Australian Biochemist

The Magazine of the Australian Society for Biochemistry and Molecular Biology Inc.

December 2018, Volume 49, Number 3

ISSN 1443-0193

ASBMB

The Australian Society for Biochemistry and Molecular Biology Conference

SAVE the DATE

1–3 OCTOBER 2019

Fremantle Esplanade Hotel

FREMANTLE, PERTH
WESTERN AUSTRALIA

www.asbmb2019.com.au

CONFERENCE THEMES

- Gene Editing
- Drug Discovery
- RNA Biology

KEY DATES

- Call for abstracts
  29 JANUARY 2019
- Registration Open
  1 APRIL 2019

CONFERENCE ORGANISING COMMITTEE

- Executive Committee
  Nicolas Taylor
  Charlie Bond
  Aleksandra Filipovska
  Ricardo Mancera
  Naomi Trengove
  Elin Gray
  Raelene Endersby
- Program Organising Committee
  Marco Falasca
  Oliver Rackham
  Archa Fox

CONFIRMED SPEAKERS

- Lingling Chen, *Shanghai Institute of Biochemistry and Cell Biology*
- Tom Blundell, *University of Cambridge*

- Conference Managers

arinex

Arinex Pty Ltd
Perth, WA 6000

P +61 8 9486 2000
F +61 2 9267 5443
E asbmb2019@arinex.com.au
W www.asbmb2019.com.au

- Sponsorship

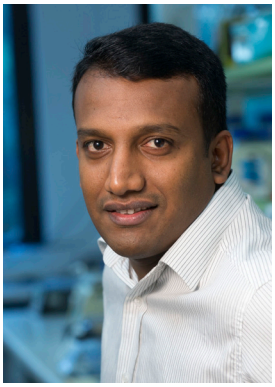
Perth
PERTH CONVENTION BUREAU

Table of Contents

Front Cover
ASBMB Grimwade Keynote Plenary Lecturer Randy Schekman (University of California, Berkeley, USA) presents at ComBio2018.

Australian Biochemist – **Editors** Suresh Mathivanan and Tatiana Soares da Costa, **Editorial Officer** Liana Friedman

Australian Biochemist Editorial Committee Members

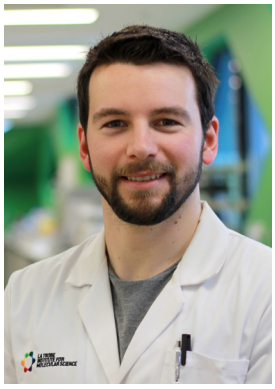


Co-Editor
Associate Professor
Suresh Mathivanan
Department of
Biochemistry and Genetics
La Trobe Institute for Molecular Science
La Trobe University
Bundoora VIC 3086
Email: editor@asbmb.org.au
Phone: (03) 9479 2565

Co-Editor
Dr Tatiana Soares da Costa
Department of Biochemistry and Genetics
La Trobe Institute for Molecular Science
La Trobe University
Bundoora VIC 3086
Email: editor@asbmb.org.au
Phone: (03) 9479 2227

Editorial Officer
Liana Friedman
Email: liana.friedman@monash.edu

Dr Doug Fairlie
Olivia Newton-John Cancer Research Institute and La Trobe University
Heidelberg VIC 3084
Email: doug.fairlie@onjcri.org.au
Phone: (03) 9496 9369



Shaun Gaskin
Department of Biochemistry and Genetics
La Trobe Institute for Molecular Science
La Trobe University
Bundoora VIC 3086
Email: gaskin.s@students.latrobe.edu.au

Dr Sarah Hennebry
FPA Patent Attorneys
101 Collins Street
Melbourne VIC 3000
Email: sarah.hennebry@fpapatents.com
Phone: (03) 9288 1213

Dr Erinna Lee
La Trobe Institute for Molecular Science and Olivia Newton-John Cancer Research Institute
Heidelberg VIC 3084
Email: erinna.lee@latrobe.edu.au
Phone: (03) 9496 9369

Associate Professor Susan Rowland
Institute for Teaching and Learning Innovation (ITaLI)
University of Queensland
St Lucia QLD 4072
Email: s.rowland1@uq.edu.au
Phone: (07) 3365 4615

