Message from the Head of Department- Professor Roger Daly

Dear Colleagues,

This is always an incredibly pressured time of the year for our researchers, many of whom have only just emerged bleary-eyed from writing their grants and fellowship applications. However, it’s clear that we’ve already established significant forward momentum in 2014. For example, the quality of the research papers highlighted in this newsletter indicate that we’re continuing to make high impact discoveries, and based on some recent discussions with individual Lab Heads, its evident that additional big stories will emerge later in the year.

In addition, the Department’s presence at the international forefront of structural biology research will be consolidated by the establishment of a new ARC Centre of Excellence in Advanced Molecular Imaging, supported by a $28M grant over seven years awarded to Professor James Whisstock and his colleagues. Of note, a celebration of this outstanding achievement will be held later in March, where James will present an overview of the Centre and its vision – please keep an eye open for this event.

Furthermore, based on recommendations emanating from the Departmental Strategic Planning Retreat held late last year, we have recently initiated several focused recruitment initiatives aimed at development of our research portfolio and establishment of the Department as a world leader in structural and functional biology. The goals of this recruitment drive are to maintain our presence at the cutting edge of certain fields, such as structural biology and immunology, build areas where we have a strong foundation, such as cancer biology, so that we attain the highest levels of research achievement, and develop research themes essential for our future international competitiveness, such as computational network biology. We’ll be hosting visits from some outstanding candidates during the year and I’ll keep you updated regarding our progress with this initiative.

Protein link to autoimmunity

Scientists at Monash University and the University of Melbourne have uncovered how a protein plays a key role in the prevention of autoimmunity.

In a study published in Nature Communications, Professor Tony Tiganis and Dr Florian Wiede, from Monash University, Department of Biochemistry and Molecular Biology; and Associate Professor Nicole La Gruta, from the University of Melbourne, Department of Microbiology and Immunology, have shown how the protein known as PTPN2 dampens excessive T cell responses and thus prevents the development of autoimmunity.

T cells are an important part of the immune system where their main purpose is to recognise and eliminate harmful bacteria, viruses and infected cells. Paradoxically, in the absence of an infection, T cell survival and turnover is reliant on T cell interaction with the body’s own cells, otherwise referred to as self.

“A key puzzle in the immunology and autoimmunity fields is how these immune responses to self are limited, so that T cells do not attack the body’s tissues and organs,” said Dr Wiede, the lead author from the Monash Department of Biochemistry and Molecular Biology.

“Our study has dealt with this conundrum head-on. When T cells are depleted, as occurs for example after an infection or intense physical stress, T cells must expand to replenish the T cell pool. This expansion is reliant on interaction with self. We have shown that PTPN2 prevents excessive T cell responses to self under these circumstances.”

The researchers have found that PTPN2 deficient T cells undergo rapid expansion when T cells are depleted, comparable with that occurring in response to foreign antigen. These rapidly expanding cells acquire the characteristics of activated T cells and promote overt auto-reactivity and disease.

Although these studies have been conducted in genetically-modified mice, this finding has strong implications for humans, where autoimmune diseases collectively affect approximately 5 per cent of individuals world-wide. Mutations that result in decreased PTPN2 in T cells have been linked with the development of Crohn’s disease, rheumatoid arthritis and type 1 diabetes. Therefore, the research published in Nature Communications define an important mechanism by which these mutations may contribute to the development of autoimmunity.

Professor Tiganis and his team are now focusing on PTPN2’s specific roles in type I diabetes and colitis.
Stopping a deadly virus in its tracks

An international team of scientists, led by Dr Greg Moseley and Professor David Jans from the Monash University Department of Biochemistry and Molecular Biology, have identified a novel vaccine strategy against lyssaviruses that cause rabies in animals and humans. Each year, over 60,000 people worldwide die from rabies following lyssavirus infections.

There are 15 known species of lyssaviruses, including Australian bat lyssavirus and rabies virus, which are commonly transmitted by bats or dogs through bites or scratches. Infected animals and humans, if not treated rapidly with a series of injections of inactivated vaccines and expensive immunoglobulins, die in 100 per cent of cases. This is the highest fatality rate for any known infectious disease.

In a study published recently in the Journal of Infectious Diseases, scientists from Monash University; Institut Pasteur, Université Paris Diderot and CNRS, in France; and Gifu University, in Japan, have developed a mutated lyssavirus that cannot evade immune responses in the body, resulting in a weakened strain that is switched from a 100 per cent lethal pathogen to one that no longer causes disease in infected mice.

