, Irvine USA 'Recent Studies in Natural Products Total Synthesis' (23 February)

Part of Bio21 Institute Seminar Series

Dr Rudi Marquez, University of Glasgow, UK 'Adventures in Natural Product Synthesis and Biological Chemistry' (23 February)
Part of Organic Chemistry Seminar Series

Prof Pamela Stanley, Horace W. Goldsmith Professor Dept. Cell Biology Albert Einstein College of Medicine, NY 'Regulation of Notch Signaling by Glycans during Embryogenesis and T Cell Development' (25 February) Part of Bio21 Institute Seminar Series

Professor William Skene, University of Montreal, Canada 'Teaching an old dog new tricks: conjugated imines as functional materials' (26 February)
Part of the Organic Chemistry Seminar Series 2010

Dr Nathalie Garasson, VP, Head of Global Adjuvant Center for Vaccine Development GSK Biologicals and Dr. Marcelle Van Mechelen. Director of Immunology Research for GSK Biologicals 'The potential for Adjuvant Systems: Recent advances to tailor vaccine design' (10 March) Professor Larry Overman, School of Physical Sciences, University of California, Irvine, USA 'Molecular rearrangements in the construction of complex molecules' (12 March) Part of the Organic Chemistry Seminar Series

Dr Andrew Leis, AAHL Biosecurity Microscopy Facility, Australian Animal Health Laboratory, Victoria Australia 'Considerations for accessing supramolecular structure via cryo-electron tomography' (17 March) Part of the Department of Biochemistry and Molecular Biology Seminar Series

Professor Doctor Martin Oestreich, University of Munich, Germany (22 March) Part of the Organic Chemistry Seminar Series

Dr Michelle Dunstone, Department of Microbiology, Monash University, Victoria Australia 'Pore forming toxins: The MACPF family' (24 March) Part of Biochemistry and Molecular Biology Seminar Series

Dr Eric Hanssen, Bio21 Institute Electron Microscopy Unit Manager and Research Fellow 'Light and electrons, Plasmodium wears green and gold' (25 March) A Bio21 Institute Platform Technologies Seminar

Professor Peter Seeberger, Max Planck Institute Germany 'Micro reactors for organic synthesis' (26 March)
Part of the Organic Chemistry Seminar Series

Professor Pamela Stanley, Department of Cell Biology, Albert Einstein College of Medicine, New York, USA 'Complex N-glycans regulate cell proliferation and tumour progression' (31 March) Part of the Biochemistry and Molecular Biology Seminar Series

Dr Michael Bieri, Department of Biochemistry and Molecular Biology, University of Melbourne, Victoria Australia

'Discovering different binding affinities of AMP activated protein kinase beta subunits to glucose' (7 April)
Part of the Biochemistry and Molecular Biology Seminar Series

Dr Andrew Webb, Department of Biochemistry and Molecular Biology, University of Melbourne Victoria Australia

'Dengue receptors and the modulation of TNF signalling during infection' (7 April)

Part of the Biochemistry and Molecular Biology Seminar Series

Dr Gino Di Labio, National Research Council, Canada 'Linear organic nanostructure on silicon surfaces: fabrication, properties and some kinetic insights' (9 April) Part of the Organic Chemistry Seminar Series Associate Professor Kat Gaus, Centre for Vascular Research, University of New South Wales, Australia 'Membrane organisation at T cell activation sites' (14 April)

Part of the Biochemistry and Molecular Biology Seminar Series

Dr Alex Hyatt, AAHL Biosecurity Microscopy Facility Livestock Industries and Ms Judith Maunders, Executive Officer AAHL Collaborative Biosecurity, Victoria Australia 'AAHL Collaborative Biosecurity Research Facility: How it can benefit current and future research activities' (19 April)

Professor Terry Lybrand, Professor of Chemistry and Pharmacology, Vanderbilt University USA 'Molecular simulation techniques for biomolecules' (21, 27, 28 April, 3 May)

Hosted by the Australian Research Council Centre of Excellence for Free Radical Chemistry and Biotechnology

Dr Bernd Kalinna, Centre for Animal Biotechnology, Faculty of Veterinary Science, The University of Melbourne, Victoria Australia

'Development of a transgenesis system for schistosomes' (21 April)

Part of the Biochemistry and Molecular Biology Seminar Series

Dr Mahendra Rao, Life Technologies Seminar 'Transitions in stem cell science' (22 April)

Professor Terry Lybrand, Professor of Chemistry and Pharmacology Vanderbilt University, USA 'Molecular modeling studies G protein-coupled receptors: possible applications for drug design' (23 April) Part of the Organic Chemistry Seminar Series Dr Katy Wood, Australian Nuclear Science and Technology Organisation, ACT, Australia 'Protein dynamics studied by neutron scattering' (28 April)

Part of the Biochemistry and Molecular Biology Seminar Series

Associate Professor Steven Turner, Department of Microbiology and Immunology, The University of Melbourne, Vic Australia

'The making of a killer: molecular regulation of signature virus-specific T cell effector function' (5 May)
Part of the Biochemistry and Molecular Biology Seminar Series

Associate Professor Peter Meikle, Metabolomics Laboratory, Baker IDI Heart and Diabetes Institute, Vic Australia

'Plasma lipid profiling for risk assessment of metabolic syndrome related disease' (26 May) Part of the Biochemistry and Molecular Biology Seminar Series

Dr Alex Maier, Department of Biochemistry, La Trobe University, Vic Australia 'Cellular traffic guidance - chaperones of the malaria parasite Plasmodium falciparum' (9 June) Part of the Biochemistry and Molecular Biology Seminar Series

Dr Tobias Bender, School of Chemistry, The University of Melbourne, Vic Australia 'Binding site determination of V-ATPase inhibitors by photoaffinity labelling' (9 July) Part of the Organic Chemistry Seminar Series

Dr Catrin Goeschen, School of Chemistry, The University of Melbourne, Vic Australia "Photoswitchable Proton Transfer based on 2-(2,4-Dinitrobenzyl) pyridine and its derivatives" (16 Jul 2010)
Part of the Organic Chemistry Seminar Series

Professor Rainer Herges, Institute of Organic Chemistry, Christian Albrecht University of Kiel, Germany 'Design and Synthesis of Molecules with Machine-like Functions' (23 July) Part of the Organic Chemistry Seminar Series Professor Laren M. Tolbert, School of Chemistry and Biochemistry, Georgia Institute of Technology, USA 'Outside the beta-barrel: GFP chromophores as protein sensors' (23 July)

Part of the Organic Chemistry Seminar Series

Professor Steven Clark, University of Glasgow, UK 'New Strategies for the Construction of Marine Polyether Natural Products and their Application to the Synthesis of CTX3X and the Gambieric Acids' (26 July)
Part of the Organic Chemistry Seminar Series

Professor Neil Greenham, Department of Physics, University of Cambridge, UK 'Charge separation and recombination in polymer solar cells' (30 July)

Part of the Organic Chemistry Seminar Series

Professor Richard Sinnott, eResearch Director University of Melbourne "The nexus between eResearch and research in health and medical sciences: opportunities and capabilities" (4 August)

A Special Faculty of MDHS/Bio21 Institute seminar

Asimo Karnezis, Bio21 Institute, University of Melbourne, Vic Australia

'Gas and solution phase studies of siyl and germyl substituted pyridinium ions' (6 August) PhD Oration - Part of the Organic Chemistry Seminar Series

Mui Ling Khoo, Bio21 Institute, University of Melbourne, Vic Australia

'Total Synthesis of episilvestrol and a bioactive analogue' (13 August)

PhD Oration - Part of the Organic Chemistry Seminar Series

Professor Jochen Balbach, University of Halle, Germany 'Functional protein folding intermediates studied by time resolved NMR spectroscopy' (18 August)
Biological Nuclear Magnetic Resonance spectroscopy

seminar

Professor Daniel Huster, University of Leipzig, Germany 'Solid-state NMR of A6 protofibrils implies a 6-sheet remodelling upon maturation into terminal amyloid fibrils' (18 August)

Biological Nuclear Magnetic Resonance spectroscopy seminar

David Tso, Bio21 Institute, University of Melbourne, Vic Australia

'Mining for stable β-silyl carbenium ions' (27 August) PhD Oration - Part of the Organic Chemistry Seminar Series

Shea Fern Lim, Bio21 Institute, University of Melbourne, Vic Australia

'The Nature of Neighbouring groups participation by Chalcogen substituents' (3 September) PhD Oration - Part of the Organic Chemistry Seminar Series

Dr Nicholas Williamson, Bio21 Institute Research Transfer Facility Manager. University of Melbourne, Vic Australia 'Mass Spectrometry 101' (9 September)
A Bio21 Institute Platform Technologies Seminar

Professor Leann Tilley, Department of Biochemistry, La Trobe University, Vic Australia 'High resolution imaging of malaria parasite-infected erythrocytes' (10 September) Part of the Biochemistry and Molecular Biology Seminar Series

Dr Erik Strandberg, Department of Chemistry, Utrecht University

'Orientation of membrane-bound peptides studied by solid-state NMR: The influence of the hydrophobic membrane core' (10 September) Part of the Organic Chemistry Seminar Series

Wyvette Wee, Bio21 Institute, University of Melbourne, Vic Australia

'Synthesis of Novel Radioprotectors Derived from Hoechst 33342' (13 September)

PhD Oration - Part of the Organic Chemistry Seminar Series

Professor Alpha Yap, Institute for Molecular Bioscience, The University of Queensland Australia 'Molecular toolboxes: regulating cell-cell interactions by the cytoskeleton' (15 September) Part of the Biochemistry and Molecular Biology Seminar Series

Samantha Wimala, Rizzacasa Group, Bio 21 Institute, University of Melbourne

'Studies towards the synthesis of the spirangiens' (17 September)

PhD Oration - Part of the Organic Chemistry Seminar Series

Dr Arthur Pardi, Professor, Department of Chemistry and Biochemistry, University of Colorado, USA 'NMR and Single Molecule Techniques for Studying RNA Folding and RNA-protein Recognition' (23 September) A Bio21 Institute Platform Technologies Seminar

Dr Rasmus Linser, Nuclear Magnetic Resonance Facility, Analytical Centre, UNSW, Australia 'Development and Application of new Methods in Proton Detected Solid State NMR on Biomolecules' (24 September)

A Biological Nuclear Magnetic Resonance Seminar

Professor Jonathon J Rosen, Boston University, USA 'The role of student mentoring in accelerating new venture formation' (29 September)

A Bio21 Cluster and Victorian Endowment for Science, Knowledge and Innovation seminar

Dr Neil Levy, Centre for Applied Philosophy and Public Ethics

'Does neuroscience threaten freedom of the will?' (6 October)

Part of the Biochemistry and Molecular Biology Seminar Series

Dr Tilman Lechel, School of Chemistry, The University of Melbourne, Vic Australia

'New syntheses of five-and-six-membered heteroaromatics via highly substituted enamides' (8 October)

Part of the Organic Chemistry Seminar Series

Prof. David Jans, Department of Biochemistry and Molecular Biology, Monash University, Vic Australia 'Nucleocytoplasmic trafficking of gene products from RNA viral pathogens; from biology to vaccines and therapeutics' (8 October)

Part of the Biochemistry and Molecular Biology Seminar Series

Dr Barbara Power, AntibOZ Pty Ltd 'Recombinant antibody trends' (13 October) Part of the Biochemistry and Molecular Biology Seminar Series

Dr Belinda Abbott, Department of Chemistry, La Trobe University, Vic Australia 'From PI3K and PDEs to PDK1 and PNAs' (15 October)

Part of the Organic Chemistry Seminar Series

Dr Suzanne Cutts, Department of Biochemistry, La Trobe University, Vic Australia

'Anthracycline-based anticancer drugs: an altered mechanism of action creates new treatment strategies' (20 October)

Part of the Biochemistry and Molecular Biology Seminar Series

Dr. Jose Villadangos, Division of Immunology, Walter and Eliza Hall Institute, Vic Austraia

'Antigen Presentation Functions of Dendritic Cells: Immunology Meets Biochemistry and Cell Biology' (21 October)

Part of the Biochemistry and Molecular Biology Seminar Series

Harvey Li, Bio21 Institute, University of Melbourne, Vic Australia

'Adventures with peroxyl radicals as precursors for α -oxo carbenes and related reactive intermediates' (22 October)

PhD Oration - Part of the Organic Chemistry Seminar Series

Professor John Flygare, Genentech, Inc. and Stanford University, USA

'Protein/Protein Interactions and Apoptosis in Cancer Cells' (27 October)

Part of the Bio21 Institute Seminar Series

Ms Fiona Houghton, Department of Biochemistry and Molecular Biology, University of Melbourne, Vic Australia 'Going GaGa: The Golgi, golgins & small G proteins in trafficking Pathways' (28 October)

Part of the Biochemistry and Molecular Biology Seminar Series

Corin Storkey, Bio21 Institute, University of Melbourne, Vic Australia

'The synthesis of selenium containing carbohydrates and their biological application' (29 October)

PhD Oration - Part of the Organic Chemistry Seminar Series

Dr Chris Burns, Walter and Eliza Hall Institute, Vic Australia

'Discovery of new drugs for cancer' (5 November) Part of the Organic Chemistry Seminar Series Mr Bernard Meade and Mr Dirk Van Der Knijff, IT Research Services, University of Melbourne, Vic, Australia "What is the OptiPortal and how can it work for you?" (26 Nov) Bio21 Institute Platform Technologies Seminar

Shan Sun, Bio21 Institute, University of Melbourne, Vic Australia 'Synthesis of novel amino acids-appended cavitands' (26 November) PhD Oration - Part of the Organic Chemistry Seminar Series

Annual Report Appendix 2010 BIO21 MOLECULAR SCIENCE AND BIOTECHNOLOGY INSTITUTE





Tony Bacic

Professor, Director Bio21 Institute and
Director Plant Cell Biology Research Centre
Structure, function and biosynthesis of plant cell walls

Professor Bacic's research is focused on the structure, function and biosynthesis of plant cell walls and their biotechnological application as well as the application of functional genomics tools to abiotic stress and productivity in cereals.

Key areas of interest include:

- Structure, function and biosynthesis of complex carbohydrates in biological systems (cell walls, cell surfaces, extracellular matrices) including arabinogalactan-proteins (AGPs), cellulose, 1,3;1,4-β-glucans and arabinoxylans.
- Biotechnological applications of polysaccharides.
- Functional genomics in the growth and end-use quality of cereals; cloning and expression of polysaccharide synthases / glycosyl transferases; proteomics of the Golgi and plasma membranes.
- Development of platform technologies (glycomics/ proteomics/ metabolomics) for functional genomics.
- · Biomass utilisation.
- Abiotic stress in cereals; applications of proteomics and metabolomics technologies to understanding boron tolerance in cereals and salt and frost tolerance in native gasses adapted to survival in salt marshes and Antarctic environments.

Collaborations

University of Melbourne Genetics and Chemistry
Departments; Universities of Adelaide and Queensland;
University of Tasmania, Australian Wine Research Institute,
Adelaide, Defence Science and Technology Organisation.
International: KTH (Biomime) Sweden, University of Dundee,
Arcadia Biosciences, IPK Germany, Energy Biosciences
Institute USA, Scottish Crop Research Institute UK, University
of Copenhagen.

Grants

Redesigning grain polysaccharides. With Prof M Gidley (University of Queensland), Prof G Fincher (University of Adelaide), Dr B Gilbert (University of Sydney), Dr S. Jobling and Dr D. Topping (CSIRO) CSIRO Flagship Cluster (2007-10) \$3.6m

Australian Centre for Plant Functional Genomics: Abiotic stress & productivity in cereals (Renewal) With Profs P Langridge & G Fincher (University of Adelaide), Pro G Spangenberg (DNRE), Prof K Basford (University of Queensland) ARC / GRDC (2008-12) \$21m

Polysaccharide synthase genes in agro-industrial applications. With Prof G Fincher (University of Adelaide), Dr K Dhugga & Dr J Rafalski (DuPont Pioneer) ARC Linkage Project (2009-11) \$1.004m

Healthy complex cereal carbohydrates. With Prof G Fincher (University of Adelaide), Prof M Gidley (University of Queensland), Prof V Bulone (KTH Sweden), Dr S. Jobling and Dr D Topping (CSIRO Plant Industry), Dr C McSweeney (CSIRO Livestock) CSIRO Flagship Cluster (2010-13) \$3.449m

Publications

Binos, S, Royce, SG, Oxley, D, Bacic, A, Bhathal, PS, Underwood, JR. (2010) A Novel Foregut Mucin Characterized by a Murine Monoclonal Autoantibody Source: *Hybridoma* 29 (2): 84-101.

Burton RA, Ma G, Baumann U, Harvey AJ, Shirley NJ, Taylor J, Pettolino F, Bacic A, Beatty M, Simmons CR, Dhugga KS, Rafalski JA, Tingey SV, Fincher GB (2010) A customized gene expression microarray reveals that the brittle stem phenotype *fs2* of barley has a retroelement in the *HvCesa4* cellulose synthase gene. *Plant Physiology*, *153*, 1716-1728.

Collins HM, Burton RA, Topping DL, Liao M-L, Bacic A, Fincher GB (2010) Variability in the fine structures of non-cellulosic cell wall polysaccharides from cereal grains: potential importance in human health and nutrition. *Cereal Chemistry* 87: 272-282.

Doblin M, Pettolino F, Bacic A (2010) The skeleton of the plant world and more: role in plant growth, development and biotechnology. Func Plant Biol (Evans Review) 37, 357–381

Domozych DS, Sørensen I, Kiemle SN, Pettolino FA, Bacic A, Gretz MR, Willats WGT (2010) The cell wall polymers of the charophycean green alga *Chara corallina*: immunobinding and biochemical screening. *Int J Plant Sci* 171:345–361.

Ellis M, Egelund J, Schultz C, Bacic A (2010) Arabinogalactanproteins (AGPs): Key regulators at the cell surface? *Plant Physiology* 153: 403-419.

Likic, VA, McConville MJ, Lithgow, T, Bacic, A (2010) Systems Biology: The Next Frontier for Bioinformatics. Advances in Bioinformatics Online journal: Article ID 268925, 10 pages, doi:10.1155/2010/268925.

Maurer JBB, Bacic A, Pereira-Netto AB, Donatti L, Zawadzki-Baggio SF, Pettolino F (2010) Arabinogalactan-proteins from cell suspension cultures of *Araucaria angustifolia*. *Phytochemistry* 71:1400-1409.

Maurer JBB, Pereira-Netto AB, Pettolino F, Gaspar YM, Bacic A (2010) Effects of Yariv dyes, arabinogalactan-protein binding reagents, on the growth and viability of Brazilian pine suspension culture cells. *Trees* 24: 391-398.

Rao, SR, Ford KL, Cassin AM, Roessner, U, Patterson JH, Bacic A (2010) Proteomic and metabolomic profiling of rice suspension culture cells as a model to study abscisic acid (ABA) signaling response pathways in plants. J. Proteome Res 9:6623-6634.

- 10 PhD and 2 MSc students
- 1 PhD and 1 MSc completion
- Chair, Biological and Biotechnological Sciences Cluster
 6, The Excellence in Research for Australia Initiative
- James Cook University Outstanding Alumni
- Associate Editorial Board, Frontiers in Plant Proteomics (2010 -)
- Editorial Board, Plant and Cell Physiology (2006-2010)
- Monitoring Editor, Plant Physiology (2000)
- Editorial Board, Planta (2000-)
- Associate Editor, Glycobiology (1998-)
- Scientific Organising Committee XII Cell Wall Meeting, Porto, Portugal (2010)
- Program Committee, OzBio 2010 (combined 12th IUBMB, 21st FAOBMB and ComBio2010 Conferences) Melbourne 2010.



Marie Bogoyevitch

Associate Professor, Department of Biochemistry and Molecular Biology Signal Transduction in Health and Disease

The Bogoyevitch research team is interested in signal transduction, i.e. the unraveling mechanisms of intracellular communication pathways in both health and disease. The team are exploring the regulation of a group of intracellular communicators, the protein kinases, which provide critical control points during signal transduction events. Their specific focus lies in the c-Jun N-terminal Kinase (JNK) subfamily. The JNKs have attracted increasing interest following their initial description as stress and cytokine-activated protein kinases. They are now implicated as mediators in diseases including stroke, obesity and diabetes. A better understanding of these kinases will facilitate the development of better therapeutic strategies for these diseases.

Collaborations

Ludwig Institute, Baker IDI, Centenerary Institute Sydney, University of Western Australia, Monash University, LaTrobe University, IMB Queensland, Phylogica Perth. International: Israel, China, Singapore and Japan.

Grants

2010-12 "c-Jun N-terminal kinase regulation f microtubule destabilizer, Stathmin - a novel cytoprotective and cardioprotective pathway"; Ng & Bogoyevitch; NHMRC \$540,581.

2009-11 "c-Jun N-terminal kinase (JNK) actions in the response to stress"; Bogoyevitch & Dhillon; NHMRC \$471,300.

2009-11 "New peptides to probe protein kinase functions"; Bogoyevitch; ARC Discovery Grants Scheme \$190,000.