Dr Nirma Samarawickrema
Department of Biochemistry and Molecular Biology
Monash University
Clayton VIC 3800
Email: nirma.samarawickrema@monash.edu
Phone: (03) 9902 0295

Dr Natalie Spillman
Bio21 Institute Department of Biochemistry and Molecular Biology University of Melbourne
Parkville VIC 3010
Email: natalie.spillman@unimelb.edu.au
Phone: (03) 8344 2312

26TH CONGRESS OF THE INTERNATIONAL UNION FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY

MELBOURNE CONVENTION AND EXHIBITION CENTRE
22-26 SEPTEMBER 2024

MELBOURNE 2024

EXECUTIVE COMMITTEE MEMBERS & SUPPORTING SOCIETIES

CHAIR Professor Leann Tilley

DEPUTY CHAIR Professor Christina Mitchell

GENERAL SECRETARY & CHAIR Associate Professor Danny Hatters

CHAIR, SCIENTIFIC PROGRAM Professor Andrew Hill

TREASURER Associate Professor Terry Piva

FAOBMB REGION REPRESENTATIVE Professor Paul Gleeson

EDUCATION REPRESENTATIVE Professor Janet Macaulay

SBMB

FAOBMB

NEW ZEALAND SBMB

The Australian Society for Microbiology
bringing Microbiologists together

AUSTRALIAN SOCIETY OF PLANT SCIENTISTS

ANZSCDB
Australia and New Zealand Society for Cell and Developmental Biology Inc.

Publications with Impact

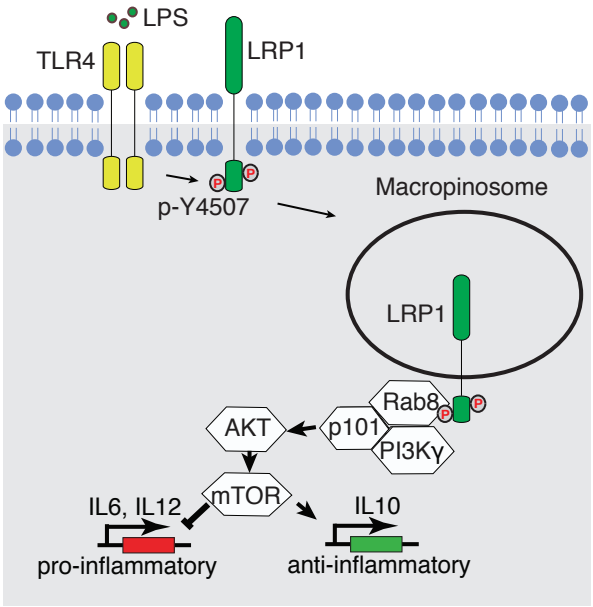
Publications with Impact profiles recent, high impact publications by ASBMB members. These short summaries showcase some of the latest research by presenting the work in a brief but accessible manner. If your work has recently been published in a high profile journal, please contact us at editor@asbmb.org.au.

TLRs Call on a Receptor Friend to Help Suppress Inflammation

Luo L, Wall AA, Tong SJ, Hung Y, Xiao Z, Tarique AA, Sly PD, Fantino E, Marzolo MP, Stow JL*. TLR crosstalk activates LRP1 to recruit Rab8a and PI3Kγ for suppression of inflammatory responses. *Cell Rep* 2018;24(11):3033-3044.
***Corresponding author: j.stow@imb.uq.edu.au**

Pathogen-activated Toll-like receptors (TLRs) signal to mount pro- and anti-inflammatory responses. The class 1B PI3Kγ is activated (remotely) downstream of multiple TLRs to augment Akt and mTOR signalling that biases macrophage programming and cytokine outputs to constrain inflammation. Rab8a, not Ras, is known to recruit PI3Kγ noncanonically for TLR signalling, but the mechanism for this recruitment was unknown. Now, a new paper from the Stow lab at the University of Queensland's IMB, reveals that TLRs call on the ubiquitous endocytic receptor, LDL receptor-related protein 1 (LRP1), to recruit the Rab8a/PI3Kγ complex for signalling. LRP1 has known roles in chronic diseases, including Alzheimer's disease, atherosclerosis and cancer, and it has an emerging profile as a suppressor of inflammation. In this study, LRP1 is shown to be crosstalk activated by ligand-activated TLRs, triggering the recruitment of GTP-Rab8a with its effector PI3Kγ. This finding expands the repertoire of players in TLR-induced signalling and highlights a mechanism for LRP1 to bias macrophage programming and constrain inflammation.