"The production of this new viral strain is a great first step towards making new live rabies vaccines in the future," said Dr Moseley, the overall team leader from the Monash Department of Biochemistry and Molecular Biology.

"Live vaccines can be grown easily in large quantities, and delivered as a single oral dose, unlike existing ‘killed’ rabies vaccines that must be injected several times over an extended period, limiting their application in resource-poor countries."

In the research study, the Monash University researchers identified the region in a lyssavirus protein that inhibits immune responses. This region was mutated and the modified virus was used to infect mice, which were able to overcome infection without developing disease, whereas control mice infected with an unmodified virus died.

"By making only two specific changes to the approximately 12,000 base pair viral genome, we have rendered the virus non-pathogenic," said lead author and Monash University PhD student Linda Wiltzer.

"We now plan to develop a candidate vaccine based on our attenuated virus, and test its safety and efficacy in mice."

If this approach is successful, Dr Moseley believes that this novel vaccine strategy may have widespread application for domestic animals and possibly humans who are exposed to bats or dogs that harbour lyssaviruses.

Since embarking on this vaccine research, Monash University has filed an Australian provisional patent application to facilitate future clinical development.

Monash Micro Imaging “Image of the year competition”
Sponsored by Life Technologies https://platforms.monash.edu/mmi/

1st Prize- Dr. Anabel Herr
Department of Biochemistry and Molecular Biology (Whisstock Lab)
School of Biological Sciences (Warr Lab)

2nd Prize- Dr Travis Johnson
Department of Biochemistry and Molecular Biology (Whisstock Lab)
School of Biological Sciences (Warr Lab)

3rd Prize- Dr. Anabel Herr
Department of Biochemistry and Molecular Biology (Whisstock Lab)
School of Biological Sciences (Warr Lab)

SoBS Round 1, 2014 Travel Grants
Congratulations to Patricia Illing and Jiyoti Verma Gaur from the Department of Biochemistry and Molecular Biology who received travel grants from SoBS. For more information regarding travel grants see http://www.med.monash.edu.au/intranet/sobs/

SoBS Round 2, 2014 Travel Grants
Round 2 2014 (for travel between 1 July 2014 and 31 December 2014) is now open.
Applications close 5.00 pm on Thursday, 29th May 2014.
The guidelines and application form can be found here: http://www.med.monash.edu.au/intranet/sobs/
All enquiries and applications should be emailed to: SOBS.travelgrants@monash.edu

More Biochemistry news: please visit our website www.med.monash.edu.au/biochem
Scientists solve a sticky problem

Scientists have uncovered how an ulcer causing stomach bacteria, that has been linked to gastric cancer, sticks to and infects the lining of the stomach and gut.

Australian scientists have long had an interest in how the bacterium, Helicobacter pylori, causes ulcers and more rarely gastric cancer. Now, researchers led by Dr Terry Kwok and Professor James Whisstock, from Monash University’s Department of Biochemistry and Molecular Biology, have determined the 3-dimensional structure of a protein called SabA. SabA effectively acts as glue, sticking the bacteria to the cells lining the stomach, which can cause gastric disease.

Professor Whisstock said the findings could pave the way for potential new treatments for various gastric diseases.

“SabA is a type of protein known as an adhesin. As the name suggests, adhesins stick the bacteria to the cells lining the stomach. If we can stop SabA from working properly, then we may have a new approach for treating a range of different gastric diseases,” Professor Whisstock said.

Dr Kwok said infection with bacteria Helicobacter pylori is the cause of most stomach and small intestine ulcers.

The Monash University researchers pinpointed the part of SabA that is important for its stickiness, and they are now working to develop specific drugs that stop the protein from working properly.

“Chronic Helicobacter pylori infection is an important problem, with re-occurring infections particularly difficult to treat, so there is great interest in developing new and specific drugs in this area,” Dr Kwok said.

The research was recently published in the Journal of Biological Chemistry and was supported by the Australian Research Council and the National Health and Medical Research Council of Australia.

ComBio2014: 28 September – 2 October 2014, National Convention Centre, Canberra, ACT

Abstract and Early Registration Deadline: 27 June 2014

ComBio2014 is the combined conference of the ASBMB (Australian Society for Biochemistry and Molecular Biology), the ASPS (Australian Society of Plant Scientists) and the ANZSCDB (Australia and New Zealand Society for Cell and Developmental Biology).