Publications

Characterization of a novel c-Jun N-terminal Kinase (JNK) inhibitory peptide. Ngoei, KR, Catimel, B, Church, N., Lio, DS, Dogovski, C, Perugini' MA, Watt' PM, Cheng, H-C, Ng, DC, and Bogoyevitch, MA. Biochem. J. minor text revision Dec 10 (BJ2010/1796)

Insulin-like growth factor-1 overexpression in cardiomyocytes diminishes ex vivo heart functional recovery after acute ischemia. Prêle, CM, Reichelt, ME., Mutsaers, SE, Davies, M, Headrick John P, Rosenthal, N, Bogoyevitch, MA and Grounds, MD Cardiovasc Pathol in press Dec 1 (CVP-D-09-00218R1)

Opposing actions of extracellular signal-regulated kinase (ERK) and signal transducer and activator of transcription 3 (STAT3) in regulating microtubule stabilization during cardiac hypertrophy. Ng DC, Ng IH, Yeap YY, Badrian B, Tsoutsman T, McMullen JR, Semsarian C, Bogoyevitch MA. J Biol Chem. 2010 In press Nov 5.

c-Jun N-terminal kinase phosphorylation of stathmin confers protection against cellular stress. Ng DC, Zhao TT, Yeap YY, Ngoei KR, Bogoyevitch MA. J Biol Chem. 2010 Sep 10;285(37):29001-13. Epub 2010 Jul 14

c-Jun N-terminal kinase/c-Jun inhibits fibroblast proliferation by negatively regulating the levels of stathmin/oncoprotein 18. Yeap YY, Ng IH, Badrian B, Nguyen TV, Yip YY, Dhillon AS, Mutsaers SE, Silke J, Bogoyevitch MA, Ng DC. Biochem J. 2010 Sep 1;430(2):345-54. (joint corresponding authors: DCN & MAB)

c-Jun N-terminal kinase (JNK) signaling: recent advances and challenges. Bogoyevitch MA, Ngoei KR, Zhao TT, Yeap YY, Ng DC. Biochim Biophys Acta. 2010 Mar;1804(3):463-75. Epub 2009 Nov 10. Review.

- 5 PhD and 4 Hons students
- 1 MSc completion
- ASBMB National Secretary & Executive member
- OzBio2010 Programme Committee and Chair of poster judging for ANZSCBD Cell Biology
- Editorial Board Member, "Biochemical Journal"
- Editorial Board Member, "International Journal of Biochemistry and Cell Biology



Kevin Barnham

NHMRC Research Fellow and Associate Professor, Department of Pathology Neurodegenerative diseases

The Barnham laboratory's focus is on the neurodegenerative diseases such as Alzheimer's, prion and Parkinson's disease. Using a range of biophysical and biochemical techniques, the group seeks to characterise the molecular events leading to disease pathology, that is, delineate the chemical events associated with degeneration. Characterisation of these events will enable the identification of potential drug targets. Current projects include investigating the role that metalions play in neurodegenerative diseases and elucidating the mechanisms leading to A β induced neuronal toxicity. In addition, the laboratory studies the copper binding sites on A β and APP as potential targets for therapeutic intervention.

Collaborations

Mental Heath Research Institute, University of Melbourne Pathology, Chemistry, Biochemistry and Genetics Departments, Austin Hospital, WEHI, Prana Biotechnology, CSIRO, CSL.

International: Japan

Grants

2009-11 NHMRC Project Identification of Biomarkers for Alzheimer's disease. \$583,163. (With Villemagne.)

Publications

Haeffner, F. Bush, A.I., Barnham, K.J., Brinck, T. Generation of soluble oligomeric
beta>-amyloid species via copper catalyzed oxidation with implications for Alzheimer's disease: A DFT study. *J. Mol. Model.* 2010, *16*, 1103-1108.

Lim S., Price K. A., Chong S., Paterson B. M., Caragounis A., Barnham K. J., Crouch P. J., Peach J. M, Dilworth J. R., White A. R., Donnelly P. S. Copper and Zinc Bis (thiosemicarbazonato) Complexes with a Fluorescent Tag: Synthesis, Radiolabelling with Copper-64, Cell Uptake and Fluorescence Studies. *J. Biol. Inorg. Chem.* 2010, *15*, 225-235.

Fodero-Tavoletti M.T., Villemagne V.L., Paterson B.M., White A.R., Li Q.-X., Camakaris J., O'Keefe G., Cappai R., Barnham K.J., Donnelly P.S. Molecular Imaging of Alzheimer's Disease with a Copper-64 bis(thiosemicarbazonato) Complex. *J. Alz. Dis.* 2010, *20*, 49-55.

Smith D.G., Ciccotosto G.D., Tew D.J., Perez K., Curtain C.C., Boas J.F., Masters C.L., Cappai R., Barnham K.J. Histidine 14 modulates membrane binding and neurotoxicity of the Alzheimer's disease amyloid- peptide. *J. Alz. Dis.* 2010, 19, 1387-1400.

Rekas A., Knott R.K., Sokolova A., Barnham K.J., Perez K., Masters C.L., Drew S.C., Cappai R. Curtain C.C. Pham C.L.L. The structure of dopamine induced alpha-synuclein oligomers. Eur. J. Biophys. 2010, 39, 1407-1419.

Kim W.S., Bhatia S., Elliott D.A., Hellström L., Kågedal K., McCann H., Halliday G.M., Barnham K.J., Garner B. Increased ATP-binding cassette transporter A1 expression in Alzheimer's disease hippocampal neurons. . *J. Alz. Dis.* 2010, *21*, 193-205

Villemagne V.L., Perez K.A., Pike K.E., Kok W.M., Rowe C.C., White A.R., Bourgeat P., Salvado O., Bedo J., Hutton C.A., Faux N.G., Masters C.L., Barnham K.J. Blood borne Ald dimer correlates with clinical markers of Alzheimer's disease. *J. Neurosci.* 2010, *30*, 6315-6322.

Harrison, C.F.; Lawson, V.A.; Coleman, B.M.3; Kim, Y.-S.; Masters, C.L.; Cappai, R.; Barnham, K.J.; Hill, A.F. Conservation of a glycine rich region in the prion protein is required for uptake of prion infectivity. J. Biol. Chem. 2010, 285, 20213-20223

Lim S.C., Paterson B.M., Fodero-Tavoletti M.T., O'Keefe, G.J., Cappai R., Barnham K.J., Villemagne V.L., Donnelly P.S. Copper Radiopharmaceuticals for Diagnostic Imaging of Alzheimer's Disease: A bis(thiosemicarbazonato)copper(II) complex that binds selectively to amyloid-beta plaques. Chem Commun 2010, 46, 5437-5439.

Duce J.A., Tsatsanis A., Cater M.A., James S.A., Robb E., Wikhe K., Leong S.L., Perez K., Johanssen T., Greenough M.A., Cho H.H., Cappai D., Moir R.D., Masters C.L., McLean C., Tanzi R.E., Cappai R., Barnham K.J., Ciccotosto G.D., Rogers J.T., Bush A.I. An iron-export ferroxidase activity of β -amyloid protein precursor is inhibited by zinc in Alzheimer's Disease. Cell 2010, 142, 857-867.

Boland M.P., Hatty C.R., Separovic F., Hill A.F., Tew D.J., Barnham K.J., Haigh C.L., James M., Masters C.L., Collins S.J. Anionic phospholipid interactions of the prion protein N-Terminus are minimally perturbing and not driven solely by the octapeptide repeat domain. J. Biol. Chem. 2010, 285, 32282-32292.

Lawson V.A.; Haigh C.L.; Roberts B.R.; Kenche V.B.; Klemm, H.; Masters, C.L.; Collins, S.J.; Barnham, K.J.; Drew, S.C. Near Infrared Fluorescence Imaging of Apoptotic Neuronal Cell Death in a Live Animal Model of Prion Disease. *ACS Chem. Neurosci.* 2010, *1*, 720-727.

- 9 PhD and 1 MSc students
- 6 PhD completions



Philip Batterham

Professor, Department of Genetics
Pest insect genomics and insecticide resistance

The Batterham research group is interested in the mechanisms by which agricultural and domestic insect pests develop resistance to chemical insecticides. The genes that encode insecticide targets (nicotinic acetylcholine receptors, gaba-gated chloride channels and glutamate channels) and detoxification enzymes (Carboxylesterases, Cytochrome P450s, Glutathione-s-transferases and UGTglycosyltransferases) are being examined. This research is underpinned by genomics research on these pests. In collaboration with Michael Parker the relationship between target protein structure and function is being examined. The group has developed the capacity to predict the genetic basis of insecticide resistance before it arises in the field. They also have the capacity to conduct insect genome projects identifying all of the existing resistance genes and novel targets for the development of species-specific insecticides. Much of their work is initiated on the model insect, Drosophila melanogaster. The group's fundamental research finds extension and focus in improving the control of major crop pests in the developing world.

Collaborations

CSIRO Entomology, Novartis Animal Health, Dow Agrosciences

Internatinonal: Nanjing Agricultural University.

Grants

2009-11 DIISR Australia-India Biotechnology Fund. Batterham, P. \$400,000 (\$133,000 in 2010). Sustainability of pyramided Bt genes for insect control in crop plants.

2009-11 ARC LP Batterham, P. (CI) \$280,000 (\$95,000 in 2010). Identification of the targets of a novel metalloproteinase inhibitor used for the treatment of human head lice.

2009-11 ARC DP Batterham, P. (CI) Parker, M.W. (CI) \$387,805 (\$124,970 in 2010). Functional and regulatory analysis of n-acetylcholine receptors, key targets of insecticides.

2010-12 ARC LP Batterham, P. (CI) Parker, M.W. (PI) \$520,000 (\$163,320 in 2010). Identification of the molecular targets of insecticides that impact the insect nervous system.

2010-12 ARC Batterham, P. (CI), Daborn, P.J. (CI) \$315,000 (\$117,386 in 2010). Dissecting Insect Gut Function to Understand Insecticide Metabolism.

Publications

Low, W. Y., Feil, S. C., Ng, H. L., Gorman, M. A., Morton, C. J., Pyke, J., McConville, M. J., Robin, C., Gooley, P.R., Parker,

M.W. and P. Batterham (2010). Recognition and detoxification of the insecticide DDT by *Drosophila melanogaster* glutathione S- transferase D1. J. Mol. Biol 399(3):358-66.

Tay,W.T., Behere, G.T., Batterham, P. and D.G. Heckel (2010). Generation of microsatellite repeat families by RTE retrotransposons in lepidopteran genomes. BMC Evolutionary Biology 10: 144

Schmidt J.M., Good R.T., Appleton, B., Sherrard, J., Raymant, G.C., Bogwitz. M.R., Martin, J., Daborn, P.J., Goddard, M.E., Batterham, P., Robin, C. (2010). Copy number variation and transposable elements feature in recent, ongoing adaptation at the *Cyp6g1* locus. PLoS Genetics 6: e1000998

Grzywacz, D., Rossbach, A., Rauf, A., Russell, D.A., Srinivasan, R. and A. Shelton (2010) Current control methods for Diamondback moth and other brassica insect pests and the prospects for improved management with lepidopterous resistant Bt vegetable brassics in Asia and Africa. *Crop Protection* 29:68-79.

Jones, R.T., Bakker, S.E., Stone, D., Shuttleworth, S.N., Boundy, S., McCart, C., Daborn, P.J., ffrench-Constant, R.H., van den Elsen, J.M. (2010) Homology modelling of *Drosophila* cytochrome P450 enzymes associated with insecticide resistance. Pest Manag Sci 66, 1106-1115.

- 10 PhD, 4 MSc students. 1 PhD, 3 MSc completions
- President of the Genetics Society of Australasia
- Local organiser 63rd UN Department of Public Information NGO Conference.



Roberto Cappai

Professor, Department of Pathology Neurodegenerative diseases

The Cappai laboratory's research interest is on the key neurodegenerative diseases of Alzheimer's, Parkinson's, Prion disease and neurotrauma. The group are studying the key proteins associated with these neurodegenerated diseases - alpha-synuclein, Abeta, APP and PrP, to identify the critical molecular interactions and cellular pathways that cause the neuronal dysfunction and death. Current projects include small molecule screening for modulators of neurotoxicity, studying the function and metabolism of these proteins, delineating the folding pathways and modulators that lead to misfolded toxic proteins, the development of ligands for the imaging of these proteins and identifying proteins that confer neuroprotective activity following injury.

Collaborations

University of Melbourne Departments of Anatomy and Cell Biology and Biochemistry and Molecular Biology, Adelaide

International: Tohoku University, Graz University, Lund University, Free University, Aarhus University, INSERM Paris, McGill University, IPGME&R Kolkata India.

2010-12 ARC Discovery Project Grant, R.Cappai. Delineating the functional role of the amyloid precursor protein's copper binding domain (\$100,000 per year)

2009-13 NHMRC Fellowship - Senior Research Fellow Level B, R. Cappai (\$116,250 per year)

2008-10 NHMRC Project Grant R. Cappai, O.M. Andersen. Delineating the interaction between the Amyloid Precursor Protein family and sorLA/LR11. (\$239,000 per year)

2006-10 NHMRC Program Grant.C.L. Masters, K.J. Barnham, A.I. Bush, R. Cappai, R. Cherny, S.J. Collins, A.F. Hill, A.R. White. Neurodegeneration in the aging brain: how the pathways leading to aggregated protein cause disease. (\$269,000 per year)

Publications

Smith D.G., Ciccotosto G.D., Tew D.J., Perez K., Curtain C.C., Boas J.F., Masters C.L., Cappai R. and Barnham K.J. Histidine 14 modulates membrane binding and neurotoxicity of the Alzheimer's disease amyloid- β peptide. Journal of Alzheimer's disease (2010) 19: 1387-1400.

Harikrishnan K.N., Bayles R., Ciccotosto G D., Maxwell S., Cappai R., Pelka G.J. Tam , P.P.L., Christodoulou J.and El-Osta A. Alleviating transcriptional inhibition of the norepinephrine Slc6a2 transporter gene in depolarised neurons. The Journal of Neuroscience (2010) 30:1494-1501 Banerjee K., Sinha M, Pham C.L.L., Jana S., Chanda D., Cappai R. and Chakrabarti S. α-Synuclein induced membrane depolarization and loss of phosphorylation capacity of isolated rat brain mitochondria: Implications in the pathogenesis of sporadic Parkinson's Disease. FEBS Letters (2010) 584:1571-1576

Rekas A, Knott RB, Sokolova A, Barnham KJ, Perez KA, Masters CL, Drew SC, Cappai R, Curtain CC, Pham CL. The structure of dopamine induced alpha-synuclein oligomers. European Biophysics Journal. (2010) 39: 1407-1419

Harrison CF, Lawson VA, Coleman BM, Kim YS, Masters CL, Cappai R, Barnham KJ, Hill AF. Conservation of a glycine-rich region in the prion protein is required for uptake of prion infectivity. Journal of Biological Chemistry (2010) 285(26):20213-20223

Perreau VM, Orchard S, Adlard PA, Bellingham SA, Cappai R, Ciccotosto GD, Cowie TF, Crouch PJ, Duce JA, Evin G, Faux NG, Hill AF, Hung YH, James SA, Li QX, Mok SS, Tew DJ, White AR, Bush AI, Hermjakob H, Masters CL. A domain level interaction network of amyloid precursor protein and Abeta of Alzheimer's disease. Proteomics. 2010 Jun;10(12):2377-95.

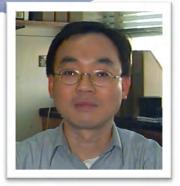
Nisbet RM, Harrison CF, Lawson VA, Masters CL, Cappai R, Hill AF. Residues surrounding the glycosylphosphatidylinositol anchor attachment site of PrP modulate prion infection: insight from the resistance of rabbits to prion disease. Journal of Virology. (2010) 84(13): 6678-6686

Lim S, Paterson BM, Fodero-Tavoletti MT, O'Keefe GJ, Cappai R, Barnham KJ, Villemagne VL, Donnelly PS. A copper radiopharmaceutical for diagnostic imaging of Alzheimer's disease: a bis(thiosemicarbazonato)copper(II) complex that binds to amyloid-beta plaques. Chem Commun (Camb). (2010) 46: 5437-5439

Duce JA, Tsatsanis A, Cater MA, James SA, Robb E, Wikhe K, Leong SL, Perez K, Johanssen T, Greenough MA, Cho HH, Galatis D, Moir RD, Masters CL, McLean C, Tanzi RE, Cappai R, Barnham KJ, Ciccotosto GD, Rogers JT, Bush AI. Ironexport ferroxidase activity of β-amyloid precursor protein is inhibited by zinc in Alzheimer's disease. Cell. 2010 142: 857-867.

Dinet V, An N, Ciccotosto GD, Bruban J, Maoui A, Bellingham SA, Hill AF, Andersen OM, Nykjaer A, Jonet L, Cappai R, Mascarelli F. APP involvement in retinogenesis of mice. Acta Neuropathol. 2010 Oct 27

- 2 PhD students and 1 International PhD Student
- 3 PhD completions
- Member of the Grant Review Panel (Neurosciences)



Heung Chin-Cheng

Associate Professor, Department of Biochemistry & Molecular Biology Enzymology of protein kinases and phosphatases involved in cancer and neurodegeneration

The Cheng research team is focused on a group of enzymes called protein kinases and phosphatases which play a key role in contributing to the formation and disease progression of cancer such as chronic myelogenous leukaemia and neurodegenerative diseases such as Parkinson's disease and Alzheimer's disease. Specifically, the team employ biochemical, cell biology and structural biology approaches to investigate the structure, function and regulation of these enzymes, and how aberrant regulation of these enzymes contributes to diseases. Results of our investigation will provide a better understanding of causes of these diseases and contribute to the development of novel therapeutic strategies for the treatment of these diseases.

Collaborations

Dept of Pathology and Surgery, University of Melbourne, St Vincent's Hospital, Ludwig Institute, University of Tasmania, Surgery Austin Hospital and Pharmacy College Monash University.

International: University of Calgary, Yale University School of Medicine University of Pittsburgh.

Grants

"Deciphering how PTEN phosphatase mediates excitotoxic neuronal death. NHMRC \$166,250/yr. Net income to the department in 2010: \$83,125

"Inhibition of Nef-activated Src-family kinases by CHK (with Mulhern, van Driel). NHMRC, Net income to the department in 2010: \$166,250

"Deciphering the neuroprotective mechanism of Parkinson's disease-associated protein kinase PINK1" NHMRC \$182,275/yr. Net income to the department in 2010: \$121,516

"Regulation and substrate identification of Parkinson's disease causative Leucine-rich Repeat Kinase 2 (LRRK2) with Janetta Culvenor (Pathology) NHMRC \$222,500/yr. Net Income to the department in 2010: \$74,167

Publications

Chia, J.Y., Gajewski, J.E., Xiao, Y., Zhu, H.J. and Cheng, H.-C.(2010) "Unique biochemical properties of the protein tyrosine phosphatase activity of PTEN – demonstration of different active site structural requirements for phosphopeptide and phospholipid phosphatase activities of PTEN" Biochim. Biophys. Acta, 1804(9):1785-95.

Ia, K.K., Mills, R.D., Hossain, M.I., Jarasrassamee, B., Jorissen, R.N., and Cheng, H.C. (2010) "Structural Elements and Allosteric Mechanisms Governing Regulation, Catalysis and Substrate Recognition of CSK-Family Kinases" Growth Factors, 28(5):329-50.

Chan, K.C., Lio, D.S., Jarasrassamee, B., Hossain, M.I., Ia, K.K., Cheng, H.-C. (2010) "Development of the Procedures for High Yield Expression and Rapid Purification of Active Recombinant Csk-Homologous Kinase (CHK) - Comparison of the catalytic activities of CHK and CSK" Protein Exp. & Purif., 74(2):139-47.

Kamaruddin, M.A., Ung, P. Hossain, M.I., Jarasrassamee, B., Thompson, P., Scanlon, D. Cheng, H.C. Graham, B. (2010) "A rapid and convenient click chemistry method to develop fluorescent based chemosensor for protein tyrosine kinases" Bioorganic & Medicinal Chemistry Letters., In Press.

Chen, M.J., Soo, P.C., Choy, M.S., Peng, Z.F., Cheng, H.C. and Cheung, N. S. (2010) Calpains-mediated PTEN cleavage in excitotoxic neuronal death, submitted to Journal of Biochemistry - Molecular Biology at the Post-Genomic Era, In Press.

Ngoei, K.R.W.; Catimel, B., Church, N., Lio, D.S., Dogoski, C., Perugini, M.A., Watt, P.M., Cheng, H.C., Ng, D.H., and Bogoyevitch, M.A. "Characterization of a novel c-Jun Nterminal Kinase (JNK) inhibitory peptide" Biochem. J. Provisionally accepted. Re-submitted with minor revision.

- 8 PhD and 2 Hons students
- 3 PhD completions
- Research and Lab skills training Hosted two Coburg Senior High School students as part of the Victorian School Apprenticeship Program (1 day per week over 2 years).



Paul Donnelly
Senior Lecturer, School of Chemistry
Metals in Medicine and Biology

The Donnelly research group's interests broadly pertain to the application of synthetic inorganic chemistry to the development of new metal-based drugs and new materials. The group is also interested in the role of metal ions in biology. A particular focus is the development of metal-based radiopharmaceuticals for imaging and therapy of cancer. Other projects focus on the development of metal-based drugs for the treatment and diagnosis of neurodegenerative disease.

Collaborations

University of Melbourne Pathology and Biochemistry and Molecular Biology Departments, Howard Florey Institute and Austin Hospital.

Grants

2008-10 ARC Discovery Project (A. Wedd, P.S. Donnelly): Molecular Probes for Bio-Metals (\$390,000).

2009-11 NHMRC Project Grant (A. White, P.S. Donnelly, P.J. Crouch): Modulation of neurotherapeutic cell signalling pathways by metallo-complexes for treatment of Alzheimer's disease (\$627,750).

2010 Zo-ee MND Research Grant, Motor Neurone Disease Research Institute of Australia (Q. Li, P. Donnelly, A. White, K. Barnham): *In vivo* targets affected by a novel therapeutic agent for MND GIA 1310, (\$31,000).

2010 Zo-ee MND Research Grant, Motor Neurone Disease Research Institute of Australia (P. Crouch, P. Donnelly, A. White, K. Barnham): Cellular hypoxia as a causative factor in MND GIA, (\$31,000).

Publications

Paterson, B. M.; Karas, J. A.; Scanlon, D. B.; White, J. M.; Donnelly, P. S. "Versatile New Bis(thiosemicarbazone) Bifunctional Chelators: Synthesis, Conjugation to Bombesin(7-14)-NH2, and Copper-64 Radiolabeling." *Inorg. Chem.* 2010, 49, 1884.