Macrophages are activated by Toll-like receptors (TLRs) to initiate inflammatory responses as a first-line defence against pathogens. We have previously described roles for Rab8a and its effector PI3Kγ in biasing TLR signalling and cytokine profiles via Akt/mTOR pathway to constrain inflammation in macrophages. Here we set out to investigate the precise mechanism for activating and recruiting Rab8a in relevant membrane domains. By using affinity pull-down and mass spectrometry analysis, we identified low-density lipoprotein receptor related protein-1 (LRP1) – a multi-ligand endocytic receptor – as a TLR-responsive Rab8a binding partner. Analysis of phosphorylation sites showed that LRP1 is phosphorylated at Y4507 in response to activation of multiple TLRs. Crosstalk induced Y4507 phosphorylation of LRP1 occurs through a yet-to-be-identified kinase and it allows the binding and recruitment of the Rab8/p110γ/p101 complex by the LRP1 cytoplasmic tail. LRP1



Model for LPS/TLR4 mediated crosstalk activation of LRP1. LPS/TLR4 activates LRP1, resulting in phosphorylation of LRP1 at Y4507. The phosphorylation of LRP1 recruits Rab8a with its PI3Kγ effector complex, which in turn activates Akt/mTOR signalling for the biased synthesis and secretion of pro-inflammatory (reduced) and anti-inflammatory (increased) cytokines.

likely recruits this complex to membrane domains of the early macropinosomes for activation of the signalling kinases Akt and mTOR. Using LRP1 deleted MEFs and CRISPR deletion of LRP1 in RAW macrophages, signalling and cytokine outputs were examined, showing that, like Rab8a and PI3Kγ, LRP1 is needed for constraining pro-inflammatory and enhancing anti-inflammatory responses. By enlisting LRP1 to recruit signalling complexes, TLRs enhance PI3K-Akt-mTOR activation, reaching thresholds that bias signalling and receptor outputs.

Given various roles for LRP1 in prevalent chronic diseases and cancer, and an increasing number

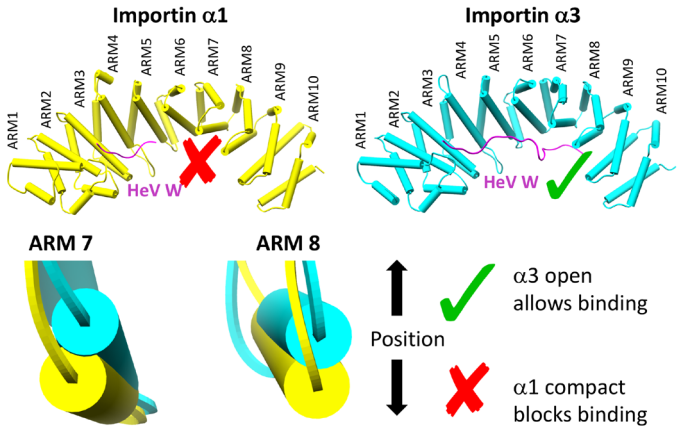
of reports linking this receptor to the control of inflammation, the relationship between LRP1 and TLRs is of heightened clinical significance. LRP1 presents as a new target, with several possible strategies for regulation of macrophage programming and inflammatory responses. Further investigation will now focus on the TLR-LRP1 link in inflammatory disease and infection. This research is being pursued through a current NHMRC grant, jointly funded with our coauthors and collaborators in the group of Professor Peter Sly at UQ's Child Health Research Centre. Peter, Tarique and Emmanuelle, along with our collaborator in Chile, Maria Marzolo, are integral to this work.