The provisional conference streams are listed below, but the provisional topics within the streams, can be downloaded from:

- Plant Biology
- Plants and Global Change
- Cell Biology
- Developmental Biology, Stem Cells & Regeneration
- Genome Biology & Bioinformatics
- Signalling
- Protein Structure, Function & Proteomics
- Education

A full list of the plenary speakers (together with biographies and photographs) will be available by mid to late March from:

Online registration and abstract submission will be available in early to mid April.

Environmental Sustainability At Monash

Anyone concerned with any environmental issues should contact Shani Keleher (shani.keleher@monash.edu) or visit The Office of Environmental Sustainability (TOES) http://www.fsd.monash.edu.au/environmental-sustainability.

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Laboratory Head Profile: Dr Alfons Lawen

At high-school in Germany I became excited about biochemistry and decided to study biochemistry via chemistry in Würzburg, Germany. There I also started my scientific life with a diploma thesis in the Biochemistry Department, working on oligo-2',5'-adenylate synthetase. After finishing my degree as “Diplom-Chemiker”, I embarked on a PhD (Dr. rer. nat.) thesis on S6-kinase. At that time, the existence of the enzyme was known, but not much more. I managed to partially purify and characterise the enzyme (a paper submitted to Nature was rejected on the basis that it was well-established that the enzyme was activated by partial proteolysis and not – as we claimed – by phosphorylation).

I then undertook post-doctoral studies at Technical University in Berlin (then West-Berlin), where I remained in the area of enzymology, but shifted from the ribosome to non-ribosomal peptide biosynthesis. My task was to characterise the enzyme system responsible for the biosynthesis of the immunosuppressant cyclosporin A (CsA). Since CsA was composed of 11 amino acids and the maximal size for an enzyme at that time was believed to be about 450 kDa, I was looking for an enzyme complex of at least 3 to 4 subunits. As it turned out I was in reality chasing a single-polypeptide enzyme which comprised all 40 active sites necessary for CsA biosynthesis. The molecular mass of of the enzyme is about 1.7 MDa (The enzyme has been cloned by others; its open reading frame contains 45 Mb). I had the chance to form my own small group in Berlin and I had one gifted PhD student (Joachim Dittmann) in Berlin and later another gifted PhD student at Monash (Tony Velkov), who both managed to get a first-authored JBC paper published on the enzyme.

I joined Monash in March 1993 and started to predominantly work on electron transport across the plasma membrane. That there were electron transport enzymes (called the plasma membrane NADH-oxidoreductase system or PMOR) located in the plasma membrane was first shown by Fred Crane (the discoverer of coenzyme Q) in the mid-70s, however, little was known about the biochemistry of these enzymes. With an Honours/PhD student (Jari Larm) I started to analyse the relationship between PMOR and mitochondria and we were able to show that the PMOR can compensate for mitochondrial NAD+ generation. With a postdoc in the lab (Ernst Wolvetang) we were at the same time able to show that inhibition of the PMOR can result in apoptosis (this work also resulted in a project on the intrinsic pathway of apoptosis, on which again I had two good PhD students [Karina Johnson and David Grubb] working). I then had another gifted PhD student (Mark Baker) who was brave enough to undertake the endeavour of purification of an enzyme of the PMOR. After several years of hard work he found a mitochondrial protein, VDAC1, which is also expressed at the level of the plasma membrane, where it functions as a reductase.

My last (again extremely gifted) PhD student, Darius Lane, analysed the involvement of the PMOR in non-transferrin-bound iron uptake and to our surprise found that the 40-year old paradigm, claiming that iron is directly reduced by a plasma membrane reductase, was wrong (at least for the ascorbate-stimulated activity). Darius again managed to publish his main findings as a first-authored JBC paper and has now published a total of 12 papers with me.

I had fruitful collaborations with the then Head of the Psychology Department, Kim Ng, on the biochemistry of memory formation and with Steve Robinson from the same Department on oxidative stress and iron metabolism in brain cells. In recent years I have started a collaborative project with Melanie Pritchard on RCAN1 (playing a role in Downs syndrome and Alzheimer’s) and oxidative stress.