Buncic, G.; Donnelly, P. S.; Paterson, B. M.; White, J. M.; Zimmermann, M.; Xiao, Z.; Wedd, A. G. "A Water-Soluble Bis(thiosemicarbazone) Ligand. A Sensitive Probe and Metal Buffer for Zinc." *Inorg. Chem.* 2010, 49, 3071.

Paterson, B. M.; White, J. M.; Donnelly, P. S. "A hexadentate bis(thiosemicarbazonato) ligand: rhenium(V), iron(III) and cobalt(III) complexes." *Dalton Trans.* 2010, 39, 2831.

Fodero-Tavoletti, M. T.; Villemagne, V. L.; Paterson, B. M.; White, A. R.; Li, Q.-X.; Camakaris, J.; O'Keefe, G.; Cappai, R.; Barnham, K. J.; Donnelly, P. S. "Bis(thiosemicarbazonato) Cu-64 Complexes for Positron Emission Tomography Imaging of Alzheimer's Disease." *J. Alz. Dis.* 2010, 20, 49.

Lim, S.; Price, K. A.; Chong, S.-F.; Paterson, B. M.; Caragounis, A.; Barnham, K. J.; Crouch, P. J.; Peach, J. M.; Dilworth, J. R.; White, A. R.; Donnelly, P. S. "Copper and zinc bis(thiosemicarbazonato) complexes with a fluorescent tag: synthesis, radiolabelling with copper-64, cell uptake and fluorescence studies." *J. Biol. Inorg. Chem.* 2010, 15, 225.

Ma, M. T.; Donnelly, P. S. "Peptide targeted copper radiopharmacuticals." *Curr. Topics Med. Chem.* 2010, in press.

Lim, S.; Paterson, B. M.; Fodero-Tavoletti, M. T.; O'Keefe, G. J.; Cappai, R.; Barnham, K. J.; Villemagne, V.L; Donnelly, P.S. "A copper radiopharmaceutical for diagnostic imaging of Alzheimer's disease: a bis(thiosemicarbazonato)copper(II) complex that binds to amyloid- β plaques" *Chem. Commun.*, 2010, 46, 5437.

- 7 PhD and 2 Hons students
- 2 PhD completions
- Has been an inventor on four patents in the last four years (2 in 2010)
- Founding member and on the Scientific Advisory Board for Procypra Therapeutics
- Awarded 2009/10 Alan Sargeson Lectureship RACI for significant and innovative contribution to inorganic chemistry by an early career researcher
- Awarded 2010 RACI Rennie Medal
- Associate Editor Journal of Alzheimer's Disease
- 'Founding member and Head Scientist of Clarity Pharmaceuticals'
- Invited Keynote Lecturer at International Conference on Coordination Chemistry, ICCC39, Adelaide, Australia, 25th-30th July 2010



Paul Gleeson

Professor and Head of Department, Department of Biochemistry and Molecular Biology
Membrane trafficking and protein sorting / Molecular immunology and autoimmunity

The Gleeson research team has two major research interests:

Membrane trafficking and protein sorting
Membrane trafficking underpins a wide variety of
physiological processes, including secretion of hormones
and growth factors, antigen presentation, regulation of
receptor signalling and establishment of polarised epithelial
cells

A focus of this laboratory is to understand the molecular basis of membrane and protein sorting in the secretory and endocytic pathways of mammalian cells, with particular emphasis on the regulation of post-Golgi membrane transport, role of macropinocytosis in the downregulation of activated receptors and antigen presentation and acid secretion by parietal cells. Our laboratory has developed strategies to explore the function of trafficking components in primary cells and whole organisms, including the silencing of components by RNAi in cells and in mice.

Molecular immunology and autoimmunity
Autoimmune disease occurs when the immune system turns
against the body's own tissues resulting in immunemediated destruction. Our objective is to understand the
development of autoimmune diseases and the basis for the
loss of immunological tolerance to self-antigens. Together
with A/Prof Ian van Driel, we have established a highly
defined mouse model of autoimmune gastritis to investigate
the mechanisms of T lymphocyte tolerance to gastric
selfantigens and the pathogenesis of this organ-specific
autoimmune disease. A major focus is to understand the
basis for the loss of tolerance to self-antigens and the
development of autoimmune disease. A goal of this research
is to develop molecular and cellular strategies for the
treatment of autoimmune disorders.

Collaborations

IMB, University of Queensland International: Vanderbilt University Medical Center USA, Curie Institute France, Bristol University UK, University of Arkansas for Medical Sciences USA.

Grants

2008-2010 NHMRC Project. The generation and function of tissue-specific regulatory T cells. PA Gleeson and IR van Driel. \$390K

2009-2012: ARC LP Inhibition of pro-inflammatory cytokine secretion- A new route to therapeutics of chronic inflammatory disease. PA Gleeson and JL Stow. \$336K

2009-2011 NHMRC Project. Dissecting retrograde endosomal-Golgi transport pathways relevant to development, cell function and disease. PA Gleeson. \$510K

2009-2011 NHMRC Project. Cell biology of macropinocytosis in antigen presenting cells. PA Gleeson and RD Teasdale. \$520K

2010-2012: ARC DP. The structure and function of the trans-Golgi network-Role of golgins and G proteins, PA Gleeson, \$330K.

2010-2012 NHMRC Project, Regulating the secretion of inflammatory cytokines. JL Stow and PA Gleeson. \$537K

Publications

Lieu, ZZ and Gleeson PA (2010) Identification of different itineraries and retromer components for endosome-to-Golgi transport of TGN38 and Shiga toxin. *Eur. J. Cell Biol* 89:379-303

Gleeson PA and Goud, B (2010) TGN golgins, Rabs and cytoskeleton: Regulating the Golgi trafficking highways. *Trends Cell Biology* 20: 329-336

Allen, S, Turner, SJ, Bourges, D, Gleeson, PA and van Driel, IR (2010). Shaping the T-cell repertoire in the periphery. *Immunol Cell Biol.* (in press)

Lieu, ZZ and Gleeson, PA (2010) Endosome-to-Golgi transport pathways in physiological processes. *Histol Histopath* (in press).

- 4 PhD, 1 Hons and 1 MSc (part time) students
- 1 PhD completions
- Editorial Board of J. Autoimmunity, Glycoconjugate Journal
- Contributing member to Faculty of 1000 (immunology)



Paul Gooley

Associate Professor, Department of Biochemistry and Molecular Biology NMR spectroscopy: Protein structure and dynamics

The Gooley research group is interested in all things biological and NMR. In particular, the group focuses on the structural and dynamic investigations of protein-protein, protein-peptide and protein-lipid interactions including: the relaxin GPCR and its homologues, their interactions with their respective hormones and their curious mechanism of activation; the specificity and affinity for oligosaccharides by the carbohydrate binding modules, and their significance in regulation of the enzyme AMP protein activated kinase; protein import receptors of mitochondria and how they bind and pass preproteins through the membrane; apolipoprotein CII in the amyloid state from lipid and lipid-free environments; and insecticide resistant GST proteins and their interactions with insecticides. A relative new interest is applying NMR methods to metabolomics, focussed on the role and impact of the gut microflora in health and in syndromes such as chronic fatigue. We are interested in studying the effect of prebiotics, probiotics on the exometabolome of the microbiota.

Collaborations

Howard Florey Institute, La Trobe University, St Vincent's Hospital, Bioscreen.

International: Switzerland, South Korea

Grants

2010 NHMRC - \$70,000 Specific roles of the transmembrane exoloops and the LDLa module in the activity of relaxin and INSL3 receptors (Bathgate, Gooley).

2008-2010 ARC Discovery - \$381,000 'Investigating the subunit interactions of a molecular import machine' (Gooley, Mulhern, Buchanan, Oschkinat).

Publications

Tull, D., Naderer, T., Spurck, T., Mertens, H.D.T., Macfadden, G., Gooley, P.R. and McConville, M.J. "The diacylated protein, SMP-1, is required for flagellum biogenesis and motility in *Leishmania*" Journal of Cell Science (2010) 123, 544-554.

Sheedy, J. R, Ebeling, P.R., Gooley, P. R. and McConville, M.J. "A sample preparation protocol for 1H-NMR studies of water soluble metabolites in blood and urine." Analytical Biochemistry (2010) 398, 263-265.

Low, W.Y., Feil, S.C., Ng, H.L., Gorman, M.A., Morton, C.J., Pyke, J., McConville, M.J., Bieri, M., Mok, Y.F., Robin, C., Gooley, P.R., Parker M.W. and Batterham, P. "Recognition and detoxification of the insecticide DDT by *Drosophila melanogaster* glutathione S-transferase D1" Journal of Molecular Biology (2010) 399, 358-366.

Koay' A., Woodcroft, B., Petrie, E.J., Yue, H., Emanuelle, S., Bieri, M., Bailey, M.F., Hargreaves, M., Park, J.-T., Park, K.-H., Ralph, S., Neumann, D., Stapleton, D., and Gooley, P.R. "AMPK Beta Subunits Display Isoform Specific Affinities for Carbohydrates." FEBS Letters (2010) 584, 3499-3503.

Kong, R.C.K., Shilling, P.J., Lobb, D.K., Gooley, P.R. and Bathgate, R.A.D. "Membrane receptors: Structure and function of the Relaxin Family Peptide Receptors" Molecular and Cellular Endocrinology (2010) 320, 1-15.

- 7 PhD and 3 Hons students
- 1 PhD completion
- Invited lecture International Conference on NMR at the Interface of Physics Chemistry & Biology, November 29-30 2010 Indian Institute of Science, Education, Research, Mohali, India.



Sally Gras

Senior Lecturer, Department of Chemical and Biomolecular Engineering Chemical and Bioengineering from the biomolecular to the large scale

The Gras research group is interested in four key areas:

Materials Science: The group is developing advanced materials that deliver anti-inflammatory peptides for tissue engineering or drugs for the treatment of cancer. Other new materials include self-assembling peptide systems and grafted peptide layers that can control interfacial properties and nanoparticle aggregation.

Protein Misfolding: A number of proteins form amyloid fibrils with positive functions. A number of proteins form amyloid fibrils with positive functions. The group is examining fibrils formed by bacterial proteins and hope to uncover why these fibrils are different to those formed in disease. They also design de novo peptide sequences that self-assemble and can be used for bio and nanotechnology. A further interest is the structure of amyloid fibrils formed from natural, designed or disease associated peptides and proteins and we often work at the macromolecular crystallography, the Fourier transform infrared spectroscopy and Small Angle X-ray Scattering beamlines at The Australian Synchrotron.

Dairy Science and Engineering: What makes a good Cheddar cheese crumble? The team have a small scale (500g) cheese making facility and are examining the determinants of cheese microstructure to assist the Australian Dairy Industry make cheese with consistent a texture and better yield. They are also studying cheese maturation and looking at the properties of buffalo milk.

Gut health, fermentation and metabolic engineering: The group make high value nutraceuticals, known as galacotoligosaccharides, from lactose. These saccharides have great potential for increasing digestive health in the elderly and in newborns and they are probing how these saccharides influence bacterial metabolism. They are also interested in metabolic engineering and using cells to produce fine chemicals in large scale (>5L) culture vessels.

Collaborations

Baker Institute, SARDI, University of Adelaide, Monash University, Deakin University, The Australian Synchrotron, CSIRO.

International:, Cambridge University UK, Reading University UK, University of Groningen The Netherlands, New York University USA, Virginia Tech USA, Institute of Biophysics, Chinese Academy of Sciences, China, University of Canterbury NZ, Javapur University and IIT Kanpur India.

Grants

2010 - Dairy Innovation Australia Research Grant - Microstructure in mature Cheddar cheese - \$160,000. 2010 - Rural Industries and Research Development Corporation Research Priorities Program —"Characterisation of buffalo milk, cheese and yoghurt properties" \$60,000 over two years.

Publications

Gras S.L., Waddington L.J., Goldie K.N., Transmission Electron Microscopy, Methods in Molecular Biology: Protein folding and misfolding protocols; Springer Press, in press accepted June 21st, 2010, Invited Chapter.

Gras S.L., Squires A.M., Dried and hydrated X-ray scattering analysis of amyloid fibrils, Methods in Molecular Biology: Protein folding and misfolding protocols; Springer Press, in press accepted June 21st, 2010, Invited Chapter.

Ong L., Dagastine R.R., Kentish S.E., Gras S.L., The Effect of Milk Processing on the Microstructure of the Milk Fat Globule and Rennet Induced Gel Observed Using Confocal Laser Scanning Microscopy, Journal of Food Science, 75(3): E135-E145, 2010.

Gosling A., Stevens G.W., Barber A., Kentish S.E., Gras S.L., Recent advances refining galactooligosaccharide production from lactose, Food Chemistry, Food Chemistry, 121(2): 307-308, 2010.

Mosse W.K.J, Koppens M.L., Gras S.L., Ducker W., Complexity in Nanoparticle assembly and Function Obtained by Direct-Grafted Peptides, Langmuir, 26(2): 1013-1018, 2010.

Go D.P, Palmer J.A., Gras S.L., O'Connor A.J., Delivery of an Anti-Inflammatory Hormone via Layer-by-Layer Assembly of Biomolecules, European Cells and Materials Vol. 20. Suppl. 3, 2010 (page 93).

Ong L., Dagastine R.R., Kentish S.E., and Gras S.L., Transmission electron microscopy imaging of the microstructure of milk in cheddar cheese production under different processing conditions, Australian Journal of Dairy Technology, 65(3): in press, 2010.

- 9 PhD, 1 MSc, 4 Hons and 2 summer students
- 1 PhD completion
- Committee member of the Australian Council of Learned Academies project: "Making Interdisciplinary Research Work Achieving a Sustainable Australia" 2010; steering committee member Gardiner Foundation 'Feeding for Higher Value Milk project; Represented The Australian Academy of Science at Science Meets Parliament.



Danny Hatters

Grimwade Fellow, Department of Biochemistry and Molecular Biology Detecting and mapping different protein conformations in live cells

The Hatters lab focuses on how dynamics in protein conformation affects cellular functioning. A key area of investigation is assessing i) how aggregation-prone proteins misfold and aggregate into nanometre and micrometre-sized aggregates in living cells and ii) the concomitant effects on normal cellular functioning and disease progression. Such processes are fundamental to several neurodegenerative diseases, and the group's major research effort revolves around the molecular mechanisms underpinning Huntington's disease using two internationally recognized new technologies they recently developed. The team is also interested in establishing new approaches to monitor the conformational dynamics of other proteins, such as kinases, directly in live cells and in vivo in simple organism models of disease such as Drosophila.

Collaborations

University of Melbourne Department of Anatomy and Cell Biology, Patrys Ltd.

International: Gladstone Institute and University of California San Francisco, USA.

Grants

2010-12 Australian Research Council Linkage Grant. Title: Biophysical identification of natural human antibody targets. Chief Investigators: Geoff Howlett, Terrence Mulhern, Danny Hatters. Partner Organisation: Patrys Ltd. \$300,000

2009-11 National Health and Medical Research Council. Title: The Role of Huntingtin Misfolding and Oligomerization in Huntington's Disease. Chief Investigator: Daniel Hatters. \$454,250

Publications

Tetali SD, Budamagunta MS, Simion C, den Hartigh LJ, Kalai T, Hideg K, Hatters DM, Weisgraber KH, Voss JC, Rutledge JC (2010) VLDL lipolysis products increase VLDL fluidity and convert apolipoprotein E4 into a more expanded conformation. *J Lipid Res.* 51:1273–83

Ramdzan YM, Nisbet RM, Miller J, Finkbeiner SF, Hill AF, Hatters DM (2010) Conformation sensors that distinguish monomeric proteins from oligomers in live cells. *Chem. Biol.* 17: 371–379.

Olshina MA, Angley LM, Ramdzan RM, Tang J, Bailey M, Hill AF, Hatters DM (2010) Tracking mutant huntingtin aggregation kinetics in cells reveals three major populations including an invariant oligomer pool. *J. Biol. Chem.* 285:21807–16

- 4 PhD and 4 Hons students
- Member of the Huntington's Disease Research Group of Victoria
- Secretary of the Lorne Conference on Protein Structure and Function
- Invited speaker at Biomedical Imaging Symposium Sydney Australia



Andrew Hill

Associate Professor, Department of Biochemistry and Molecular Biology Cellular and Molecular Biology of Neurodegenerative Diseases

The Hill lab focuses on neurodegenerative diseases caused by protein misfolding and aggregation, in particular Creutzfeldt-Jakob disease (CJD) and Alzheimer's disease (AD). The group is interested in dissecting the pathways involved in the conversion of the normal cellular form of the prion protein (PrPC) to the abnormal, disease associated isoform (PrPSc). Current work involves looking at cell to cell infection via exosomes, miRNA profiling of mouse and human blood and exosomes, mutational analysis of specific motifs thought to play a role in protein misfolding, protein trafficking and identification of the toxic species involved in CJD and AD. (Photo: Gavin Blues)

Collaborations

University of Melbourne Departments of Pathology and Genetics, University of Wollongong, University of NSW, University of Sydney, Brain and Mind Institute University of Sydney, Mental Health Research Institute of Victoria. International: University of Padova, Hallym University Korea, Ireland, MRC Prion Unit UK, Ludwig Institute Brazil.

Grants

2006-2010 NHMRC Program Grant . Masters CL, Bush Al, Barnham KJ, Cappai R, Cherny RA, Collins SJ, Hill AF, White AR. *Diseases of the ageing brain* (\$11,601,890)

2008-11 ARC Discovery Project Grant – Hill AF (sole-CI) (\$120,000 per year) Investigating the GxxxG domain in mammalian prion proteins.

2008-2012 NHMRC Career Development Award level 2 A.F. Hill - \$400,000

2010 Australian Research Council – LIEF grant. *Protein interactions facility*. Anthony Purcell, Anthony Bacic, Marie-Isabel Aguilar, Matthew Perugini, Nicholas Williamson, Trevor Lithgow, Andrew Hill, Ian Smith, Jamie Rossjohn, Richard O'Hair. \$470,000

Publications

Lawson VA, Furness JB, Klemm HM, Pontell L, Chan E, Hill AF, Chiocchetti R. The brain to gut pathway: a possible route of prion transmission. Gut. 2010 Dec;59(12):1643-51.

Dinet V, An N, Ciccotosto GD, Bruban J, Maoui A, Bellingham SA, Hill AF, Andersen OM, Nykjaer A, Jonet L, Cappai R, Mascarelli F. APP involvement in retinogenesis of mice. Acta Neuropathol. 2010 Oct 27. [Epub ahead of print]

Lawson VA, Lumicisi B, Welton J, Machalek D, Gouramanis K, Klemm HM, Stewart JD, Masters CL, Hoke DE, Collins SJ, Hill AF. Glycosaminoglycan sulphation affects the seeded misfolding of a mutant prion protein. PLoS One. 2010 Aug 23;5(8). pii: e12351.

Boland MP, Hatty CR, Separovic F, Hill AF, Tew DJ, Barnham KJ, Haigh CL, James M, Masters CL, Collins SJ. Anionic phospholipid interactions of the prion protein N terminus are minimally perturbing and not driven solely by the octapeptide repeat domain. J Biol Chem. 2010 Oct 15;285(42):32282-92.

Li H, Kim WS, Guillemin GJ, Hill AF, Evin G, Garner B. Modulation of amyloid precursor protein processing by synthetic ceramide analogues. Biochim Biophys Acta. 2010 Aug;1801(8):887-95.

Brazier MW, Volitakis I, Kvasnicka M, White AR, Underwood JR, Green JE, Han S, Hill AF, Masters CL, Collins SJ. Manganese chelation therapy extends survival in a mouse model of M1000 prion disease. J Neurochem. 2010 Jul;114(2):440-51.

Olshina MA, Angley LM, Ramdzan YM, Tang J, Bailey MF, Hill AF, Hatters DM. Tracking mutant huntingtin aggregation kinetics in cells reveals three major populations that include an invariant oligomer pool. J Biol Chem. 2010 Jul 9;285(28):21807-16.

Nisbet RM, Harrison CF, Lawson VA, Masters CL, Cappai R, Hill AF. Residues surrounding the glycosylphosphatidylinositol anchor attachment site of PrP modulate prion infection: insight from the resistance of rabbits to prion disease. J Virol. 2010 Jul;84(13):6678-86.

Ramdzan YM, Nisbet RM, Miller J, Finkbeiner S, Hill AF, Hatters DM. Conformation sensors that distinguish monomeric proteins from oligomers in live cells. Chem Biol. 2010 Apr 23;17(4):371-9.

Perreau VM, Orchard S, Adlard PA, Bellingham SA, Cappai R, Ciccotosto GD, Cowie TF, Crouch PJ, Duce JA, Evin G, Faux NG, Hill AF, Hung YH, James SA, Li QX, Mok SS, Tew DJ, White AR, Bush AI, Hermjakob H, Masters CL. A domain level interaction network of amyloid precursor protein and Abeta of Alzheimer's disease. Proteomics. 2010 Jun;10(12):2377-95.

Harrison CF, Lawson VA, Coleman BM, Kim YS, Masters CL, Cappai R, Barnham KJ, Hill AF. Conservation of a glycine-rich region in the prion protein is required for uptake of prion infectivity. J Biol Chem. 2010 Jun 25;285(26):20213-23.