Jenny Stow and Lin Luo
Institute for Molecular Bioscience,
University of Queensland

Members of Stow lab at the IMB, from left: Yu Hung, Darren Brown, Adam Wall, Neeraj Tuladhar, Zhijian Xiao, Dominique Mcconnachie, Tatiana Khromykh, Samuel Tong, Lin Luo and Jennifer Stow.

Hendra and Nipah Virus W Proteins Specifically Bind Importin α3 to Hijack Antiviral Response

Smith KM, Tsimbalyuk S, Edwards MR, Cross EM, Aragão D, Batra J, Soares da Costa TP, Basler CF*, Forwood JK*. Structural basis for importin alpha 3 specificity of W proteins in Hendra and Nipah viruses. *Nat Commun* 2018;9(1):3703.
***Corresponding authors: jforwood@csu.edu.au, cbasler@gsu.edu**



Importin α1 (yellow) and importin α3 (blue) bound to HeV W (magenta). Insert shows positions of ARMs 7 and 8 from importin α1 and importin α3.

The W protein from the Hendra virus (HeV) and Nipah virus (NiV) is transported into the nucleus of cells where it plays an important role during infection to suppress our antiviral response. The crystal structures of HeV and NiV W proteins in complex with nuclear import receptors importin α1 and importin α3 have been determined at Charles Sturt University and the Australian Synchrotron. These structures provide valuable insights into critical host–pathogen interactions and reveal important specificity mechanisms for nuclear import receptors.

The HeV and NiV are both recently emergent biosafety level 4 pathogens that can infect bats, horses, pigs, and humans with high fatality rates. They are negative sense single-stranded RNA viruses belonging to the paramyxovirus family, and a common feature of these viruses is that they replicate in the cytoplasm of our cells. However, despite replicating in the cytoplasm, both viruses encode for a protein known as W, which plays an important role in pathogenesis by entering the nucleus of cells to dampen the immune response.

For proteins to gain entry into the nucleus, they require a nuclear localisation signal (NLS) that is recognised by a family of nuclear import receptors known as importins. The W NLS is recognised by the importin α/β nuclear import complex, importin α is the adapter molecule that binds both importin β and the NLS bearing protein. In humans, our genome encodes for seven importin α isoforms that act in both a tissue and isoform specific manner, however, these mechanisms are only recently being elucidated.

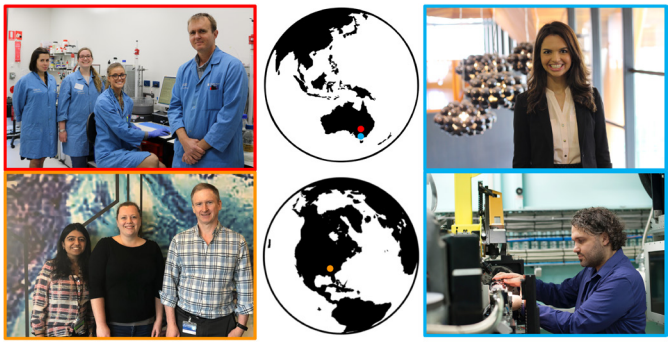
The NiV W protein was previously shown to interact specifically with importin α3 and α4. However, whether HeV W has the same importin α specificity and the mechanism for this specificity is not clear. In order to address these questions, we performed x-ray crystallography experiments at the Australian Synchrotron to determine the binding interface between the W protein with importin α1 and importin α3 at an atomic level.

Publications with Impact

Structural comparisons of these host–pathogen complexes revealed that the C-terminus conformation of importin α3 is responsible for high affinity W recognition. The positioning of armadillo repeats (ARMs) 7-8 in importin α3 is more extended than the positioning of ARMs 7-8 in importin α1. This more open conformation allows for strong binding to both the HeV W and NiV W proteins as interactions can occur throughout the entire recognition groove.

To validate the importance of the C-terminus, we designed two chimeras of importin α1 and importin α3, and performed mutagenesis targeting the second interaction site in importin α3. Cell biology data in addition to interaction measurements between the HeV W and NiV W to importin α1, α3, and α7, the importin α chimeras, and importin α3 mutants supported our conclusions. Additionally, mutations at this critical importin α3 W interface were shown in a cell context to affect both binding and nuclear transport of the HeV and NiV W proteins.