As an Academic a large portion of my time at Monash has been occupied by teaching (and teaching administration). I always found it rewarding to work with gifted and interested students; for me the most rewarding experience has always been watching the metamorphosis from a student into a scientist (often happening at international conferences). Two highlights of my undergraduate teaching were the publication of my 3rd year Science lecture notes on apoptosis and the fact that I could convince the authors of “Lehninger” to include the concept of “metabolons” into their textbook. I always enjoyed teaching outside of the area of my research expertise, as challenging as it may be at times, and I firmly believe increasing your knowledge helps in your research as you may look at old problems from completely new angles.

I am grateful to my students and to my colleagues that have endeavoured to work and collaborate with me and to many of the people at Monash who made the last twenty years a heavily enjoyable time.
2013 Biochemistry Student Symposium

The 2013 Biochemistry Student Symposium was an exciting event where postgraduate students from the department presented their research. This entirely student led and focused event was designed as an opportunity for postgraduate students of all levels to develop their presentation skills in an informal environment. Many excellent presentations were given highlighting the diversity of projects on offer across the department.

Congratulations go to the awardees (see photo below) with big thanks to our generous sponsors;

1st prize extended presentation: Greg Davis
Runner-up extended presentation: Stephen Scally
1st prize short presentation: Amanda Woon
Poster prizes: Sam Palfram and Gabrielle Watson

The successful day was brought to a close with a presentation from Jose Garcia-Bustos who shared with us his thoughts, and indeed made us all think, about 'the bigger picture' surrounding science and the impact that we can make.

Thank-you to all the attending students, members of the department, and our supporting sponsors; you all helped to make this event a great success. Finally, this event would not have been possible without the effort and dedication of a small cohort of enthusiastic PhD students. Massive thanks goes to the organising committee Giuseppe, Matt, Ben, Chen, Amanda, Julie, Kailin, Victoria, and Vera.

We hope to see you all at the 2014 Biochemistry Student Symposium!

TO ALL SUPERVISORS
A message from Monash OHS

Supervisors include those who oversee staff work programs, student research, lectures, tutorials, practicals classes and field trips.

You must:
- encourage appropriate positive attitudes towards OHS
- ensure you, your staff or students participate in approved OHS training
- use a documented risk management process to manage OHS risks
- apply relevant OHS policy and procedures
- actively participate in OHS inspections and audits
- include OHS performance in staff appraisals
- ensure all hazards and incidents are reported and investigated appropriately and suitable controls are implemented

If you supervise students, you are also responsible for their health and safety.

You can delegate the supervision or training of staff and students to a suitably qualified person, but you are accountable for ensuring they are competent and have had the relevant training.

POSTGRADUATE MATTERS

PhD Graduates

Joel Selkrig
Thesis: “Characterization of a novel protein translocation system found ubiquitously in the membranes of Gram-negative bacteria.”
Supervisor: Professor Trevor Lithgow

All queries on Postgraduate matters:
Please contact Prof Mibel Aguilar
mibel.aguilar@monash.edu

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Quick Overview of What to Do When an Emergency Arises:

1. Remain CALM...
2. Yell out for a First Aider (don’t go looking for one yourself, get someone else to go looking)
3. First Aiders: Read MSDS before treating any chemical injury
4. First Aiders: Call Med Centre if necessary ext. 53175
5. First Aiders: Call the Safety Officer and/or Safety Representative as soon as possible


OHS MATTERS

TIME TO DECLUTTER YOUR FUMEHOODS

There are many over cluttered fumehoods within the department, with large amounts of accumulated waste, soiled benchcote, protruding sharps, not clearly labelled containers/bottles. Time to clean up and remove all the waste, store away any unused chemicals, remove soiled benchcote hence minimising your risk of exposure when using the fumehood. Also remove any loose items which can be sucked up into the back filters of the fume hood.

Benchcote should not be taped down to the benches or inside the fume hood. It should only be used while carrying out a procedure and then removed and discarded appropriately. If there is a chance of a spill occurring, then TRAYS should be used instead of benchcoat to fully contain any spillage, and cleaned out on a regular basis.

Images from inside fumehood s which are not safe as is. If you need help with storage of dangerous chemicals please feel free to contact the Safety Officer for advice.

WHAT NOT TO WEAR IN THE LAB

Open (front or back), holes, absorbent shoes are not to be worn when in PC1/PC2 lab areas, even if you are not doing any lab work or walking through. Please discourage staff and students, contractors, collaborators, sales reps etc from entering the lab environment without the correct foot wear.

In the office areas, bare feet ARE NOT ACCEPTABLE. Everyone should be wearing foot wear at all times when at work.

Repeat offenders may be reported to their supervisor.