Tabrett CA, Harrison CF, Schmidt B, Bellingham SA, Hardy T, Sanejouand YH, Hill AF*, Hogg PJ. Changing the solvent accessibility of the prion protein disulfide bond markedly influences its trafficking and effect on cell function. Biochem J. 2010 May 13;428(2):169-82. (* = corresponding author)

- 4 PhD students
- 5 PhD completions
- Member NHMRC Academy (2010-)
- Member NHMRC Biomedical Training Panel (2010-)
- Coordinator UoM MDHS Biosciences Research Domain
- Merck Research Excellence Medal from ASBMB
- Chair, Organising Committee 4th Conference on Protein Misfolding and Neurological Diseases
- Awarded ARC Future Fellowship (FT3)
- Awarded NHMRC Senior Research Fellowship (Honorary)

Ary Hoffmann

Professor, Department of Genetics and Zoology and ARC Federation Fellow Centre for Aquatic Pollution Investigation and Management

The group conducts research on adaptation of organisms (particularly invertebrates) to environmental stresses including climate change and chemical pollutants, using field sites in the Victorian Alps, in tropical rainforests and in wetlands around Melbourne. The group also develops integrated pest control options for the grains and grape/wine industries, investigates how landscape changes can be harnessed to provide pest control services, contributes to novel approaches for suppressing dengue mosquito vectors, and examines new ways to predict species distribution shifts under climate change. There is a strong interest in using genetic markers and invertebrate biodiversity for monitoring environmental health and developing sustainability indicators for agricultural production.

Collaborations

Warwick Papst, La Trobe University, CSIRO, University of Queensland, QIMR, JCU, NHMRC, University of Califoria, International: University of London

Publications

Jensen, L.T. Cockerell, F.E. Kristensen, T.N. Rako, L. Loeschcke, V. McKechnie, S.W. Hoffmann, A.A. (2010). Adult heat tolerance variation in Drosophila melanogaster is not related to Hsp70 expression. Journal of Experimental Zoology 313A: 35-44. DOI: 10.1002/jez.573 Chong, C.-S., D'Alberto, C.F. Thomson, L.J. Hoffmann, A.A. (2010). Influence of native ants on arthropod communities in a vineyard. Agricultural and Forest Entomology 12: 223-232 Weeks, A.R. Endersby, N.M. Lange, C.L. Lowe. A. Zalucki, M.P. Hoffmann, A.A. (2010). Genetic variation among Helicoverpa armigera populations as assessed by microsatellites: a cautionary tale about accurate allele scoring. Bulletin of Entomological Research 100: 445-450 McKechnie, S.W. Blacket, M. Song, S. Rako, L. Caroll, X. Johnson, T.K. Jensen, L.T. Lee, S.F. Wee, C.W. Hoffmann, A.A. (2010). A clinally-varying promoter polymorphism associated with adaptive variation in wing size in Drosophila. Molecular Ecology 19: 775-784

Mitchell, K.A. Hoffmann, A.A. (2010). Thermal ramping rate influences evolutionary potential and species differences for upper thermal limits in Drosophila. Functional Ecology 24: 694-700

Hoffmann, A.A. (2010). Physiological climatic limits in Drosophila: patterns and predictions. Journal of Experimental Biology 213: 870-880 Thomson, L.J. Pearce, S. Hoffmann, A.A. (2010). Predicting the effects of climate change on natural enemies of agricultural pests. Biological Control 52: 296-306 Colinet, H. Lee, S.F., Hoffmann, A.A. (2010). Temporal expression of heat shock genes during cold stress and

recovery from chill coma in adult *Drosophila melanogaster*. FEBS Journal. DOI:10.1111/j.1742-4658.2009.07470.x Paaby, A.B. Blacket, M.J. Hoffmann, A.A. Schmidt, P.S. (2010). Identification of a candidate adaptive polymorphism for *Drosophila* life history by parallel independent clines on two continents. Molecular Ecology 19: 760-774 Danne, A. Thomson, L.J. Sharley, D.J. Penfold, C.M. Hoffmann, A.A. (2010). Effects of native grass cover crops on beneficial and pest invertebrates in Australian vineyards. Environmental Entomology 39: 970-978 Thomson, L.J. Hoffmann, A.A. (2010). Natural enemy responses and pest control: Importance of local vegetation. Biological Control 52:160-166 Nash, M.A., Hoffmann, A. A. Thomson, L.J. (2010). Identifying signatures of pesticide applications on indigenous

Identifying signatures of pesticide applications on indigenous and invasive non-target arthropod communities from vineyards. Ecological Applications 20: 1693-1703 Marshall, S. Pettigrove, V. Carew, M. Hoffmann, A.A. (2010). Isolating the impact of sediment toxicity in urban streams. Environmental Pollution 158:1716 DOI:10.1016/j.envpol.2009.11.019

Herbert, K.S. Umina, P.A. Mitrovski, P.J. Powell, K.S. Hoffmann, A.A. (2010). Clone lineages of grape phylloxera differ in their performance on *Vitis vinifera*. Bulletin of Entomological Research 100: 671-678.

DOI:10.1017/S0007485310000027

Kennington, W.J. Hoffmann, A.A. (2010). The genetic architecture of wing size divergence at varying spatial scales along a body size cline in *Drosophila melanogaster*.

Evolution 64: 1935-1943

Tantowijoyo, W. Hoffmann, A. A. (2010). Identifying factors determining the altitudinal distribution of the invasive pest leafminers *Liriomyza huidobrensis* and *L. sativae* (Diptera: Agromyzidae). Entomologia experimentalis et applicata 135: 141-153

Valenzuela, I. Ridland, P. M. Weeks, A.R. Hoffmann, A. A. (2010). Patterns of genetic variation and host adaptation in an invasive population of the bird cherry-oat aphid, *Rhopalosiphum padi* (L.). Annals of the Entomological Society of America 103:886-897 Hoffmann, A.A. (2010) A genetic perspective on insect

climate specialists. Australian Journal of Entomology 49: 93-101

Sgrò, C.M. Wegener, B. Hoffmann, A.A. (2010). A naturally-occurring variant of *Hsp90* that is associated with decanalization. Proceedings of the Royal Society B 277: 2049-2057

Carrington, L.B. Hoffmann, A.A. Weeks, A.R. (2010). Monitoring long-term evolutionary changes following *Wolbachia* introduction into a novel host: the *Wolbachia* popcorn infection in *Drosophila simulans*. Proceedings of the Royal Society B 277: 2059-2068

Arthur, A.L. Weeks, A.R. Umina, P.A. Hoffmann, A.A. (2010). Survival and reproduction of the pest mites *Balaustium medicagoense* and *Bryobia* spp. on winter grain crops. Experimental and Applied Acarology 52: 141-153 Hoffmann, A.A., Camac, J., Williams, R.J., Papst, W., Jarrad, F.F. Wahren, C-H. (2010) Phenological changes in six

Australian sub-alpine plants in response to experimental warming and year-to-year variation. Journal of Ecology 98: 927-937

Colinet, H. Hoffmann, A.A. (2010) Gene and protein expression of Drosophila Starvin during cold stress and recovery from chill coma Insect Biochemistry and Molecular Biology 40: 425-8

Chong, C.-S. Hoffmann, A.A. Thomson, L.J. (2010) Local scale spatial dynamics of ants in a temperate agroecosystem. Austral Ecology . DOI: 10.1111/j.1442-9993.2010.02155.x Coleman, R.A. Pettigrove, V. Raadik, T.A. Hoffmann, A.A. Miller, A. Carew, M.E. (2010). Microsatellite markers and mtDNA data indicate two taxa within dwarf galaxias, *Galaxiella pusilla* (Mack) (Pisces: Galaxiidae), a threatened freshwater fish from South-eastern Australia, with different levels of genetic variation. Conservation Genetics 11:1911-1928

O'Brien, M.L., Pettigrove, V. Carew, M.E., Hoffmann, A. A. (2010). Combining rapid bioassessment and field based microcosms for identifying impacts in an urban river. Environmental Toxicology and Chemistry 29: 1773-1780. Ayres, R. Pettigrove, V. Hoffmann, A.A. (2010). Low diversity and high levels of population genetic structuring in introduced eastern mosquitofish (*Gambusia holbrooki*) in the greater Melbourne area, Australia. Biological Invasions 12:3727-3744. DOI: 10.1007/s10530-010-9766-z Colinet, H. Lee, S. F. Hoffmann, A.A. (2010). Functional characterization of the *Frost* gene in *Drosophila melanogaster*: importance for recovery from chill coma. PLOS One 5: e10925

Thomson, L.J. McKenzie, J. Sharley, D.J. Nash, M.A. Tsitsilas, A. Hoffmann, A.A. (2010). Effect of woody vegetation at the landscape scale on the abundance of natural enemies in Australian vineyards. Biological Control 54:248-254. DOI:10.1016/j.biocontrol.2010.05.018

Sgrò, C.M. Overgaard, J. Kristensen, T.N. Mitchell, K. Cockerell, F. Hoffmann, A. A. (2010). A comprehensive assessment of geographic variation in heat tolerance and hardening capacity in populations of *D. melanogaster* from eastern Australia. Journal of Evolutionary Biology DOI: 10.1111/j.1752-4571.2010.00157.x

Arthur, A.L. Weeks, A, R. Hill, M.P. Hoffmann, A. A. (2010). The distribution, abundance and life cycle of the pest mites *Balaustium medicagoense* (Prostigmata: Erythraeidae) and *Bryobia* spp. (Prostigmata: Tetranychidae) in Australia. Australian Journal of Entomology 20 DEC 2010, DOI: 10.1111/j.1440-6055.2010.00778.x

Tsitsilas, A. Hoffmann, A.A. Weeks, A.R. Umina, P.A (2010). Impact of groundcover manipulations within windbreaks on mite pests and their natural enemies. Australian Journal of Entomology 20 DEC 2010, DOI: 10.1111/j.1440-6055.2010.00779.x

Takahashi, K.H. Rako, L. Takano-Shimizu, T. Hoffmann, A.A. Lee, S.F. (2010) Effects of small *Hsp* genes on developmental stability and microenvironmental canalization. BMC Evolutionary Biology 10:284. doi:10.1186/1471-2148-10-284.

Colinet, H. Lee, S.F. Hoffmann, A. A. (2010). Knocking down expression of *Hsp22* and *Hsp23* by RNA interference affects recovery from chill coma in *Drosophila melanogaster*. Journal of Experimental Biology 213:4146-4150.

- 15 PhD, 4 MSc and 3 Hons students
- 4 PhD completions
- President of The Australian Entomological Society
- Established Centre for Aquatic Pollution Identification and Monitoring supported by DIIRD



Andrew Holmes

Laureate Professor, Bio21 Institute and School of Chemistry Chemical Biology and Nanobiotechnology

Synthesis and characterization of organic and polymeric electroactive materials; organic and polymer-based solar cells; cell signal transduction - inositol phospholipids.

Collaborations

Ludwig Institute, Monash University, CSIRO, Imperial College, Ulm University, Max Planck Institute Polymer Research, University of Karlsruhe, Cornell University, Georgiea Tech

Grants

(Report includes grants held by Andrew Holmes, David Jones and Wallace Wong)

Agreement ID 13425; CG100059 DIISR ISL income received in 2010 (ICOS): \$16.870

Agreement ID 16571; DIISR AAS: \$46,000

Agreement ID 16153; LE100100147 LIEF grant: \$100,000

Agreement ID 16053; ARC DP1094497 - \$183,735

Agreement ID 15518 CSIRO FCF: \$86,920

Agreement ID 16418; LEX14842 CSIRO FCF: \$52,889 Agreement ID 14149; DPI VICOSC SU504093: \$1,150,000

Agreement ID 16616; VSA VICOSCII: \$1,000,000

Publications

Synthesis and Biological Evaluation of Phosphatidylinositol phosphate affinity probes. S. J. Conway, J. Gardiner, S. J. A. Grove, M. K. Johns, Z.-Y. Lim, G. F. Painter, D. E. J. E. Robinson, C. Schieber, J. W. Thuring, L. S.-M. Wong, M.-X. Yin, A. W. Burgess, B. Catimel, P. T. Hawkins, N. T. Ktistakis, L. R. Stephens and A. B. Holmes, *Org. Biomolec. Chem.*, 2010, 8, 66-76.

Self-assembling Thiophene Dendrimers with a Hexa-*peri*hexabenzocoronene Core – Synthesis, Characterization and Performance in Bulk Heterojunction Solar Cells. W. W. H. Wong, C.-Q. Ma, W. Pisula, C. Yan, X. Feng, D. J. Jones, K. Müllen, R. A. J. Janssen, P. Bäuerle and A. B. Holmes, *Chem. Mater.*, 2010, 22, 457-466.

Semiperfluoroalkyl Polyfluorenes for Orthogonal Processing in Fluorous Solvents. J.-K. Lee, H. H. Fong, A. A. Zakhidov, G. E. McCluskey, P. G. Taylor, M. Santiago-Berrios, H. D. Arbruna, A. B. Holmes, G. G. Malliaras and C. K. Ober, *Macromolecules*, 2010, 43, 1195-1198.

Tricyclic-Isoxazolidine Analogues via Intramolecular 1,3-Dipolar Cycloaddition Reactions of Nitrones. S. Saubern, J. M. Macdonald, J. H. Ryan, R. C. J. Woodgate, T. Louie, M. J. Fuchter, J. M. White and A. B. Holmes *Tetrahedron*, 2010, 66, 2761-2767.

Solution Processable Fluorenyl Hexa-*peri*-hexabenzocoronenes in Organic Field Effect Transistors and Solar Cells. W. W. H. Wong, Th. B. Singh, D. Vak, W. Pisula, C. Yan, X. Feng, E. L. Williams, K. L. Chan, Q. Mao, D. J. Jones, C.-Q. Ma, K. Müllen, P. Bäuerle and A. B. Holmes, *Adv. Funct. Mater.*, 2010 20, 927-938.

Flow Synthesis of Tricyclic Spiropiperidines as Building Blocks for the Histrionicotoxin Family of Alkaloids. M. Brasholz, B. A. Johnson, J. M. Macdonald, A.Polyzos, J. Tsanaktsidis, S. Saubern, A. B. Holmes and J. H. Ryan, *Tetrahedron*, 2010, 66, 6445-6449.

A Porphyrin-hexa-*peri*-hexabenzocoronene-porphyrin Triad: Synthesis, Photophysical Properties and Performance in a Photovoltaic Device. W. W. H. Wong, T. Khoury, D. Vak, C. Yan, D. J. Jones, M. J. Crossley, and A. B. Holmes, *J. Mater. Chem.*, 2010, 20, 7005-7014.

Analysis of Cellular Phosphatidylinositol (3,4,5)-trisphosphate Levels and Distribution using Confocal Fluorescent Micoscopy, M. Plamieri, C. J. Nowell, M. Condron, J. Gardiner, A. B. Holmes, J. Desai, A. W. Burgess and B. Catimel, *Anal. Biochem.*, 2010, 406, 41-50.

A Gram Scale Batch and Flow Total Synthesis of Perhydrohistrionicotoxin. M. Brasholz, J. M. Macdonald, S. Saubern, J. H. Ryan and A. B. Holmes, *Chem. Eur. J.* 2010, 16, 11471-11480.

Ambipolar Hexa-*peri*-hexabenzocoronene-Fullerene Hybrid Materials, W.W.H. Wong, D. Vak, Th. Birendra Singh, S. Ren, C. Yan, D. J. Jones, I.I. Liaw, R. N. Lamb and A. B. Holmes, *Org. Lett.*, 2010, 12, 5000-5003.

Entropy vs. Tether Strain Effects on Rates of Intramolecular 1,3-Dipolar Cycloadditions of *N*-alkenylnitrones, E. H. Krenske, K. N. Houk, A. B. Holmes and J. Thompson, *Tetrahedron Lett.*, 2010, doi:10.1016/j.tetlet.2010.11.121.

- 5 PhD students, 2 PhD completions
- Robert Robinson Lecturer, University of Oxford
- Foreign Secretary, Australian Academy of Science Doctor Honoris Causa, Universiteit Hasselt, Belgium



Geoffrey Howlett

Associate Professor, Department of Biochemistry and Molecular Biology Role of small molecules in protein conformation and amyloid fibril assembly

The Howlett research group is studying the misfolding and aggregation of plasma apolipoproteins and their propensity toform amyloid fibrils and accumulate in atherosclerotic deposits in heart disease.

Specific research interests include:

- The role of lipids in amyloid formation by apoC-II, apoA-I and apoE
- The interaction of amyloid fibrils with surfaces and nanoparticles
- The amyloid-like properties of modified plasma lipoproteins
- Analysis of amyloidogenic peptides derived from core regions within apo C-II
- The reversibility of amyloid fibril formation and the development of specific inhibitors.

Collaborations

RMIT University

International: NIH Bethesda USA

Grants

2008-10 ARC project grant: Macromolecular self-assembly of amyloid fibrils: 2010: \$40000

2009-11 ARC project grant: Protein self-assembly on surfaces, interfaces and nanoparticles: 2010: \$20000

2010-12 ARC linkage grant: Biophysical identification of natural human antibody targets: 2010: \$164000

Publications

Binger, K. J., Griffin, M. D., Heinemann, S. H., and Howlett, G. J. (2010) Methionine-oxidized amyloid fibrils are poor substrates for human methionine sulfoxide reductases A and B2, *Biochemistry* 49, 2981-2983.

Griffin, M. D., Wilson, L. M., Mok, Y. F., Januszewski, A. S., Wilson, A. M., Karschimkus, C. S., Romas, E., Lee, A. B., Godfrey, T., Wong, M., Clemens, L., Jenkins, A. J., and Howlett, G. J. (2010) Thioflavin T fluorescence in human serum: correlations with vascular health and cardiovascular risk factors, *Clin Biochem 43*, 278-286.

Mok, Y. F., Ryan, T. M., Yang, S., Hatters, D. M., Howlett, G. J., and Griffin, M. D. (2010) Sedimentation velocity analysis of amyloid oligomers and fibrils using fluorescence detection, *Methods*.

Ryan, T. M., Teoh, C. L., Griffin, M. D., Bailey, M. F., Schuck, P., and Howlett, G. J. (2010) Phospholipids enhance nucleation but not elongation of apolipoprotein C-II amyloid fibrils, *J Mol Biol* 399, 731-740.

Teoh, C. L., Pham, C. L., Todorova, N., Hung, A., Lincoln, C. N., Lees, E., Lam, Y. H., Binger, K. J., Thomson, N. H., Radford, S. E., Smith, T. A., Muller, S. A., Engel, A., Griffin, M. D., Yarovsky, I., Gooley, P. R., and Howlett, G. J. (2010) A Structural Model for Apolipoprotein C-II Amyloid Fibrils: Experimental Characterization and Molecular Dynamics Simulations, *J Mol Biol*.

Teoh, C. L., Yagi, H., Griffin, M. D., Goto, Y., and Howlett, G. J. (2010) Visualization of polymorphism in apolipoprotein C-II amyloid fibrils, *J Biochem*.

Todorova, N., Hung, A., Maaser, S. M., Griffin, M. D., Karas, J., Howlett, G. J., and Yarovsky, I. (2010) Effects of mutation on the amyloidogenic propensity of apolipoprotein C-II(60-70) peptide, *Phys Chem Chem Phys* 12, 14762-14774.

Wong, Y. Q., Binger, K. J., Howlett, G. J., and Griffin, M. D. (2010) Methionine oxidation induces amyloid fibril formation by full-length apolipoprotein A-I, *Proc Natl Acad Sci U S A 107*, 1977-1982.

- 3 PhD students, 2 Hons students
- 1 PhD completion



Craig Hutton Associate Professor, School of Chemistry Chemical Biology

The Hutton group has three key areas of research interest: Cross-linked tyrosines in peptides and proteins
Cross-linked tyrosine residues occur in a plethora of naturally occurring peptides and proteins, and their formation is associated with oxidative stress-related diseases such as Alzheimer's disease. The group is exploring methods for the preparation of dityrosine cross-links and incorporation of cross-linked amino acids into covalently-linked peptide dimers, including studies of amyloid betapeptide dimers.

New methods for amino acid and peptide synthesis Novel strategies for the stereocontrolled synthesis of unusual amino acid residues present in complex cyclic peptides are being investigated, towards the synthesis of peptide natural products such as celogentin C and echinocandin B.

Inhibitors of the lysine biosynthetic pathway
The group are investigating the enzymology of the lysine biosynthetic pathway. They have recently undertaken a high-throughput screen of 80,000 compounds as inhibitors of the first enzyme in this pathway, DHDPS, and are currently optimising hits into lead compounds for the development of potential new antibacterial agents.

Collaborations

University of Melbourne Departments of Pathology and Biochemistry and Molecular Biology; Peter MacCallum Cancer Research Centre.

International: University of Canterbury New Zealand.

Grants

2010: \$145,767. Perugini, Hutton, Gerrard, Dogovski, Alderton; "Three modes of inhibiting a tetrameric antibiotic target from Bacillus anthracis" US Army Research Office, 2007–2011, US\$1.85M.

2010: \$10,000. Perugini, Dogovski, Dobson, Robins-Browne, Hutton; "Multi-Targeted Inhibition of an Essential Tetrameric Enzyme from Drug-Resistant Streptococcus pneumonia". 2010; \$26,420. CRC for Biomedical Imaging Development; Student Research Project (PhD scholarship funding).

Publications

A. K. Y. Lam, C. A. Hutton, R. A. J. O'Hair, "Role of 2-oxo and 2-thioxo modifications on the fragmentation reactions of the histidine radical cation," *Rapid Commun. Mass Spectrom.*, 2010, 24, in press.

A. K. Y. Lam, C. A. Hutton, R. A. J. O'Hair, "Role of 2-oxo and 2-thioxo modifications on the proton affinity of histidine and fragmentation reactions of protonated histidine," *Rapid Commun. Mass Spectrom.*, 2010, *24*, 2591–2604.

V. L. Villemagne, K. A. Perez, K. E. Pike, W. M. Kok, C. C. Rowe, A. R. White, P. Bourgeat, O. Salvado, J. Bedo, C. A. Hutton, N. G. Faux, C. L. Masters, K. J. Barnham, "Bloodborne Amyloid- β dimer correlates with clinical markers of Alzheimer's disease," *J. Neurosci.*, 2010, *30*, 6315–6322.