Overall, our study has provided valuable insights into an important host–pathogen interface between importin α3 and the HeV and NiV W proteins. These findings regarding nuclear transport receptor recognition can assist in our understanding of many key regulatory processes including cell differentiation, cancer and viral infection.



Team members, from top left: Sofiya Tsimbalyuk, Emily Cross, Kate Smith, Jade Forwood, Tatiana Soares da Costa; from bottom left: Jyoti Batra, Megan Edwards, Chris Basler, David Aragão. Locations of team members are shown on maps.

Jade Forwood and Kate Smith
Charles Sturt University

Antimalarial Drug Packs a Double Whammy

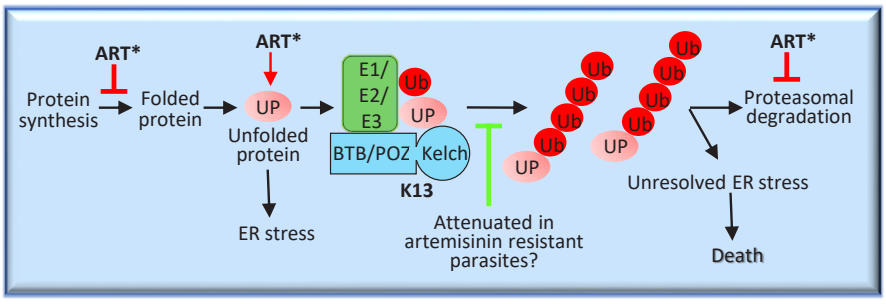
Bridgford JL, Xie SC, Cobbold SA, Pasaje CFA, Herrmann S, Yang T, Gillett DL, Dick LR, Ralph SA, Dogovski C#, Spillman NJ#, Tilley L#*. Artemisinin kills malaria parasites by damaging proteins and inhibiting the proteasome. *Nat Commun* 2018;9(1):3801.
#Equal senior authors *Corresponding author: ltilley@unimelb.edu.au

The frontline antimalarial drug artemisinin saves the lives of hundreds of thousands of children each year, but we have had very little understanding of its mechanism of action. The Tilley lab has now shown that artemisinin delivers a 'double whammy' – causing generalised unfolding of and damage to proteins, and blocking the parasite's proteasome-based waste disposal system.

The deadly mosquito-borne malaria parasite kills around 400,000 children every year. Artemisinin and its derivatives remain the most important chemotherapeutic defence. Thus, it is very concerning that parasites with decreased sensitivity to this drug class have emerged in South East Asia, leading to approximately 50% failure to cure malaria infections in some regions. If resistance spreads to Africa, a major public health crisis is feared.

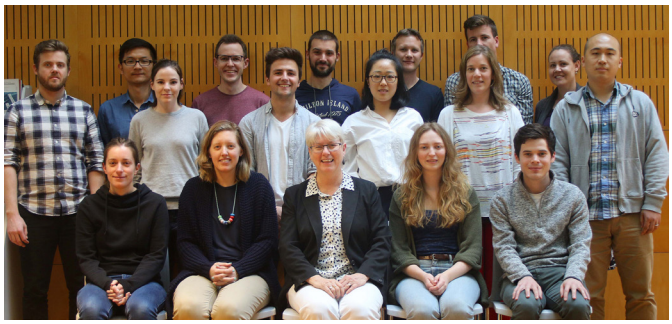
Members of the Tilley and Ralph labs at the University of Melbourne have worked with colleagues at the Japanese pharmaceutical company Takeda to discover that artemisinin kills parasites by causing a buildup of unfolded ubiquitinated proteins, as well as preventing their degradation. This buildup initiates a prolonged unfolded protein response (UPR) that leads to cell death.

The team found that treating malaria parasites with a combination of artemisinin and a proteasome inhibitor greatly synergises the activity of artemisinin and restores its activity against artemisinin-resistant parasites. By



Model of DHA-mediated killing of P. falciparum. *Activated artemisinin (ART*) initiates a multi-pronged assault on protein homeostasis by damaging and unfolding proteins, preventing folding of newly synthesised proteins and inhibiting the proteasome (toxicity indicated with red bar). Prolonged activation of the ER stress response, and accumulation of toxic polyubiquitinated proteins (UP) eventually leads to cell death. In artemisinin resistant parasites, defective presentation of proteins for polyubiquitination may enable cell survival.*

Publications with Impact



Members of the Tilley Lab.
Back, from left: Stanley Xie, Dean Andrew, Juan Nunez-Iglesias, Adam Blanch, Matt Dixon, Natalie Spillman.
Middle, from left: Simon Cobbold, Jess Bridgford, Oliver Looker, Tuo Yang, Laure Dumont, Boyin Liu.
Front, from left: Emma McHugh, Shannon Kenny, Leann Tilley, Molly Parkyn Schneider, David Gillett.

contrast, blocking protein synthesis with a translation inhibitor or inhibiting the ubiquitin-activating enzyme, E1, reduces the level of damaged, polyubiquitinated proteins, alleviates the stress response, and rescues parasites from artemisinin-induced killing. These findings pinpoint accumulated polyubiquitinated proteins as the toxic species that induces cell death.

The work identifies the ubiquitin-proteasome system as a point of critical vulnerability in *Plasmodium falciparum*. This vulnerability suggests a number of new targets for antimalarial development, including the proteasome itself, as well as the deubiquitinating enzymes that feed proteins to it. The work also points to a mechanism by which the artemisinin resistance marker, K13, an adaptor protein that facilitates protein ubiquitination, might mediate decreased sensitivity. Additionally, it explains why mutations in deubiquitinating enzymes appearing in parasites from Africa and South East Asia are associated with decreased artemisinin sensitivity.

Professor Tilley and her team, supported by funding from the Global Health Innovative Technology Fund, are currently working with experts from Takeda and Swiss-based not-for-profit organisation Medicines for Malaria Venture to discover a new parasite-specific proteasome inhibitor that could work in tandem with artemisinin, and could be advanced to clinical trials.

Leann Tilley
Bio21 Molecular Science and Biotechnology Institute, University of Melbourne

A microRNA That Finds Many Ways to Keep Control

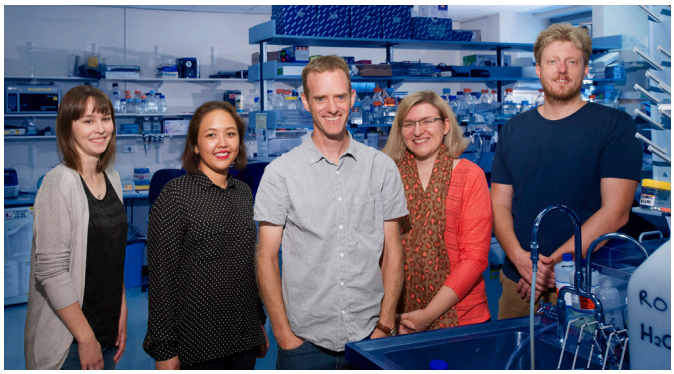
Pillman KA, Phillips CA, Roslan S, Toubia J, Dredge KB, Bert AG, Lumb R, Neumann DP, Li X, Conn SJ, Liu D, Lawrence DM, Stylianou N, Schreiber AW, Tilley WD, Hollier BG, Khew-Goodall Y, Selth LA, Goodall GJ*, Gregory PA*. miR-200/375 control epithelial plasticity-associated alternative splicing by repressing the RNA-binding protein Quaking. *EMBO J* 2018;37:e99016.
***Corresponding authors: greg.goodall@unisa.edu.au, philip.gregory@unisa.edu.au**

Philip Gregory, Greg Goodall and collaborators at the Centre for Cancer Biology, the University of Adelaide and Queensland University of Technology have reported yet another way in which a small but potent RNA influences the proteome of epithelial cells. Their previous work had shown that the miR-200 family of microRNAs exerts a powerful influence on gene expression in epithelial cells, preventing them from undergoing the differentiation process known as epithelial to mesenchymal transition (EMT). In a recent paper published in *EMBO Journal*, they now report that miR-200 also affects the alternative splicing of many genes, via its strong inhibition of the splicing regulator, Quaking (QKI).