S. J. Shirbin, B. A. Boughton, S. C. Zammit, S. D. Zanatta, S. M. Marcuccio, C. A. Hutton, S. J. Williams, "Copper-free palladium-catalyzed Sonogashira and Hiyama cross-couplings using aryl imidazol-1-ylsulfonates," *Tetrahedron Lett.*, 2010, *51*, 2971–2974.

B. T. Y. Li, J. M. White, C. A. Hutton, "Synthesis of the Leu—Trp component of the celogentin family of cyclic peptides through a C–H activation–cross-coupling strategy," *Aust. J. Chem.* 2010, *63*, 438–444.

X. Tan, H. Dagher, C. A. Hutton and J. E. Bourke, "Effects of PPAR γ ligands on TGF- β 1-induced epithelial-mesenchymal transition in alveolar epithelial cells," *Respir. Res.*, 2010, *11*, 21

J. E. Voss, S. W. Scally, N. L. Taylor, M. D. W. Griffin, J. M. Newman, C. A. Hutton, M. W. Parker, J. A. Gerrard, M. R. Alderton, C. Dogovski, R. C. J. Dobson, M. A. Perugini, "Substrate-Mediated Stabilization of a Tetrameric Drug Target Reveals Achilles Heel in Anthrax," J. Biol. Chem. 2010, 285, 5188–5195.

L. Hor, R. C. J. Dobson, C. Dogovski, C. A. Hutton, M. A. Perugini, "Crystallisation and preliminary X-ray diffraction analysis of diaminopimelate epimerase from Escherichia coli," Acta Cryst., 2010, F66, 37–40.

- 7 PhD students, 2 Hons students and 2 MSc students
- 5 PhD completions



Vladimir Likic Bio21 Institute and Metabolomics Australia Bioinformatics

Dr Likic's research interests involve all aspects of bioinformatics and computational biology, including:

- Bioinformatics methods for metabolomics; data analysis for hyphernated mass spectrometry; data mining
- Systems biology; modelling and simulation of biochemical networks; databases of metabolic pathways; integration of 'omics data
- Protein and DNA sequence analysis; applications of hidden Markov models; microRNA discovery
- Protein 3D structure modelling and computer simulations of protein dynamics

Collaborations

University of Melbourne Departmet of Biochemistry and Molecular Biology; Oral Health Science CRC; Monash University; CSIRO Australian Animal Health Laboratory. International: SIR International (US); Centre for Genomic Regulation (Spain); University of Alberta (Canada).

Grants

2010-2012 NHMRC project grant (Total amount: \$585,048. Professor M McConville and Dr V Likic. " Metabolomic analysis of Leishmania parasites; identifying metabolic pathways required for pathogenesis"

2008-10 ARC Discovery project grant (Total amount: \$369,000). Dr V Likic and Prof M McConville "Characterization of metabolic networks in microbial pathogens"

Publications

Alcock F, Webb CT, Dolezal P, Hewitt V, Shingu-Vasquez M, Likić VA, Traven A, Lithgow T, "A Small Tim Homohexamer in the Relict Mitochondrion of Cryptosporidium", Mol Biol Evol (Epub ahead of print) PMID: 21984067 (2011)

Saunders EC, Ng WW, Chambers JM, Ng M, Naderer T, Krömer JO, Likić VA, McConville MJ, "Isotopomer profiling of Leishmania mexicana promastigotes reveals important roles for succinate fermentation and aspartate uptake in tricarboxylic acid cycle (TCA) anaplerosis, glutamate synthesis, and growth. "J Biol Chem, 286(31):27706-17 (2011)

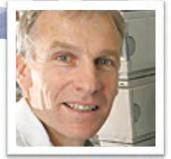
Likić VA, McConville MJ, Lithgow T, Bacic A, "Biochemical systems biology: the next frontier for bioinformatics", Advances in Bioinformatics, Volume 2010, Article ID 268925, 10 pages doi:10.1155/2010/268925 (2010)

Likić VA , "Metabolites: A Novel Platform for Converging Research on Metabolism and Metabolomics", Metabolites, 1:1-2, doi:10.3390/metabo01010001 (2011)

Dolezal P, Dagley MJ, Kono M, Wolynec P, Likić VA, Foo JH, Sedinová M, Tachezy J, Bachmann A, Bruchhaus I, Lithgow T, "The Essentials of Protein Import in the Degenerate Mitochondrion of Entamoeba histolytica", PLoS Pathogens, 2010 Mar 19;6(3):e1000812

Saunders EC, DE Souza DP, Naderer T, Sernee MF, Ralton JE, Doyle MA, Macrae JI, Chambers JL, Heng J, Nahid A, Likić VA, McConville MJ, "Central carbon metabolism of Leishmania parasites", Parasitology, Feb 17:1-11, PMID: 20158936 (2010)

- One of 35 experts invited by Okinawa Institute of Science and Technology to contribute in workshops regarding development of an international university and R&D cluster in Okinawa (Japan)
- Member Editorial Board of the journal Biosensors.
 Contributed to the establishment of a new journal Metabolites (MDPI)



Malcolm McConville

Professor, Department of Biochemistry and Molecular Biology Molecular biology

The McConville research group is interested in understanding how microbial pathogens survive within their mammalian hosts, with the view of identifying new therapies. The group focuses on a number of important parasitic and bacterial pathogens that are the cause of malaria (Plasmodium falciparum), toxoplasmosis (Toxoplasma gondii) human leishmaniasis (Leishmania spp) and tuberculosis (mycobacteria spp). They have developed new mass spectrometric-based metabolomic techniques to identify and map metabolic pathways that are specifically up-regulated during microbial infection pathogenesis analytic using a combination of genetic and advanced analytical techniques.

Collaborations

University of Melbourne, Monash University, DSTO International: University of Georgia, Glasgow University

Grants

2006-10 NHMRC Program Grant Host-parasite interactions: disease, pathogenesis and control. Coinvestigators: Brown, G. (Melbourne University), Cowman, A. (WEHI), Crabb, B. (WEHI), Handman, E.(WEHI), McConville, MJ, McFadden, G. (Melbourne University), Schofield, L. (WEHI), Speed, T. (WEHI) Amount: \$12,940,270 for 5 years 2009-11 NHMRC Project Grant Investigators: McConville MJ (CIA) and Williams SJ (CIB, Dept Chemistry, University of Melbourne)Project: Novel metabolic enzymes in Leishmania parasites Amount: \$413,625 for 3 years 2009-12 NHMRC Principal Research Fellowship Investigator: McConville (sole CI). Amount: \$600,000 over 5-years 2008-10 ARC Discovery Grant (DP Investigators: Likic, V (CIA-Bio21 Institute) and McConville, MJ (CIB) Project: Characterization of metabolic networks in a microbial pathogen. Amount: \$240,000 2010-12 ARC Discovery Grant Investigators: Williams, S.J (CIA-Dept Chemistry, Melb. Uni), McConville, MJ (CIB) Project: Chemical tools for the study of the biosynthesis of PI mannosides in Mycobacteria. Amount: \$360,000 2010-14 NIH RO1 grant Investigators: Striepen, B (CIA-University of Georgia) and McConville, MJ (CIB) Project: Genetic dissection of parasite metabolism. Amount: \$1,250,000

Publications

Tull D, Naderer' N, Spurck T, Mertens HDT, Heng J, McFadden GI,. Gooley PR and McConville MJ (2010) The membrane protein, SMP-1, is required for normal flagellum function in *Leishmania*. J. Cell Sci., 123, 544-554.

Morita YS, Yamaryo-Botte Y, Miyanagi K, Callaghan JM, Patterson JH, Crellin PK, Coppel RL, Billman-Jacobe H, Kinoshita T, McConville MJ (2010) Stress-induced synthesis of phosphatidylinositol 3-phosphate in mycobacteria. J Biol Chem. 285(22):16643-50

Low WY, Feil SC, Ng HL, Gorman MA, Morton CJ, Pyke J, McConville MJ, Bieri M, Mok YF, Robin C, Gooley PR, Parker MW, Batterham P. (2010) Recognition and detoxification of the insecticide DDT by *Drosophila melanogaster* glutathione S-transferase D1. J Mol Biol. 399, 358-66.

Sheedy JR, Ebeling PR, Gooley PR, McConville MJ (2010) A sample preparation protocol for 1H nuclear magnetic resonance studies of water-soluble metabolites in blood and urine. Anal Biochem, 398(2):263-265.

Dagley, MJ, Gentle IE, Beilharz TH, Pettolino FA, Djordjevic JT, Lo TL, Uwamahoro N, Rupasinghe T, Tull DL, McConville MJ, Beaurepaire C, Nantel A, Lithgow T, Mitchell AP, Traven A (2011) Cell wall integrity is linked to mitochondria and phospholipid homeostasis in *Candida albicans* through the activity of the posttranscriptional regulator Ccr4-Pop2. Mol. Microbiol. In press

Naderer T, Heng J, McConville MJ (2010) Evidence that intracellular stages of *Leishmania major* utilize amino sugars as a major carbon source. PlosPathogen. In press

Saunders EC, De Souza DP, Naderer, T, Sernee MF, Ralton JE, Doyle MA, MacRae JI, Chambers JL, Heng J, Nahid A, Likic VA, McConville MJ (2010) Central carbon metabolism of Leishmania. Parasitology 7:1-11

Naderer T. McConville, MJ (2010) Intracellular growth and pathogenesis of Leishmania parasites. Essays in Biochemistry in press

Likic VA, McConville MJ, Lithgow T, Bacic A (2010) Systems biology: the next frontier for bioinformatics. Adv. Bioinformatics in press

Morita YS, Fukuda T, Sena CBC, Yamaryo-Botte Y, McConville MJ, Kinoshita T (2010) Inositol lipid metabolism in mycobacteria: biosynthesis and regulatory mechanisms. Biochem. Biophys Acta submitted.

- 3 PhD students
- 2 PhD completions
- Keynote speaker, XXVI Brazilian Society of Protozoology, Foz do Iguacu, Brazil
- Appointed Bio21 Institute Deputy Director and Theme Leader, Structural Biology.



Terry Mulhern

Senior Lecturer, Department of Biochemistry and Molecular Biology Regulation of Src-family kinases; Mitochondrial import machinery

The Mulhern research group is focused on three key areas:

Protein structure and function

Work in the Mulhern lab looks at biological problems from protein structure viewpoint, integrating structure determination, biophysical analyses and molecular and cell biology.

Signal transduction enzymes associated with human diseases Current projects include: Src-family kinase activation in AIDS, cancer and autoimmune diseases, such as diabetes and systemic lupus erythematosus.

Mitochondrial import machines

We are part of a major collaborative grouping that is interested in the structure, function and evolution of the molecular machinery responsible for the targeting and import of proteins into mitochondria.

Collaborations

University of Melbourne Dentistry, Pathology, Botany departments and St Vincent's Institute. Monash Institute of Pharmaceutical Sciences, Adelaide University, La Trobe University and University of Western Australia.

Grants

2010-12 Biophysical identification of natural human antibody targets LP100100392, Howlett GJ, Mulhern TD, Hatters DM, \$100,000, Australian Research Council *Linkage Grants*.

2008-10 Inhibition of Nef-activated Src-family kinases by CHK 509115, Mulhern TD, Cheng HC, Van Driel IR, \$161,250, National Health and Medical Research Council *Projects*

2008-10 Investigating the subunit interactions of a molecular protein import machine. Gooley PR, Mulhern TD. \$127,000, Australian Research Council *Discovery Grants*

Publications

Rimmer KA, Foo JH, Ng A, Petrie EJ, Shilling PJ, Perry AJ, Mertens HDT, Lithgow T, Mulhern TD & Gooley PR. (2010) "Recognition of mitochondrial targeting sequences by the import receptors Tom20 and Tom22" *J Mol Biol* in press.

- · 3 PhD, 1 Hons students
- · 3 PhD completions



Richard O'Hair

Professor, School of Chemistry & ARC Centre for Free Radical Chemistry and Biotechnology

The O'Hair group makes use of two Nobel Prize winning technologies, the quadrupole ion trap and electrospray ionisation (ESI) to examine the fundamental gas phase chemistry of a cornucopia of ionic species. The group uses multiple stages of mass spectrometry (MS) with collision induced dissociation, electron capture dissociation and ion-molecule reactions to examine gas phase unimolecular and bimolecular reactions in the following areas:

Transition metals - from catalysis to coordination reactions The unique multi-trapping capabilities allow the group to study catalytic cycles relevant to important problems such as oxidation reactions and C-H bond activation. They are also exploring reactions of interest in organic synthesis including the formation and reactivity of organometallics.

Fundamental properties of gas phase ions derived from biomolecules- The group is interested in: (i) developing gas phase ion-molecule reactions as probes of biomolecule structure; and (ii) understanding the fragmentation mechanisms of peptide and oligonucleotide ions with a view to improving the analysis of these biologically important molecules via tandem mass spectrometric techniques. Other areas of interest include: lipidlipid and lipid-peptide interactions; chemistry of beta peptides; gas phase chemistry of noncovalent complexes; comparing the fragmentation behaviour of radical cations to their even electron counterparts.

Collaborations

University of Melbourne Departments of Genetics, Chemical and Biomolecular Engineering, Biochemistry and Molecular Biology, University of Sydney, Australian National University, University of Western Australia.

International: USA, France, Japan.

Grants

ARC Centre of Excellence for Free Radical Chemistry and Biotechnology (founded in 2005). Founding Member. Annual share of the funding has been \$160,000 per year since the establishment of the centre.

Publications

O'Hair, R. A. J., "Gas Phase Ligand Fragmentation to Unmask Reactive Metallic Species.", in "Reactive Intermediates. MS Investigations in Solution." (Santos, L.S.; Ed.; ISBN: 978-3-527-32351-7), Wiley-VCH, Weinheim, Ch 6, 2010, 199 - 227.

O'Hair, R. A. J.; Williams, C. M.; Clark, T., "Neighboring Group Stabilization by σ -Holes.", *J. Mol. Mod.*, 2010, *16*, 559-565 (DOI: 10.1007/s00894-009-0567-1).

Edtbauer, A.; Denifl, S.; Viczaino, V.; An der Lan, L.; Russell, K.; Taubitz, J.; Wille, U.; Feketeová, L.; O'Hair, R. A. J.; Märk, T. D.; Illenberger, E.; Scheier, P.; "Very low energy electrons transform the cyclobutane-pyrimidine dimer into a highly reactive intermediate.", *ChemPhysChem*, 2010, *11*, 561 - 564 (DOI: 10.1002/cphc.200900912).

Feketeová, L.; Wong, M. W.; O'Hair, R. A. J., "The role of metal cation in electron-induced dissociation of tryptophan.", *Eur. Phys. J. D.*, 2010, *60*, 11 – 20 (DOI: 10.1140/epjd/e2010-00019-6). "Gas Phase Ion Chemistry of Biomolecules. Part 68"

Lam, A.; Ryzhov, V.; O'Hair, R. A. J., "Mobile Protons versus Mobile Radicals: Gas Phase Unimolecular Chemistry of Radical Cations of Cysteine Containing Peptides.", *J. Am. Soc. Mass Spectrom.*, 2010, *21*, 1296 – 1312 (invited contribution to special Vicki Wysocki and Simon Gaskell ASMS award issue, DOI: 10.1016/j.jasms.2010.01.027) "Gas Phase Ion Chemistry of Biomolecules. Part 69"

Khairallah, G.N.; Yoo, E. J. H.; O'Hair, R. A. J., "Formation of Methylmagnesium or Coordinated Ylide? Competition Between Decarboxylation of Acetate and Betaine Ligands in $[CH_3CO_2MgO_2CCH_2X(CH_3)_2]^{\dagger}$ (where $X = NCH_3$ and S).", Organometallics, 2010, 29, 1238 – 1245 (DOI: 10.1021/om901050s).

Rijs, N.J.; Yates, B. F.; O'Hair, R. A. J. * "Dimethylcuprate undergoes a dyotropic rearrangement.", *Chem. Eur. J.*, 2010, *16*, 2674 - 2678 (DOI: 10.1002/ chem.200903510).

Barnett, Z. M. E; Feketeová, L.; O'Hair, R. A. J.*, "The Major Product Ion of S-Adenosyl-L-methionine Arises From a Neighbouring Group Reaction.", *Rapid Commun. Mass Spectrom.*, 2010, 24, 1387 – 1391 (DOI: 10.1002/rcm.4515). "Gas Phase Ion Chemistry of Biomolecules. Part 70"

Rijs, N.J.; O'Hair, R. A. J. "Unimolecular Reactions of Organocuprates and Organoargenates.", *Organometallics*, 2010, *29*, 2282 – 2291 (DOI: 10.1021/om1000875).

Lam, A. K. Y; O'Hair, R. A. J., "Isomer Distinction via CID: The Case of Protonated α - , β^2 - and β^3 Phenylalanines and Their Derivatives.", Rapid Commun. Mass Spectrom., 2010, 24, 1779 – 1790 (DOI: 10.1002/rcm.4576). "Gas Phase Ion Chemistry of Biomolecules. Part 71"

Lam, A. K. Y; Hutton, C. A.; O'Hair, R. A. J., "Role of 2-oxo and 2-thioxo modifications on the proton affinity of histidine and fragmentation reactions of protonated histidine.", *Rapid Commun. Mass Spectrom.*, 2010, 24, 2591–2604 (DOI: 10.1002/rcm.4671). "Gas Phase Ion Chemistry of Biomolecules. Part 74"

Rijs, N.J.; Sanvido, G.B.; Khairallah, G.N.; O'Hair, R. A. J. "Gas phase synthesis and reactivity of dimethylaurate.", *Dalton Trans.*, 2010, *39*, 8655 - 8662 (DOI:10.1039/c0dt00508h).

Feketeová, L.; Khairallah, G.N.; Brunet, C.; Lemoine, J.; Antoine, R.; Dugourd, P.; O'Hair, R. A. J. "Fragmentation of the Tryptophan cluster [Trp₉-2H]²⁻ induced by different activation methods.", *Rapid Commun. Mass. Spectrom.*, 2010; 24: 3255–3260. DOI: 10.1002/rcm.4763 "Gas Phase Ion Chemistry of Biomolecules. Part 75"

- 2 PhD, 2 Hons and 1 MSc student.
- Associate Editor of the Jjournal of the American Society for Mass Spectrometry (2009-)



Michael Parker

Honorary Professorial Fellow Bio21/Department of Biochemistry and Molecular Biology
Protein crystallography

The focus of Professor Parker's research is to understand the three-dimensional structures of medically important proteins using X-ray crystallography. Key areas of interest include proteins that play a role in infection (bacterial, parasitic or viral), cancer and neurobiology (e.g. Alzheimer's disease, epilepsy). The structures that result provide a detailed understanding of how each protein works and how it contributes to disease. Most importantly, the structures can be used to discover drugs using computational approaches. The group's work is supported by laboratories that specialise in protein expression, purification, biophysical characterisation and electrophysiology.

Collaborations

University of Melbourne Biochemistry, Dentistry and Pathology departments, St Vincent's Institute, John Curtin School of Medical Research, Peter MacCallum Cancer, Children's Medical Research Institute, Murdoch Children's Research Institute, Dept of Medicine-Austin Health, Centenary Institute, Prince Henry's Institute of Medical Research, Centre for Cancer Biology, Centre for Children's Cancer and Blood Disorders, University, of Adelaide, Institute for Molecular Bioscience —The University of Queensland, Howard Florey Institute, Monash Institute of Pharmaceutical Sciences, Australian National University. International: Columbia University, University of Oklahoma, Ecole Polytechnique Federale de Lausanne, University of Rome 'Tor Vergata', University of Almeria, Uppsala University.

Grants

2008-2010 NHMRC Project Grant "The mechanism of growth hormone receptor activation". Amount - \$675,347 (total) - \$49,868 in 2010 (SVI), Chief Investigators: Waters. M., Parker, M.W.

2008-2010 NHMRC Project Grant: "Inhibitors of Siah ubiquitin ligase". Amount - \$564,818 (total) - \$84,000 in 2010 (SVI). Chief Investigators: Bowtell, D., House, C., Parker, M.W., Workman, P.

2008-2010 NHMRC Project Grant: "Structure/function studies of insulin-regulated membrane aminopeptidase". Amount - \$523,366 (total) - \$179,080 in 2010 (SVI) Chief Investigators: Parker, M.W., Chai, S.Y.

2009-2011 NHMRC Project Grant: "A novel mode of cytokine receptor assembly and activation: functional and structural characterisation". Amount - \$609,900 (total) - \$207,161 in 2010 (SVI) Chief Investigators: Parker, M.W., Hercus, T.R.

2009-2011 ARC Discovery Grant: "Functional and regulatory analysis of nicotinic acetylcholine receptors, key targets of insecticides". Amount - \$380,000 (total) - \$120,000 in 2010 (Dept. of Genetics). Chief Investigators: Batterham, P., Parker, M.W.

2007-2011 ARC Federation Fellowship. Amount-\$1,580,000 (total) - \$348,106 in 2010 (SVI)

2010-2014 NHMRC Program Grant: "Structural biology of cytokine receptor signalling". Amount - \$3,710,000 (total) - \$278,250 in 2010 (SVI) Chief Investigators: Lopez, A.F., Parker, M.W.

2009-2010 NHMRC Project Grant: "Swine influenza: Molecular basis of potential resistance to neuraminidase inhibitors". Amount - \$97,250 (total) - \$48,625 in 2010 (SVI) Chief Investigator: Parker, M.W.

2010-2012 ARC Linkage Grant: "New approaches to inhibition of activity of HIV integrase". Amount - \$600,000 (total) – (Monash University). Chief and Partner Investigators: Scanlon, M.J., Parker, M.W., Deadmen, J.J., Rhodes, D.I., Chalmers, D.K.