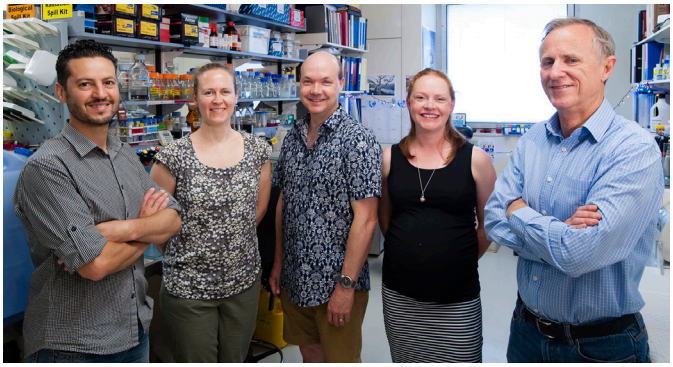
Members of the miR-200 family are critical gatekeepers of the epithelial state, restraining expression of pro-mesenchymal genes that drive EMT. EMT is a developmental process which is exploited by tumours to drive malignant progression and metastasis. As metastasis is the major cause of death resulting from solid tumours, there is great interest in uncovering the mechanisms driving EMT and the potential of modulating these as a cancer therapy. A central pathway that controls EMT is a reciprocal feedback loop between the miR-200 family and ZEB1/2 (ZEB) transcription factors. This interaction is particularly powerful, and results in widespread changes in gene expression that cause cells to switch between an epithelial state (miR-200 high, ZEB low) and a mesenchymal state (miR-200 low, ZEB high). By virtue of its potency, the miR-200-ZEB loop functions widely in controlling cell invasiveness, stemness, and tumour metastasis in many cancers.

We sought to determine whether there were any additional strong targets of miR-200 that were especially relevant to cancer progression. To accomplish this, we calculated microRNA-mRNA correlations across clinical cancer and EMT data sets, merged these with biochemical data of genome-wide miR-200 binding sites (generated by Argonaute HITS-CLIP) and generated a ranked list of strong, cancer-related miR-200 targets.

Publications with Impact



Gregory laboratory, from left: Caroline Phillips, Suraya Roslan, Philip Gregory, Victoria Arnet and Daniel Neumann.



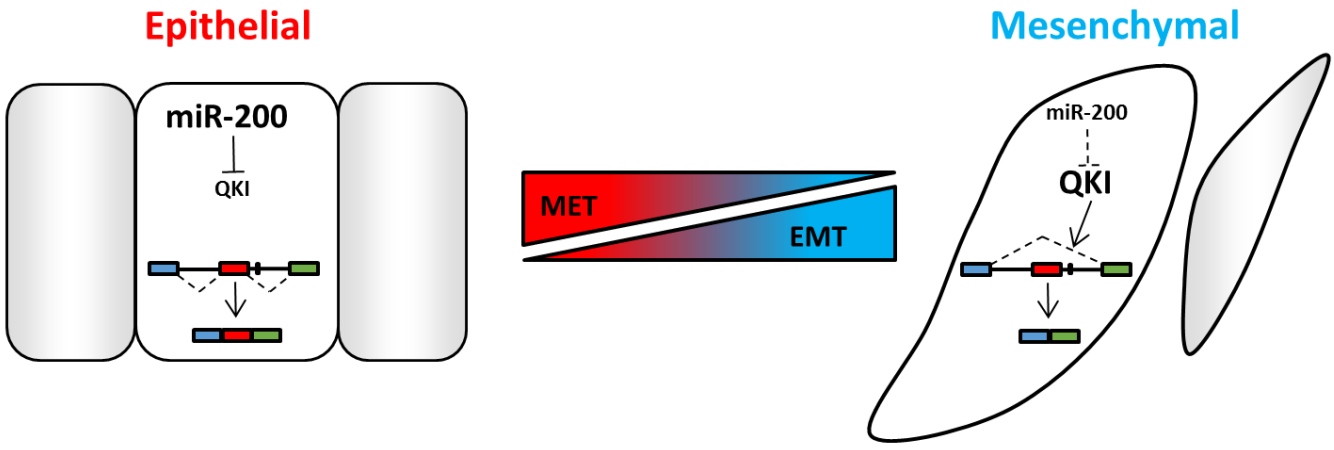
Goodall laboratory, from left: John Toubia, Kate Dredge, Andrew Bert, Katherine Pillman and Greg Goodall.