2010-2012 ARC Linkage Grant: "Insecticide targets in the nervous system: discovery and design for sustainable insect pest control". Amount - \$520,000 (total) – (Dept. of Genetics). Chief and Partner Investigators: Batterham, P., Parker, M.W.

2007-2013 Co-operative Research Centre for Cancer Therapeutics. Amount - \$37,690,000 (total) - \$184,942.47 in 2010 (SVI) Lead Investigators: Street, I. et al.

Publications

Voss, J.E., Angley, L.M., Scally, S.W., Taylor, N.L., Dogovski, C., Newman, J.M., Mitsakos, V., Hutton, C.A., Gerrard, J.A., Parker, M.W., Dobson, R.C.J. & Perugini, M.A. (2010) Substrate-mediated stabilization of a tetrameric drug target reveals achilles heel in anthrax. *J. Biol. Chem.*, 285, 5188-5195.

Dommaraju, S.R., Gorman, M.A., Dogovski, C., Pearce, G.F., Gerrard, J.A., Dobson, R.C.J., Parker, M.W. & Perugini, M.A. (2010) Cloning, expression and crystallization of dihydrodipicolinate reductase from methicillin-resistant *Staphylococcus aureus. Acta Crystallogr. F-Struct. Biol. Cryst. Commun.* F66, 57-60.

Sibarani, N.E., Gorman, M.A., Dogovski, C., Parker, M.W. & Perugini, M.A. (2010) Crystallization of dihydrodipicolinate synthase from a clinical isolate of *Streptococcus pneumoniae*. *Acta Crystallogr. F-Struct. Biol. Cryst. Commun.* F66, 32-36.

Wielens, J., Headley, S.J., Jeevarajah, D., Chalmers, D.K., Scanlon, M.J. & Parker, M.W. (2010) Crystal structure of the HIV-1 integrase core domain in complex with sucrose reveals details of an allosteric inhibitory binding site. *FEBS Letts*. 584, 1455-1462.

Low, W.Y., Feil, S.C., Ng. H.L., Gorman, M.A., Morton, C.J., Pyke, J., McConville, M.J., Beiri, M., Mok, Y-F., Robin, C., Gooley, P.R., Parker, M.W. & Batterham, P. (2010) Recognition and detoxification of the insecticide DDT by *Drosophila melanogaster* glutathione S-transferase D1. *J. Mol. Biol.* 399, 358-366.

Lopez, A.F., Hercus, T.R., Ekert, P., Littler, D.R., Guthridge, M., Thomas, D., Ramshaw, H.S., Stomski, F., Perugini, M., D'Andrea, R., Grimbaldeston, M. & Parker, M.W. (2010) Molecular basis of cytokine receptor activation. *IUBMB Life* 62, 509-518.

Albiston, A.L., Pham, V., Ye, S., Ng, L., Lew, R.A., Thompson, P.E., Holien, J.K., Morton, C.J., Parker, M.W. & Chai, S.Y. (2010) Phenylalanine-544 plays a key role in substrate and inhibitor binding by providing a hydrophobic packing point at the active site of insulin-regulated aminopeptidase. *Mol. Pharmacol.* 78, 600-607.)

Pearce, M.C., Powers, G.A., Feil, S.C., Hansen, G., Parker, M.W. & Bottomley, S.P. (2010) Identification and characterization of a misfolded monomeric serpin formed at physiological temperature. *J. Mol. Biol.* 403, 459-467.

Wubben, J.M., Dogovski, C., Renwick, C.J., Codd, R., Gerrard, J.A., Parker, M.W. & Perugini, M. A. (2010) Cloning, expression, purification and crystallization of dihydrodipicolinate synthase from the psychrophile *Shewanella benthica*. *Acta Crystallogr. F-Struct. Biol. Cryst. Commun.* F66, 1511-1516.

Laguerre, A., Wielens, J., Parker, M.W., Porter, C.J. & Scanlon, M.J. (2010) Preparation, crystallisation and preliminary X-ray diffraction analysis of two intestinal fatty acid binding proteins in the presence of 11-(dansylamino)undecanoic acid. *Acta Crystallogr. F-Struct. Biol. Cryst. Commun.*, in press. (Acceptance date: 9 Dec).

Feil, S.C., Polekhina, G., Gorman, M.A. & Parker, M.W. (2010) Introduction. In: "Proteins: membrane binding and pore formation", (Anderluh, G., Lakey, J., eds.), Landes Bioscience and Springer, Texas, *Adv. Exp. Med. Biol.* 677, 1-13.

Jurczyluk, J., Nouwens, A.S., Holien, J.K., Adams, T.E., Lovrecz, G.O., Parker, M.W., Cohen, S.B. & Bryan, T.M. (2010) Direct involvement of the TEN domain at the active site of human telomerase. Nucleic Acids Res., in press.

Quesada-Soriano, I., Parker, L.J., Primavera, A., Wielens, J., Holien, J.K., Casas-Solvas, J.M., Vargas-Berenguel, A., Aguilera, A., Nuccetelli, M., Mazzetti, A.P., Lo Bello, M., Parker, M.W. and García-Fuentes, L. (2010) Kinetic, thermodynamic and structural properties of the C47S/Y108V mutant of human glutathione transferase P1-1. J. Mol. Recog., in press.

Wielens, J., Headey, S., Deadman, J.J., Rhodes, D.I., Parker, M.W., Chalmers, D.K. & Scanlon, M.J. (2010) Fragment-based design of ligands targeting a novel site on the integrase enzyme of human immunodeficiency virus. ChemMedChem, in press.

Laguerre, A., Wielens, J., Parker, M.W., Porter, C.J. & Scanlon, M.J. (2010) Preparation, crystallisation and preliminary X-ray diffraction analysis of two intestinal fatty acid binding proteins in the presence of 11-(dansylamino)undecanoic acid. Acta Crystallogr. F-Struct. Biol. Cryst. Commun., in press. (Acceptance date: 9 Dec).

Miles, L.A., Crespi, G.A.N., Sen, H., Hill, A.F. & Parker, M.W. (2010) An Escherichia coli cell-free system for recominant protein synthesis on a milligram scale. In: "Methods in Molecular Biology", (Hill, A.F., ed.), Humana Press Inc., New Jersey, in press

- 3 PhD students
- Fellow of the Australian Academy of Science
- President of the Lorne Protein Organizing Committee



Matthew Perugini

Associate Professor, Department of Biochemistry and Molecular Biology Structure, function and inhibition of bacterial lysine biosynthetic enzymes

The primary research interests of the Perugini group include: anti-infective agent/drug discovery (antibiotics, pesticides & herbicides); chemical and biological defence; enzymology; lysine metabolism in bacteria and plants; molecular evolution; protein-protein and protein-ligand interactions; protein dynamics; and structure & function of virulence factors from bacteria.

Collaborations

University of Melbourne Chemistry Department, Defence Science and Technology Organisation, La Trobe University, Monash University, Walter and Eliza Hall Institute, Burnet Institute, Deakin University, RMIT University, University of Technology.

International: Massey University, UTHSCSA – USA, University of Munster, The Scripps Research Institute, Natick Soldier Center, Brandeis University.

Grants

NH&MRC Project Grant. Perugini, M.A., Dogovski, C., Dobson, R.C.J., Robins-Browne, R., Hutton, C.A.; *Multi-Targeted Inhibition of an Essential Tetrameric Enzyme from Drug-Resistant Streptococcus pneumoniae*; 2010: \$148,375, 2011: \$148,375, 2012: \$148,375.

Defense Threat Reduction Agency Program Grant. Perugini, M.A., Hutton, C.A., Gerrard, J.A., Dogovski, C. & Alderton, M.; Three Modes of Inhibiting a Tetrameric Antibiotic Target from Bacillus anthracis; 2007 (US\$): \$100,000, 2008: \$406,403, 2009: \$436,271, 2010: \$470,959, 2011: \$433,677.

ARC Linkage Infrastructure Equipment & Facilities Grant; Purcell, A.W., Bacic, A., Aguilar, M.I., Perugini, M.A., Williamson, N.A., Lithgow, T.J., Hill, A.F., Smith, I. Rossjohn, J. & O'Hair, R.A. *A Protein Molecular Interaction & Localization Facility*; 2010: \$470,000.

Publications

Wubben, J.M., Dogovski, C., Dobson, R.C.J., Codd, R., Gerrard, J.A., Parker, M.W. & Perugini, M.A. (2010) Cloning, expression, purification and crystallization of dihydrodipicolinate synthase from the psychrophile *Shewanella benthica*. *Acta Cryst*. F66, 1511-1516.

Pang, S.S., Berry, R., Chen, Z., Kjer-Nielsen, L. Perugini, M.A., King, G.F. Wang, C., Chew, S.H., Gruta, N.L. Williams, N.K., Beddoe, T., Tiganis, T., Cowieson, N.P. Godfrey, D.I., Purcell, A.W., Wilce, M.C. McCluskey, J. & Rossjohn, J. (2010) The mode of autonomous dimerisation by the pre T-cell receptor allows coupling of T-cell receptor quality control and T-cell differentiation. *Nature* 467, 844-848.

Muscroft-Taylor, A.C., Catchpole, R.J., Dobson, R.C.J., Pearce, F.G., Perugini, M.A. & Gerrard J.A. (2010) Disruption of quaternary structure in *Escherichia coli* dihydrodipicolinate synthase (DHDPS) generates a functional monomer that is no longer inhibited by lysine *Arch. Biochem. Biophys.* 503, 202-206.

Chan, K.-C., Daisy S. Lio, D.S., Dobson, R.C., Jarasrassamee, B., Hossain, M.I., Roselee, A.K., Ia, K.K., Perugini, M.A. & Cheng, H.-C. (2010) Development of the Procedures for High Yield Expression and Rapid Purification of Active Recombinant Csk-Homologous Kinase (CHK) - Comparison of the catalytic activities of CHK and CSK. *Prot. Expr. Purif.* 74, 139-147.

Collins, L., Parker, A.L., Gehman, J.D., Eckley, L., Perugini, M.A., Separovic, F. & Fabre, J.W. (2010) Self assembly of peptides into spherical nanoparticles for delivery of hydrophilic moieties to the cytosol. *ACS Nano* 4, 2856-2864.

Voss, J.E., Scally, S.W., Taylor, N.L., Atkinson, S.C., Griffin, M.D.W., Hutton, C.A., Parker, M.W., Alderton, M.R., Gerrard, J.A., Dobson, R.C.J., Dogovski, C. & Perugini, M.A. (2010) Substrate-mediated stabilization of a tetrameric drug target reveals achilles heel in anthrax. *J. Biol. Chem.* 285, 5188-95. Dommaraju, S.R., Gorman, M.A., Dogovski, C., Pearce, F.G., Gerrard, J.A., Dobson, R.C.J., Parker, M.W. & Perugini, M.A. (2010) Crystallisation of dihydrodipicolinate reductase from methicillin-resistant *Staphylococcus aureus*. *ACTA Cryst.* F66, 57-60.

Hor, L., Dogovski, C., Dobson, R.C.J., Hutton, C.A. & Perugini. M.A. (2010) Crystallization and preliminary X-ray diffraction analysis of diaminopimelate epimerase from *Escherichia coli*. ACTA *Cryst*. F66, 37-40.

Sibarani, N.E., Gorman, M.A., Dogovski, C., Parker, M.W. & Perugini, M.A. (2010) Crystallization of dihydrodipicolinate synthase from a clinical isolate of *Streptococcus pneumoniae*. *ACTA Cryst*. F66, 32-36.

Griffin, M.D.W., Dobson, R.C.J., Gerrard, J.A. & Perugini, M.A. (2010) Exploring the dimer-dimer interface of the dihydrodipicolinate synthase tetramer: how resilient is the interface? *Arch. Biochem. Biophys.* 494, 58-63. *Includes Cover Feature*.

- 9 PhD students
- 2 PhD completions
- Selected as Co-Leader of the "Chemical and Biological Defence" Theme of the Defence Science Institute
- ARC Future Fellowship (2009-2013)



Mark Rizzacasa

Professor, School of Chemistry
Total synthesis of bioactive natural products

The main research interests of the Rizzacasa research group are the total synthesis of biologically active natural products and the development of synthetic methodology.

Their research includes the synthesis of oxygen containing heterocyclic compounds, the use of pericyclic reactions in the synthesis of natural products and the total synthesis of myxobacteria metabolites. The group is also interested in biogenesis inspired total synthesis.

Collaborations

Walter and Eliza Hall Institute, RMIT University, CSIRO. International: Ohio State University.

Grants

2010 Vanderbilt International Office Category A grant Chemistry and Biology of Natural Products: Leads in Anticancer Drug Discovery \$3,910 USD

2008-2010 ARC DP Grant Synthesis of Myxobacteria Metabolites and Analogues \$115,000 (2008) \$114,000 (2009) \$109,000 (2010) total \$338,000

2010-12 CTx (Cancer Therapeutics) CRC PhD top-up Scholarship *Synthesis of Silvestrol Analogues* \$14,000 (2010) total \$42,000

Publications

Gunawan, C.; Rizzacasa, M. A. *Org. Lett.* 2010, *12*, 1388-1391. "Mulberry Diels-Alder Adducts: Synthesis of Chalcomoracin and Mulberrofuran C Methyl Ethers"

El Sous, M.; Ganame, D.; Tregloan, P. Rizzacasa, M. A. *Synthesis*, 2010, 3954-3966. *Feature Article* "Total Synthesis of (–)-Reveromycin A *via* a Hetero-Diels-Alder Approach"

Lynch, J. E.; Zanatta, S. D.; White, J. M.; Rizzacasa, M. A. *Chem. Eur. J.* 2010, in press.
"Stereoselective Total Synthesis of (–)-Spirofungin A Utilizing H-Bond Controlled Spiroketalization"

- 13 PhD students
- 2 PhD completions
- Awarded the 2010 RACI Birch Medal



Charles Robin

Senior Lecturer, Department of Genetics
The Evolution of Detoxification Genes

The Robin research group is interested in genetics of adaptation and the molecular evolutionary processes that are associated with it. They work with species of *Drosophila* and species of moths in the genus *Helicoverpa*. A major theme of the lab is the use of insecticide resistance as a model trait to characterize (i) the molecular evolutionary response to extreme selection and (ii) the population genetics of adaptive variants. The group also study the adaptive differences *between* species - and in particular how different species have adapted to niche-defining toxins. They use comparative genomics to study millions of years of molecular evolution in detoxification genes, and are studying structure/function relationships in the proteins they encode. Microarrays are used to study the ability of natural toxins to induce the regulation of detoxification genes.

Much of the signature of adaptive evolution comes from patterns of DNA variation within and between species and to provide a baseline to these comparisons the Robin group have a project on pseudogenes. The group also study pseudogenes, as they are signatures of gene loss, a process that may play an under-appreciated role in the phenotypic divergence and adaptability of species.

Collaborations

University of Melbourne Biochemistry and Molecular Biology Department, St. Vincent's Institute, CSIRO, University of Western Australia.

International: North Carolina State University, University of California Davis USA.

Grants

2009-2012 ARC Discovery Project: "Testing the DNA decay hypothesis of ecological specialization". 2009: \$220,000, 2010: \$200,000, 2011: \$210,000, 2012: \$150,000.

Publications

Schmidt, J. M., Good, R.T., Appleton, B., Lydall, J., Bogwitz, M. R., Martin, Daborn, P.J., Batterham, P and Robin, C. (2010) Copy Number Variation and Transposable Elements feature in an adaptive walk at the *Cyp6g1* locus *Plos Genetics* 6(6): Art. No. e1000998.

Low, W.Y, Feil, S., Ng, H.L., Gorman, M.A., Morton, C.J., Pyke, J., McConville, M.J., Michael Bieri, Yee-Foong Mok, Robin, C[†], Gooley, P.R., Parker, M.W., and Batterham, P. (2010) Structural insights of the binding of glutathione and DDT to *Drosophila melanogaster* GSTD1. Journal of Molecular Biology. 399(3): 358-366.

Teese, M. G, Campbell P. M; Scott C., Gordon, K.H, Southon, A., Hovan, D., Robin, C., Russell R.J, Oakeshott, J.G. (2010) Transcriptional and proteomic analysis of the esterases of the cotton bollworm, *Helicoverpa armigera*. *Insect Biochemistry and Molecular Biology* 40(1):1-16.

Southon A., Palstra N, Veldhuis N., Gaeth A., Robin C., Burke R., Camakaris J. (2010) Conservation of copper-transporting P(IB)-type ATPase function. Biometals 23(4):681-694.

- 3 PhD, 1 MPhil, 1 MSc and 1 Hons student
- 2 MSc completions
- CSIRO Scientist in Schools Program



Carl Schiesser

Professor, School of Chemistry and Director, ARC Centre of Excellence for Free Radical Chemistry and Biotechnology

The major focus of Schiesser's group is in the development and application of novel free radical chemistry with specific emphasis on the chemistry of selenium and in novel reagents. The group has developed world-leading expertise in homolytic substitution chemistry involving higher heteroatoms and routinely applies this chemistry to the preparation of novel molecules of therapeutic value. Specific current targets are in the areas of hypertension, inflammation and heart disease.

The group has also developed considerable expertise in the application of quantum-based molecular modelling techniques to augment laboratory studies and has made major contributions to the general understanding of the factors that affect and control free radical reactions. Of recent interest has been the important discovery that the unpaired electron is not necessarily the most reactive component in a free radical, and that radicals can often masquerade as electrophiles.

Collaborations

University of Melbourne Centre for Cultural Materials Conservation and Department of Pharmacology, Australian National University, Monash University, The Heart Research Institute, University of Sydney, Queensland University of Technology, National Gallery of Victoria, Artlab Australia, PPG Australia Pty Limited, Environmental Biotechnology Co-operative Research Centre, BlueScope Steel, University of Tasmania, Getty Conservation Institute, Osaka Prefecture University, Getty Conservation Institute, Tate Britain

Grants

2010 - ARC Centre of Excellence for Free Radical Chemistry and Biotechnology CE0561607". \$ 2.6 million (ARC)

2010 - "The 20th Century in Paint". ARC Linkage project LP0883309. \$ 182K

2010 - "Improving Energy Efficiency through Cool Polymers in Building Materials". ARC Linkage project, LP0883528. \$26K

Publications

IDE, A.; DRISKO, G. L.; SCALES, N.; SCHIESSER, C. H.; CARUSO, R. A., Monitoring Bisphosphonate
Surface Functionalization and Acid Stability of Hierarchically
Porous Titanium-Zirconium-Oxides, *Langmuir*,
2010, *submitted*.

BECKWITH, A. L. J.; SCHIESSER, C. H., Treasures from the *Free Radical Renaissance Period* — Miscellaneous Hexenyl Radical Kinetic Data, *Org. Biomol. Chem.*, 2010, DOI:10.1039/c0ob00708k.

STAPLES, M. K.; GRANGE, R. L.; ANGUS, J. A.; ZIOGAS, J.; TAN, N. P. H.; TAYLOR, M. K.; SCHIESSER, C. H., Tandem Free-Radical Addition/Substitution Chemistry and it's Application to the Preparation of Novel AT1 Receptor Antagonists, *Org. Biomol. Chem.*, 2010, DOI: 10.1039/c0ob00573h.

AMOS, R. I. J.; SMITH, J. A.; YATES, B. F.; SCHIESSER, C. H., Acyl Radical Addition To Benzene And Related Systems - A Computational Study, *Tetrahedron*, 2010, *66*, 7600 – 7604.

KYNE, S. H.; LIN, C. Y.; RYU, I.; COOTE, M. L.; SCHIESSER, C. H., First Determination of the Rate Constant for Ring-Closure of an Azahexenoyl Radical: 6-Aza-7-ethylhexenoyl, *Chem. Commun.*, 2010, 46, 6521 – 6523.

HORVAT, S. M.; SCHIESSER, C. H., An *ab-initio* and DFT study of Homolytic Substitution Reactions of Acyl Radicals at Sulfur, Selenium, and Tellurium, *New J. Chem.*, 2010, *34*, 1692 – 1699.

TRAN, T. A.; SCHIESSER, C. H., Reactions of Acetyl Radical with Acetylene – A Computational Study, *Bull. Korean Chem. Soc*, 2010, *31*, 595 – 598.

POVIE, G.; VILLA, G.; FORD, L.; POZZI, D.; SCHIESSER, C. H.; RENAUD, P., Role of Catechol in the Radical Reduction of *B*-Alkylcatecholboranes in presence of Methanol, *Chem. Commun.*, 2010, *46*, 803 – 805.

STAPLES, M. K.; SCHIESSER, C. H., Selenochromanes via Tandem Homolytic Addition/Substitution Chemistry, *Chem. Commun.*, 2010, 46, 565 – 567.

- 12 PhD, 3 MSc and 1 Exchange student
- 4 PhD completions
- Was invited to speak at the Australian Embassy in Zagreb



Frances Separovic

Professor and Head, School of Chemistry Membrane Biophysics & Solid-State NMR

The Separovic group is interested in the structure-function relationships of macro-molecular assemblies and biological systems at the molecular level using primarily nuclear magnetic resonance spectroscopy (NMR). Their primary research is directed at the determination of the structure and dynamics of the components of biological membranes *in situ* using solid-state NMR techniques. The group have determined the molecular structure of the antibiotic gramicidin A and the bee toxin melittin within phospholipid membranes and the techniques used to study these polypeptides are being extended to membrane proteins. Together with their collaborators, they are providing insight into the structure-function relationships of membrane-active peptides and proteins relevant to disease states and treatments.

Collaborations

University of Melbourne Pathology Department, CSIRO, Orica, Monash University.
Internationa: Karlsruhe Institute of Technology, Birkbeck College, University of Oxford.

Grants

Melbourne SEED grant: Membrane recognition of antimicrobial peptides \$40,000

DP0984815 Membrane-associated structure and the effect of metals on Abeta peptide from Alzheimer's disease \$90,000

Publications

"Solid-state NMR study of membrane interactions of the pore-forming cytolysin, equinatoxin II." Drechsler, A., Anderluh, G., Norton, R.S. and Separovic, F. (2010) *Biochim. Biophys. Acta* **1798**, 244-251.

"Effect of helix-promoting strategies on the biological activity of novel analogues of the B-chain of INSL3." Shabanpoor, F., Hughes, R.A., Zhang, S., Bathgate, R.D., Layfield, S., Hossain. M.A., Tregear, G.W., Separovic, F. and Wade, J.D. (2010) *Amino Acids* **38**, 121-131.

"Preparation of protic ionic liquids with minimal water content and ¹⁵N NMR study of proton transfer." Burrell, G.L., Burgar, I.M., Separovic, F. and Dunlop, N.F. (2010) *Phys. Chem. Chem. Phys.* **12**, 1571-1577.

"Solid-state NMR and simulation studies of equinatoxin II N-terminus interaction with lipid bilayers." Lam, Y.H., Hung, A., Norton, R.S., Separovic, F., and Watts, A. (2010) *Proteins* **78**, 858-872.

"Non-Newtonian viscous shear-thinning in ionic liquids." Burrell, G.F., Dunlop, N.F. and Separovic, F. (2010) *Soft Matter* **6**, 2080-2086.

"Design and development of analogues of dimers of insulinlike peptide 3 (INSL3)B-chain as high affinity antagonists of RXFP2." Shabanpoor, F., Zhang, S., Hughes, R.A., Hossain, M.A., Layfield, S., Ferraro, T., Bathgate, R.A.D., Separovic, F. and Wade, J.D. (2010) *Biopolymers Peptide Science* (in press).

"Self assembly of spherical peptide nanoparticles for delivery of hydrophilic moieties to the cytosol." Collins, L., Parker, A.L., Gehman, J., Eckley, L., Perugini, M.A., Separovic, F. and Fabre, J.W. (2010) ACS Nano 4, 2856-2864.

"Anionic phospholipid interactions of the prion protein N terminus are minimally perturbing and not driven solely by the octapeptide repeat domain." Boland, M.P., Hatty, C.R., Separovic, F., Hill, A.F., Tew, D.J., Barnham, K.J., Haigh, C.L., James, M., Masters, C.L. and Collins, S.J. (2010) *J. Biol. Chem.* **285**, 32282-32292.

"Real time quantitative analysis of lipid disordering by aurein 1.2 during membrane adsorption, destabilisation and lysis." Lee, T.-Z., Heng, C., Swann, M.J., Gehman, J.D., Separovic, F., Aguilar, M.-I. (2010) *Biochim. Biophys. Acta* **1798**, 1977-1986.

"NMR relaxation and self-diffusion study at high and low magnetic fields of ionic association in protic ionic liquids." Burrell, G.L., Burgar, I.M., Gong, Q., Dunlop, N.F. and Separovic, F. (2010) *J. Phys. Chem. B* **114**, 11436-11443.

- 5 PhD students
- 1 PhD completion
- 7 invited talks at national and international meetings, including plenary talk at WWMR 2010: World Wide Magnetic Resonance Conference, Florence, Italy
- 9 seminars at international institutions
- Received the Roberston Award (Australian Society for Biophysics)



lan van Driel

Associate Professor, Department of Biochemistry and Molecular Biology
Autoimmune disease & immunological tolerance

The van Driel group is focused on two key areas Immunology and Inflammatory diseases and Cell Biology. Specificially the group's interests include:

- Autoimmune disease occurs when the immune system is directed against the body's own tissues, resulting in destruction or disruption.
- Autoimmune diseases are a major public health problem in industrialized nations. Approximately 5 % of the population suffer from autoimmune diseases.
 For some autoimmune diseases the symptoms can be treated, but for the most part, specific therapies that cure the underlying immunological disease are unavailable.
- Defining the events and mechanisms that lead to the initiation of autoimmune diseases will lead to an understanding of the processes of immunological tolerance and the development of new predictive, preventative and therapeutic strategies.
- We have concentrated on autoimmune diseases of the stomach - pernicious anaemia and autoimmune gastritis. The prevalence in Western populations of these diseases in people over the age of 60 years is 1.9 per cent. They represent some of the commonest autoimmune diseases and the commonest cause of vitamin B12 deficiency.

Collaborations

University of Melbourne Microbiology Department, Murdoch Childrens Research Institute, James Cook University.

Grants

2010 The generation and function of tissue-specific regulatory T cells, IR van Driel PA Gleeson,, NHMRC, Project, 508900, \$172,750

2010 Genetic control of susceptibility to autoimmune gastritis, AG Baxter,IR van Driel, NHMRC, Project, 485819, \$103,000

2010 Inhibition of Nef-activated Src-family kinases by CHK, T Mulhern, H-C Cheng, IR van Driel, NHMRC, Project, 509115, \$166,250

Publications

Ang, D. K., Oates, C. V., Schuelein, R., Kelly, M., Sansom, F. M., Bourges, D., Boon, L, Hertzog, PJ, Hartland, EL and van Driel, IR (2010). Cutting edge: Pulmonary legionella pneumophila is controlled by plasmacytoid dendritic cells but not type I IFN. *J Immunol*, *184*(10), 5429-33.

Newton, H. J., Ang, D. K. Y., van Driel, I. R., & Hartland, E. L. (2010). The molecular pathogenesis of infections caused by *Legionella pneumophila*. *Clinical Microbiology Reviews*, 23(2):274-98.

Shao, J., Gumz, M. L., Cain, B. D., Xia, S. L., Shull, G. E., van Driel, I. R and Wingo CS. (2010). Pharmacological profiles of the murine gastric and colonic H,K-ATPases. *Biochimica Et Biophysica Acta*, *1800*(9), 906-11.

Nguyen N, Judd LM, Kalantzis A, Giraud AS, van Driel IR (2010) Random mutagenesis of the mouse genome: A strategy for discovering gene function and the molecular basis of disease. Am J Physiol. IN PRESS

Allen S, Turner S, Bourges D, Gleeson PA and van Driel IR (2010) Shaping the T cell repertoire in the periphery. Immunol Cell Biol, IN PRESS

Allen S, Bourges D, Ross EM, Read, S, Houghton, FJ, Tu, E, Heath, WR, Bedoui, S, Gleeson PA and van Driel IR (2010) Migratory dendritic cells present autoantigens and secrete inflammatory cytokines in autoimmune disease, submitted

- 4 PhD students
- 1 PhD completion





Anthony Wedd

Professor, School of Chemistry
Molecular aspects of metal nutrition; water oxidation catalysts

The Wedd group's aim is to understand how healthy cells control toxic but essential metals so that enlightened intervention is possible when disturbances of their metabolism become patho-logical. It is now known that 10 % of the genome codes for zinc proteins (~3,000 in all). The chemistry of key molecules are studied to reveal molecular aspects of transition metal transport proteins with emphasis on Zn and Cu:-

- Copper operons in strains of bacterium that confer Curesistance;
- Copper and zinc transport proteins in humans and yeast that facilitate rapid distribution in cells;
- The molecular basis of the interactions between the anticancer drug cisplatin and Cu transport proteins;
- Cell-free expression of metal transport proteins.

Catalytic photo-oxidation of water to dihydrogen and dioxygen is one of the 'holy grails' of sustainable fuel development ('artificial photosynthesis'). We have discovered that classic polyoxometalate cluster anions can promote this reaction in aqueous solutions activated by the presence of an ionic liquid and are pursuing this development.

Collaborations

University of Melbourne Chemistry and Genetics Department, Monash University, Centenary Institute, University of Queensland, Pharma-Chemistry – Italy, CERM – Italy, Durham University, Stanford University

Grants

2008-10 ARC Discovery DP0877156 'Molecular Probes for Biometals' CI: AG Wedd, PS Donnelly, AI: N. Robinson (Total = \$390k)

2010-12 ARC Discovery DP1093345 'Chemistry of the Transport of Nutrient Copper in Biological Cells' CI: AG Wedd, AI: F. Arnesano (Total \$490k)

Publications

J. Xie, R. Gilbert-Wilson, B. Moubaraki, K. S. Murray, and A. G. Wedd, "A Fe(bpy)₂ unit fused to a Keggin Polyoxotungstate Anion" *Aust. J. Chem.* 2010, *62*, 252-256.

K. Y. Djoko, L. X. Chong, Z. Xiao and A. G. Wedd, "Reaction Mechanisms of the Multicopper Oxidase CueO from Escherichia coli Support its Functional Role as a Cuprous Oxidase" *J. Am. Chem. Soc.* **2010**, *132*, 2005-2015.

G. Buncic, P. S. Donnelly, J. White, Z. Xiao and A. G. Wedd, "Water-soluble *Bis*(thiosemicarbazone) Ligands: Sensitive Probes and Metal Buffers for Zinc" *Inorg. Chem.* **2010**, *49*, 3071-3.

Z. Xiao and A. G. Wedd, "Challenges of Determining Metal-Protein Affinities" *Nat. Prod. Rpts.* **2010**, *27*, 768-789.

N. Sun, A. Dey, Z. Xiao, A. G. Wedd, K. O. Hodgson, B. Hedman and E. I. Solomon, "Solvation Effects on S K-Edge XAS Spectra of Fe–S Proteins: Normal and Inverse Effects on WT and Mutant Rubredoxin" *J. Am. Chem. Soc.*, **2010**, *132*, 12639–12647.

- 7 PhD students
- 1 PhD completion
- Received the 2010 Burrows Medal of the Royal Australian Chemical Institute



Jonathan White

Associate Professor, School of Chemistry Structural organic chemistry

The White group's research interests focus on:

Mechanistic organic chemistry, using accurate single crystal x-ray structure determinations of model organic systems for mapping out chemical reaction or rearrangements from the ground state structures. Information has been used to determine the magnitude and mechanism of neighbouring participation by B-silicon, germanium and tin substituents, π -systems and chalcogens (S, Se and Te).

Radiopharmaceuticals. Design and synthesis of DNA-binding bis-benzimidazoles as radiomodifiers for use in radiation treatment of cancer. Design and synthesis PET imaging agents selective for hypoxic tissue.

Photoactive materials for use in photovoltaic applications.

Collaborations

University of Melbourne Bio21, Peter MacCallum Institute, Austin Hospital, University of Southern California, University of New Hampshire.

Grants

2010 NHMRC App. ID 469002 A new family of Fluorine-18 based PET tracers for imaging hypoxia \$40,000.

2010 NHMRC App. ID 582401 Preclinical evaluation of F-18 fluoroethyltriazolyl PEGstilbenes as potential PET imaging agents for Alzheimer's disease \$60,000.

2010 LE100100109 Small Molecule X-ray Molecular Structure Elucidation Facility \$ 530,000

Publications

J.E. Lynch, S.D. Zanatta, J. M. White, M.A. Rizzacasa, Stereoselective Total Synthesis of (¿)-Spirofungin A Utilizing H-BondControlled Spiroketalization, Chemistry Eur. J., published online Dec. 11th 2010 DOI:

10.1002/chem.201002501

K.B. Szpakolski, K. Latham, C.J. Rix, J. M. White, 'Di(2-Pyridyl)Ketone Complexes of Cu(I)- and Cu(II)-Containing lodide and Thiocyanate Ligande: An unusual case of a Mixed-Aldol Condensation' Eur. J. Inorg. Chem., Published Online Nov. 10 2010, DOI: 10.1002/ejic.201000860 H. Lioe, J.M. White, R.A.J. O'Hair, 'Preference for bridging versus terminal ligands in magnesium dimers' J. Molec. Modell. 2010, 1-10

R.J. Williams, N.W. McGill, J.M. White, S.J. Williams, 'Neighbouring Group Participation in Glycosylation Reactions by 2,6-Di-substituted 2-O-Benzoyl groups: A Mechanistic investigation' J. Carbohydr. Chem., 2010, 29, 236-263. V.W.L. Ng, M.K. Taylor, J.M. White, C.G. Young, cis-Dioxo and cis-(Hydroxo)oxo-Mo(V) Complexes Stabilised by Intramolecular Hydrogen Bonding, Inorgt. Chem., 2010, 49, 9460-9469.

K. J. Tan, J. M. White, U. Wille, Self-terminating Radical Cyclisations: How are Thiyl Radicals Performing? *Eur. J. Org. Chem.*, 2010, 4902-4911.

V. W. L. Ng, M. K. Taylor, L. M. R. Hill, J. M. White, C. G. Young, Novel O,O'-Donor Oxo-Mo(IV) Hydrotris(3-isopropylpyrazoyl)borate Complexes Formed by Chelation of Potentially Hydrogen-Bonding Phenolate Ligands on reduction of Dioxo-Mo(VI) Complexes, *Eur. J. Inorg. Chem.*, 2010, 3261-3269.

B. T. Y. Li, J. M. White, C. A. Hutton, Synthesis of the leu-Trp Component of the Celogentin family of Cyclic Peptides Through a C-H Activation-Cross-Coupling Strategy, *Aust. J. Chem.*, 2010, *63*, 438-444.

K. B. Szpakolski, K. Latham, C. J. Rix, J. M. White, B. Moubaraki, K. S. Murray, Synthetic and Structural Studies on Copper 1H-[1,10]-Phenanthrolin-2-one Coordination Complexes: Isolation of a Novel Intermediate During 1,10-Phenanthroline Hydroxylation, *Chem. Eur. J.*, 2010, *16*, 1691-1696.

G. Buncic, P. S. Donnelly, B. M. Paterson, J. M. White, M. Zimmerman, Z. Xiao, A. G. Wedd, 'A water-soluble bis(thiosemicarbazone) ligand. A sensitive probe and metal buffer for zinc' Inorg. Chem. 2010, 49, 3071-3073. L.S.-M. Wong, K.A. Turner, J.M. White, A.B. Holmes, J.H. Ryan, Asymmetric synthesis of a hydroxylated ninemembered lactone from tartaric acid using the Claisen rearrangement, Aust. J. Chem., 2010 63, 529-532 S. Sauburn, J. M. Macdonald, J. H. Ryan, R. C. J. Woodgate, T. S. Louie, M. J. Fuchter, J. M. White, A. B. Holmes,

B. M. Paterson, J. M. White, P. S. Donnelly, A hexadentate bis(thiosemicarbazonate) ligand: rhenium(V), iron(III) and cobalt(III) complexes' *J. Chem. Soc. Daltan Trans.* 2010, 39, 2831-2837.

Tetrahedron, 2010, 66, 2761-2767

B. M. Paterson, J. A. Karas, D. Scanlon. J. M. White, P. S. Donnelly, 'Verastile new Bis(thiosemicarbazone) Bifunctional Chelators: Synthesis, Conjugation to Bombesin(7-14), and copper-64 Radiolabelling' *Inorg. Chem.*, 2010, 49, 1884-1893

G. A. Hope, R. Woods, A. N. Buckley, J. M. White, J. McLean; 'Spectroscopic Characterisation of Octanohydroxamic acid and Potassium Hydrogen n-Octanohydroxamate' *Inorg. Chim. Acta*, 2010 935-943.

- 9 PhD students
- 1 PhD completion



Uta Wille

Associate Professor, School of Chemistry Organic and Physical Organic Chemistry

The Wille group's research interests focus on free radical chemistry. In particular the development of new synthetic methodology in solution and the gas-phase, understanding and exploring reaction mechanisms using experimental (for example laser flash photolysis) and computational techniques, detecting radical-induced damage in paints, damage to biosurfaces by environmental radicals.

Collaborations

University of Melbourne Bio21, University of Woolongong, ANU, University of Queensland, Queensland University of Technology, PPG Industries, Innsbruck – Austria

Grants

2010 National Computing Infrastructure, Wille.

Computational Study of Dual Orbital Interactions in Radical Chemistry., AUD60,000 (in-kind)

2008–2010 ACS Petroleum Research Fund, Wille. Development of new pathways for the oxidative transformation of alkynes into highly reactive carbonyl compounds., USD50,000

2008–2010 BIO21 Interdisciplinary Grant, Wille, Hoffmann. Reactive Oxygen Species: Development of a Biological Detection System for Atmospheric Pollutants., AUD20,000

2008–2011 ARC Linkage, LP0883528, Schiesser, Micallef, Wille, Hall. *Improving Energy Efficiency through Cool Polymers In Building Materials.*, AUD78,000

Publications

WILLE U. Self-Terminating Radical Cyclizations and Other Radical Cascades Initiated by Intermolecular Radical Addition to Alkynes. *Chem. Rev.*, submitted (invited review).

Goeschen C, Wibowo N, White JM, WILLE U. Damage of aromatic amino acids by the atmospheric free radical oxidant $NO_3 \bullet$ in the presence of $NO_2 \bullet$, O_3 and O_2 . *Org. Biomol. Chem.*, submitted.

WILLE U. "Self-Terminating Radical Cyclizations" – new insight into the mechanism from computational studies. *J. Phys. Org. Chem.* 2010, first published online: 11/11/2010, DOI:10.1002/poc.1808.

Tan KJ, White JM, WILLE U*. Self-Terminating Radical Cyclizations: How are Thiyl Radicals Performing? *Eur. J. Org. Chem.* 2010, 4902-4911.

Edtbauer A, Denifl S, Viczaino ^c, Russel K, Taubitz J, WILLE U, Feketeová L, O'Hair RA, Märk TD, Illenberger E*, Scheier P*. Very Low Energy Electrons Transform the Cyclobutane-Pyrimidine Dimer into a Highly Reactive Intermediate. *ChemPhysChem.* 2010, *11*, 561-564.

WILLE U. Radical Photochemistry. In: *CRC Handbook of Organic Photochemistry and Photobiology* (Eds. Oelgemoeller M, Griesbeck A, Ghetti, F.), in print.

WILLE U. Intermolecular Radical Additions to Alkynes: Cascade-Type Radical Cyclizations. In: *Reactive Intermediates in Chemistry and Biology Vol. 4: Carbon Centered Radicals: Structure, Reactivity and Dynamics* (Ed. Forbes M), John Wiley & Sons, Inc., Hoboken, New Jersey, 2010, p. 9-41.

- 3 PhD, 2 MSc and 1 hons student.
- 1 PhD completion
- Presentation at "Gentech Careers Workshop" as a part of Science Week



Spencer Williams

Senior Lecturer, School of Chemistry Biological Organic Chemistry and Carbohydrates

> 2010 Williams, Jarrott, Novel Antioxidant Drugs to Treat Motor Neuron Disease, Interdisciplinary Seed Funding Scheme, University of Melbourne; \$50,000.

Publications Gao. X., Willi

Gao, X., Williams, S.J., Woodman, O.L., Marriott, P.J., 'Comprehensive two-dimensional gas chromatography, retention indices and time-of-flight mass spectra of flavonoids and chalcones', *J. Chromatogr. A*, 2010, 1217, 8317-826.

Hakki, Z., Cao, B., Heskes, A.M., Goodger, J.Q.D., Woodrow, I.E., Williams, S.J., 'Synthesis of the monoterpenoid esters cypellocarpin C and cuniloside B and evidence for their widespread occurrence in eucalyptus', *Carbohydr. Res.*, 2010, 345, 2079-2084.

Williams, R.J., McGill, N.W., White, J.M., Williams, S.J., 'Neighboring group participation in glycosylation reactions by 2,6-disubstituted 2-O-benzoyl groups: A mechanistic investigation', *J. Carbohydr. Chem.*, 2010, 29, 236-263. Cao, B., Williams, S.J., Chemical approaches for the study of themycobacterial glycolipids phosphatidylinositol mannosie s, lipomannanand lipoarabinomannan, *Nat. Prod. Rep.*, 2010, 27, 919-947.

Song, M.-J., Baek, I., Seo, M., Kim, S.-H., Suk, K., Woodman, O.L., Williams, S.J., Kim, I. K.,, '3',4'-Dihydroxyflavonol decreases vascular contraction through inhibition of the RhoA/Rho-kinase pathway in endothelium-denuded rat aorta', *Clin. Exper. Pharmacol. Physiol.*, 2010,37, 803-810.

Shirbin, S.J., Boughton, B.A., Zammit, S.C., Zanatta, S.D., Marcuccio, S.M., Hutton, C.H., Williams, S.J., Copper-Free Palladium-Catalyzed Sonogashira and Hiyama Cross-Couplings using Aryl Imidazol-1-ylsulfonates, *Tetrahedron Lett.*, 2010, 51, 2971-2974.

Zhu, Y., Suits, M.D.L., Thompson, A.J., Chavan, S., Dinev, Z., Dumon, C., Smith, N., Moremen, K., Xiang, Y., Siriwardena, A., Williams, S.J., Gilbert, H.J., Davies, G.J., 'Mechanistic insights into a calcium-dependent family of α -mannosidases in a human gut symbiont, *Nat. Chem. Biol.*, 2010, 6, 125-132.

Zanatta, S.D., Jarrott, B., Williams, S.J., 'Synthesis and preliminary pharmacological evaluation of aryl dithiolethiones with cyclooxygenase-2-selective inhibitory activity and hydrogen sulfide-releasing properties', *Aust. J. Chem.*, 2010, 63, 946-957.

2010 Additional Highlights

- 5 PhD, 1 MSc and 1 hons student
- 2 PhD and 1 MSc completions
- 2010 Biota Award for Medicinal Chemistry

The Williams group's research expertise includes carbohydrate chemistry, bioorganic chemistry and medicinal chemistry. The group's research interests include the application of organic chemistry to the study of biological systems. This involves the synthesis of carefully designed molecules and their application in a variety of biological systems. Research areas include: the study of pathogen-specific carbohydrate processing pathways in the human pathogens Leishmania spp. (Leishmaniasis) and Mycobacteria spp. (tuberculosis); using substrates and inhibitors to dissect the mechanism of mannose transferring enzymes (glycosidases and glycosyltransferases); applications and mechanism of copper and copper-free 'click' chemistry; and development of drugs for the treatment of pain, cardiovascular disease and diabetes.

Collaborations

University of Melbourne Bio21, Botany, Medicine departments, Monash University, RMIT University, Howard Florey Institute.

International: Oxford University, York University, University of Toronto, Czech Academy of Sciences, Kyunpook University.

Grants

2010-12 Williams, McConville; Mannosyl transfer process in leishmania and mycobacteria; ARC; Discovery; \$330,000.

2009-11 McConville, Williams; Novel metabolic enzyme in Leishmania parasites; NHMRC Project; \$431,625.

2008-10 Williams, Woodman; Understanding the cardioprotective effects of flavonols; ARC; Discovery; \$245,000. (41K per year)

2010 JM White, AF Richards, SR Batten, BF Abrahams, PJ Barnard, AB Hughes, PS Donnelly, C Boskovic, CA Hutton, CG Young, SJ Williams, PC Junk, C Jones, L Spiccia, DJ Wilson, CF Hogan, PC Andrews, GB Deacon, AB Holmes, KS Murray; Small molecule X ray molecular structure elucidation facility; ARC; LIEF LE100100109; \$530,000.

2010 Williams, O'Hair; Chemistry Online Resources: Preparing students for laboratory and tutorial success; Learning and Teaching Initiatives; University of Melbourne; \$34,400.

2010 Williams, Jarrott, Development Of An Improved Derivative Of Paracetamol With More Potent And Longer Analgesic Actions, CASS Foundation; \$52,500.

Annual Report Appendix 2010 BIO21 MOLECULAR SCIENCE AND BIOTECHNOLOGY INSTITUTE



Professional service & community engagement

Bio21 Institute research group leaders are involved in a range of outreach and community engagement activities in addition to undertaking a range of roles to support the scientific community. Some of these include participating in conference organisation and management, committee, journal and editorial board roles and membership, engaging with schools and the community.

Professor Tony Bacic

- Associate Editorial Board, Frontiers in Plant Proteomics (2010 -)
- Editorial Board, Plant and Cell Physiology (2006-2010)
- Monitoring Editor, Plant Physiology (2000)
- Editorial Board, Planta (2000-)
- Associate Editor, Glycobiology (1998-)
- Scientific Organising Committee XII Cell Wall Meeting, Porto, Portugal (2010)
- Program Committee, OzBio 2010 (combined 12th IUBMB, 21st FAOBMB and ComBio2010 Conferences) Melbourne 2010.
- New Generation Sequencing Committee, member 2008-
- VLSCI (Victorian Life Sciences Computation Initiative)
 Steering Committee, member 2008-
- Australian Proteomics Computational Facility
 Management Committee, Ludwig Institute, University of Melbourne2006
- Maud Gibson Trust, Royal Botanic Gardens, Cranbourne 1997-
- XII Cell Wall Meeting, Porto, Portugal [Scientific Organising Committee] 2010
- OzBIO 2010 (combined 12th IUBMB, 21st FAOBMB and ComBio2010 Conferences), Melbourne (Sept 2010) [Program Committee]
- Associate Editorial Board, Frontiers in Plant Proteomics 2010-
- Editorial Board, Plant and Cell Physiology 2006-2010
- Monitoring Editor, Plant Physiology 2000-
- Editorial Board, Planta 2000-
- Associate Editor, Glycobiology 1998-

Professor Philip Batterham

- President of the Genetics Society of Australasia
- Local organiser 63rd UN Department of Public Information NGO Conference, Melbourne Convention Exhibition Centre (August 30 – September 1).

Associate Professor Marie Bogoyevitch

- ASBMB National Secretary & Executive member
- Editorial Board Member, "Biochemical Journal"
- Editorial Board Member, "International Journal of Biochemistry and Cell Biology

Associate Professor Heung-Chin Cheng

 Research and Lab skills training - Hosted two Coburg Senior High School students as part of the Victorian School Apprenticeship Program.

Dr Paul Donnelly

- Founding member and on the Scientific Advisory Board for Procypra Therapeutics
- Associate Editor Journal of Alzheimer's Disease
- Founding member and Head Scientist of Clarity Pharmaceuticals
- Secretary, Inorganic Chemistry Special Interest Group of RACI (VIC branch)
- Associate Editor, Journal of Alzheimer's Disease

Professor Paul Gleeson

- Editorial Board of J. Autoimmunity, Glycoconjugate
 lournal
- Member of the Editorial Board of J. Autoimmunity, Glycoconjugate Journal
- Vice-President, Cellular Biology Meeting Inc, 2009-

Dr Sally Gras

 Represented The Australian Academy of Science at Science Meets Parliament

Dr Danny Hatters

- Member of the Huntington's Disease Research Group of Victoria
- Secretary of the Lorne Conference on Protein Structure and Function

Associate Professor Andrew Hill

- Member NHMRC Academy (2010-)
- Member NHMRC Biomedical Training Panel (2010-)
- Chair, Organising Committee 4th Conference on Protein Misfolding and Neurological Diseases
- Visits to two Secondary Schools
- Hosted year 11 student (Roah Al Bakiri) who completed Cert III in Laboratory Skills

Professor Andrew Holmes

- Robert Robinson Lecturer, University of Oxford
- Foreign Secretary, Australian Academy of Science
- Doctor Honoris Causa, Universiteit Hasselt, Belgium

Professor Ary Hoffmann

- President of The Australian Entomological Society
- Member of Editorial Board of Journal of Experimental Zoology, 2006-
- Member of Editorial Board of The American Naturalist, 2009-
- President, Australian Entomological Society, 2010-2

Dr Craig Hutton

- CSIRO Scientist in Schools Program
- Visit to Eltham Primary School Science Discovery event

Dr Vladimir Likic

- One of 35 experts invited by Okinawa Institute of Science and Technology (Japan) to contribute in workshops regarding development of an international university and R&D cluster in Okinawa
- Member Editorial Board of the Journal Biosensors.
- Contributed to the establishment of a new journal Metabolites was established.

Professor Malcolm McConville

 GTAC Teacher Symposium presentation 'The Omic Revolution' Metabolomics,- taking metabolism out of the test tube and into the cell. University High School, June 2010

Professor Richard O'Hair

 Associate Editor of the Journal of the American Society for Mass Spectrometry (2009-)

Professor Michael Parker

- President of the Lorne Protein Organising Committee
- Member of the Royal Society of Victoria, 2009-
- President of the Lorne Protein Organizing Committee, 2009-
- OzBio2010 (12th IUBMB Conference, 21st FAOBMB Conference, Annual Conference of the Australian Society for Biochemistry and Molecular Biology), Melbourne, September 2010: Chair of session on "Signalling across membranes"

Associate Professor Matthew Perugini

- Treasurer and co-organiser of the Lorne Conference on Protein Structure and Function
- Co-Theme Leader of the "Chemical and Biological Defence Theme" of the combined University of Melbourne and DSTO Defence Science Institute
- Chair of the student initiatives sub-committee of the Australasian Proteomics Society

Professor Charlie Robin

CSIRO Scientist in Schools Program

Professor Frances Separovic

 Organising Committee of RACI 2010, AMP 2010, Biophysical Society (USA) 2010, ICMRBS 2010, ASB 2010, Pacifichem 2010

Dr Uta Wille

 "Gentech Careers Workshop" as a part of National Science Week

Invited Lectures and Presentations

Bio21 Institute Research Group leaders present seminars and lectures at a number of local, national and international events and conferences. Some of these include:

Professor Roberto Cappai

- Presenter at Symposium of Imaging, Tohoku University, Sendai
- Presenter atInstitute of Medical Biochemistry, University of Aarhus, Aarhus
- Presenter atInternational Congress on Alzheimer's disease, Honolulu
- A&PD Symposium on Pathomechanisms in Neurodegeneration, Sydney

Dr Paul Donnelly

- Keynote Lecturer at International Conference on Coordination Chemistry, ICCC39, Adelaide, Australia, 25th-30th July 2010
- Keynote Speaker at 39th International Coordination Chemistry Conference (ICCC39), a major international inorganic chemistry conference, Adelaide, July 25–30, 2010
- Speaker at the Singapore International Chemical Conference, Singapore, (Dec 15-18 2009)
- Selected to give an Oral presentation at the 13th International Conference on Biological Inorganic Chemistry (15-20 July 2007) the major conference in the discipline
- Alan Sargeson Lectureship award, delivered 11 invited lectures at different Universities throughout Australia in 2009 and 2010 and two lectures in New Zealand.

Professor Paul Gleeson

- Invited Speaker, 10th Hunter Cell Biology Meeting March, 2010. "Retrograde trafficking in health and disease"
- Invited Speaker, 2nd International and 11th National Symposium on Membrane Biology (2nd ISMB & 11th NSMB) November, 2010, Ningbo, China
- Invited Speaker WEHI (27th November), Institute seminar
- Invited Speaker Centenary Institute, Sydney, June 2010
- Invited Speaker, School of Biotechnology and Biomolecular Sciences University of New South Wales, June 2010

Dr Sally Gras

- Bioengineering: from the nano to the large scale, Technology of Milk and Egg, INRA, Renne, France, 14th of April, 2010.
- Functional amyloid fibrils: Groningen Biomolecular Sciences and Biotechnology Institute, University of Groningen, The Netherlands, 16th of June 2010.
- Bioengineering: from the nano to the large scale, Moorepark, Teasgac, Ireland, 24th of June 2010.
- Functional amyloid fibrils; Institute of Food Research, Norwich, United Kingdom, 29th of June 2010.
- Cheese: under the microscope, Royal Australian Chemical Institute –Tasmania Branch invited public lecture this year as part of National Chemistry Week, Hobart, 21st of July, 2010.
- Functional peptide materials, School of Chemistry and Physics, University of Adelaide, Adelaide, 21st of September, 2010, invited presentation.
- The formation of amyloid fibrils by the five chaplin peptides from Streptomyces coelicolor, 1st of October, Ozbio2010, Molecules of life: from discovery to biotechnology, Melbourne, Australia. Invited presentation.
- Increasing Yield and Reducing Environmental Waste in the Dairy Industry, Australian French Association for Science and Technology, Melbourne, 26th of November, 2010. Invited presentation.

Associate Professor Paul Gooley

Invited lecture, International Conference on NMR at the Interface of Physics Chemistry & Biology, November 29-30 2010
 Indian Institute of Science, Education, Research, Mohali, India. "Recognition of mitochondrial targeting sequences by the import receptors Tom20 and Tom22."

Dr Danny Hatters

- Invited Speaker, Gordon conference, Lucca Italy (2011)
- Invited Speaker, PepCon2011, China (2011)
- Invited Speaker, Biomedical imaging symposium, Sydney (2010)

Associate Professor Andy Hill

- Plenary Lecture, OzBio2010 (as recipient of Merck Medal)
- Master Lecture, Asia-Oceania Symposium on Prion Diseases
- Symposium Lecture, PrP Canada

Professor Ary Hoffmann

- 'Evolutionary potential and climate change'. Plenary, Symposium on Evolutionary Potential in Natural Populations. Sjandberg, Denmark, 2010.
- 'Why evolutionary considerations matter when it comes to climate change' Symposium presentation, Society for the Study of Evolution, Portland, Oregon 2010.
- 'Plastic responses and species distributions', American Naturalists Meeting, Vice President Symposium, Portland, Oregon 2010

Professor Andrew Holmes

- Ta-shue Chou Memorial Lecturer, Academia Sinica, Taiwan, February, 2010
- Contributed Lecture, MRS Spring Meeting, San Francisco, 05 09 Apr 2010
- Robert Robinson Lectures, University of Oxford, May 2010
- Keynote Speaker, Pacifichem, Symposium #225, 14-20 Dec 2010

Dr Craig Hutton

- Invited Speaker, International Chemical Congress of Pacific Basin Societies (Pacifichem 2010), Honolulu, USA, 15–20 December 2010. "Synthesis of covalently cross-linked homodimeric peptides: Application to the study of dityrosine-linked Ab dimmers"
- Invited Speaker, International Chemical Congress of Pacific Basin Societies (Pacifichem 2010), Honolulu, USA, 15–20 December 2010. "Interconversion of boronic acid protecting and activating groups"

Professor Malcolm McConville

- Keynote speaker and symposium chairperson, XII International congress of parasitology (ICOPA), Melbourne, 15-20 August, 2010
- Plenary speaker BioMalPal (invited but unable to attend) (May 2010)
- Keynote speaker, XXVI Brazilian Society of Protozoology, Foz do Iguacu, Brazil 25-27 October, 2010
- Speaker, 2nd Australasian Metabolomics Conference. 3-5 October, 2010
- Keynote speaker; Clinical Research Excellence 2010, Melbourne Convention Centre, 5-6 August 2010

Professor Michael Parker

- Australian Academy of Science "Science at the Shine Dome", Canberra, May 2010: " A tale of two toxins".
- The Lowy Symposium on "Discovering Cancer Therapeutics", University of New South Wales, Sydney, May 2010: "Cancer structural biology and drug discovery".
- 5th Garvan Signalling Symposium, Sydney, October 2010: "Assembly of the GM-CSF receptor".

Associate Professor Matthew Perugini

- September 2010, Queenstown Drug Discovery and Development Satellite Meeting, New Zealand. Presentation title: "Multi-Targeted Inhibition of an Essential Tetrameric Enzyme from Bacillus anthracis".
- April 2010, Enzymes and Biocatalysis-2010, Shanghai, China. Symposium talk title: "Multiple DHDPS Personalities from an Important Plant Pathogen".
- March 2010, PepCon-2010, Beijing, China. Symposium talk title: "Molecular Evolution in Quaternary Structure of an Essential Bacterial Enzyme".
- September 2010, OzBio 2010, Melbourne, Australia. Symposium talk title: "Molecular Evolution in Quaternary Structure of an Essential Enzyme from Bacterial Extremophiles".
- June 2010, School of Molecular and Biomedical Science, University of Adelaide. Seminar title: 'Multiple Personalities in Quaternary Structure and Regulation of a Novel Antibiotic Target'
- April 2010, Institute for Molecular Bioscience, The University of Queensland. Seminar title: 'Multiple Personalities of an Essential Bacterial Enzyme'.

Professor Carl Schiesser

- Lecture at the EUCHEM Conference on Organic Free Radicals, Bologna, Italy,
- Oral presentation at the SFRR Australasia 19th Annual Conference in Akaroa, New Zealand. 30 November-2 December 2010. "
 Nitrasartan, Radical Chemistry and Hypertension Diseases".

Professor Eric Reynolds

- Invited Speaker, CIOSP International Dental Meeting, Sao Paulo, Brazil "Teaching, Research and the Role of Recaldent on Enamel Remineralization", January, Sao Paulo, Brazil, January.
- Invited Speaker, International Association for Dental Research General Session, IADR Symposium Immuno-Evasion and Suppressive Strategies of Oral Microbes, "Secretion, surface assembly and role of the RgpA-Kgp proteinase-adhesin complexes of P. gingivalis in evasion of the immune response", Barcelona, July.
- Invited Speaker, International Association for Dental Research General Session, "Comparison of Tooth Mousse (MI Paste) with ClinPro in situ", Barcelona, July.
- Invited Speaker, FDI Annual World Dental Congress, Salvador, BA, Brazil "Remineralization of the Non-cavitated Lesion", Salvador, Brazil, September.
- Invited Speaker, Pacific Coast Society of Orthodontists 74th Annual Session, "How to Prevent White Spot Lesions Around Orthodontic Brackets", Honolulu, Hawaii, October.
- Invited Speaker, Pacific Coast Society of Orthodontists 74th Annual Session, "White Spot Lesions Demineralization and Remineralization", Honolulu, USA, October.

Professor Mark Rizzacasa

- Birch Award Address, RACI National Connect Conference in Melbourne, July 8, 2010
- Invited Spekaer, Chemistry Education Association, Bio21 Institute, November 23, 2010
- Plenary Lecturer, WA391 Synthesis Symposium, Murdoch University, WA, Nov 29, 2010
- Visiting Professor VIO grant, Vanderbilt University, Nashville, TN, USA, July 15-23, 2010

Professor Frances Separovic

- "NMR studies of antimicrobial and amyloid peptides in membranes." Separovic, F. (2010) Emily M. Gray Award Lecture, Proc. 54th Biophysical Society Meeting, San Francisco, USA, p16.
- "Membrane interactions of antimicrobial and amyloid peptides as revealed by solid-state NMR spectroscopy" Separovic, F. (2010) Australian Biophysical Chemistry Workshop 2010, Adelaide, SA, p13.
- "Solid-state NMR studies of the membrane interactions of antimicrobial and amyloid peptides." 455th WE Heraeus Seminar: Biophysics of Membrane-Active Peptides, Bad Honnef, Germany, p4.
- "Resolving antimicrobial and amyloid peptides in membranes." Separovic, F. (2010) WWMR 2010: World Wide Magnetic Resonance Conference, Florence, Italy, p14.
- "NMR studies of antimicrobial peptides in model membranes." Separovic, F. (2010) AMP 2010: Australia-Croatia Workshop on Antimicrobial Peptides, Split, Croatia, p23.
- "The effect of membrane-active peptides on membrane dynamics and molecular order." Separovic, F. (2010) Proc. 34th Australian Society for Biophysics, Adelaide, SA, p168.

Professor Tony Wedd

- Keynote lecturer, 10th European Conference on Biological Inorganic Chemistry, Thessaloniki, Greece, June 22-26, 2010.
- Burrows Medalist and plenary lecturer, 39th International Conference on Coordination Chemistry, Adelaide, Australia, July 25-30, 2010.
- Plenary lecturer, 7th International Meeting on Copper in Biology, Alghero, Italy, Oct 17-21, 2010.
- Keynote lecturer, 5th Asian Conference on Biological Inorganic Chemistry, Kaoisung, Taiwan, Nov 2-6, 2010.

Dr Uta Wille

 Invited Lecture, Australian Health and Medical Research Congress. Mechanistic Insight into the Enzymatic Repair of UV Induced Damage in DNA. Melbourne, Australia, 11/2010.

Dr Spencer Williams

- Developing an improved derivative of paracetamol, Philanthropy and Research Australia Health and Medical Research Forum, Melbourne, May 27, 2010.
- The role of 2,6-disubstituted benzoates in the synthesis of AGP-related oligo-@-D-galactosides, 25th International Carbohydrate Symposium, Tokyo, Japan, August 2010.
- Approaches to the synthesis of mycobacterial glycolipids, Pacifichem, Hawaii, December 2010.

Postdoctoral and Student Achievements

Postgraduate Students and Postdoctoral Fellows at the Bio21 Institute have been successful in achieving a range of prizes, awards and travel grants. Some of these include:

Chris Armstrong (Biochemistry and Molecular Biology)
Poster prize at the 2nd Australian Symposium on
Metabolomics for Biomedical and Microbial Metabolomics

Marie Bongionvanni (Chemical and Biomolecular Engineering)ARC Nanotechnology Travel grant; Melbourne Abroad Travelling Scholarship;

Samantha Byrne (Oral Health CRC) Oral biology award, ANZ IADR meeting (NSW)

Pei Zhi Cheryl Chia (Biochemistry and Molecular Biology) – ASCB travel award

Nathan Cochrane (Oral Health CRC) Community and preventive dentistry award, ANZ IADR meeting NSW

John Gehman and Hadi Lioe (Chemistry) Inaugural winners of University of Melbourne Vanderbilt Mobility Research Grants

Dewi Go (Chemical and Biomolecular Engineering) Graduate Certificate of Commercialisation Melbourne Business School.

Wei Hong (Oral Health CRC) Australian Society for Microbiology's student prize for his presentation on "The *mntR* locus in *Porphyromonas gingivalis*

Lin Wai Hung (Pathology) – ASBMB Fellowship in recognition of outstanding work in area of biochemistry and molecular biology

David Jones (Chemistry/ Bio21 Institute) Austrlian Academy of Science Australia-Germany Researcher Mobility funding.

Karramadin (Biochemistry and Molecular Biology) Selected Speaker Melbourne Protein Group Symposium

Brandon MacDonald (Chemistry/Nanoscience) – Australian Institute of Energy award for poster presentations at the AII Energy 2010

Lydia Ong (Chemical and Biomolecular Engineering) Early Career Research Grant, Melbourne School of Engineering; AINSE Travel Grant to attend Food and Neutron Oral presentation at the Wrld Dairy Summit NZ.

Thomas Park Oral Health CRC) Gordon Castle scholarship from the University of Melbourne

Stephanie Quek (Oral Health CRC) University of Melbourne Faculty of Science 2010 Deans Award in Honours, March 2010

Aaron Song – 2nd place in the National Postgraduate Student Energy Awards 2010 Australia

Corin Storkey (Chemistry) – Best Student Prize at the Society for Free Radical Research Australasia 19th Annual Conference held in New Zealand

Roisin O'Flaherty (Chemistry) Australian Government DEST Endeavour Award

Beth Sawyer (Chemical and Biomolecular Engineering) Endeavour Research Fellowship; Chinese Academy of Sciences Fellowship for Young International Scientists

Keng Tan (Oral Health CRC) second place in the senior basic science section of the IADR, Unilever Hatton Award (Barcelona, Spain)

Andrew Tilley (Chemistry) – The Royal Australian Chemical Institute National Convention Student Poster PRize

Wallace Wong (Chemistry/Bio21 Institute) Australia China Young Scientist Exchange Program.

Wallace Wong (Chemistry/Bio21 Institute) Australian Academy of Science Australia-Germany solar Photovoltaics Research funding.

Qiaohui Yang (Oral Health CRC) Gordon Castle scholarship from the University of Melbourne.

BIO21 MOLECULAR SCIENCE AND BIOTECHNOLOGY INSTITUTE

The Bio21 Institute 2010 Annual Report Appendix has been produced by Bio21 Institute Communications and published for the web by the Bio21 Institute Director's Office.

Hard copies of the 2010 Annual Report can be requested by contacting the Bio21 Institute.

The Bio21 Institute 2010 Annual Report and associated Appendix is available on the Bio21 Institute website at www.bio21.unimelb.edu.au

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