After ZEB1, the second highest ranked gene was the RNA-binding protein QKI, which had not been described to be a target of miR-200. Intriguingly, we had recently shown that QKI could regulate circRNA production during EMT (Conn *et al.*, 2015 *Cell*), however its functional consequences in EMT were unclear.

By deep transcriptomic sequencing, we show that miR-200c and another epithelial-enriched miRNA, miR-375, exert widespread control of alternative splicing during EMT through their strong suppression of QKI. We generated a global interaction map of QKI binding which demonstrated that QKI directly bound to and regulated hundreds of alternative splicing events during EMT. Functionally, QKI exerted pleiotropic effects in mesenchymal cells, including potentiating cell migration and invasion and restraining tumour growth, and did so without appreciably affecting mRNA levels. These findings demonstrated the existence of a miR-200/miR-375/QKI axis that impacts cancer-associated EMT through widespread control of alternative splicing.

As a final twist, we found that QKI predominantly regulated the alternative splicing of genes associated with the actin cytoskeleton, some of which were previously shown to be direct miR-200 targets. We demonstrated that several of these genes (MPRIP, NIN and MYOF) are directly targeted both by QKI and miR-200, and that members of whole actin gene networks are regulated by either QKI or miR-200. Together, these findings reveal coordinated control of alternative splicing and mRNA abundance during EMT. Given the important roles of miR-200, miR-375 and QKI in cell differentiation, we propose this pathway may define transcript selection in a broad range of biological contexts.

Phillip Gregory and Greg Goodall
Centre for Cancer Biology
SA Pathology and University of South Australia



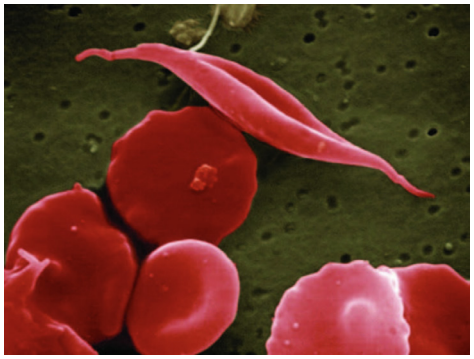
miR-200 orchestrates dynamic changes in alternative splicing during EMT through suppression of QKI.

Publications with Impact

CRISPR Gene Editing is a Big Deal but What Will Be the First Therapeutic Applications?

Martyn GE, Wienert B, Yang L, Shah M, Norton LJ, Burdach J, Kurita R, Nakamura Y, Pearson RCM, Funnell APW, Quinlan KGR, Crossley M*. Natural regulatory mutations elevate the fetal globin gene via disruption of BCL11A or ZBTB7A binding. *Nat Genet* 2018;50(4):498-503.
***Corresponding author: m.crossley@unsw.edu.au**

One early use may be in treating blood disorders, like sickle cell anemia and beta thalassemia. These are among the most widespread genetic diseases known, and the burden in both human suffering and lifetime health care costs is significant.



Normal red blood cells and a cell that has adopted a sickled shape due to the presence of a mutant beta globin protein.

Sickle cell anemia was described by Linus Pauling as the first 'molecular disease'. Nevertheless, despite the fact that we've understood the genetic defect for decades, progress in combatting the disorder by gene replacement therapy has been slow. Put simply, it has been difficult to get replacement globin genes into enough stem cells and to get the required level of sustained globin expression in the face of epigenetic silencing of the viral vectors.

The idea of correcting the causative mutation has been suggested and there have even been papers from researchers in China attempting to correct globin genes in human embryos. But the complexity of the locus (the number of duplicated globin genes) and the low rates of gene correction by homology directed repair in stem cells means that other options are being explored.

Back in the 1980s, Francis Collins, who later led the public effort to sequence the human genome, investigated an individual who had a mutation in the fetal globin gene promoter that upregulated that gene. The individual expressed enough fetal globin to compensate for their defective adult beta globin gene. Several other similar individuals have been discovered with mutations disrupting key repressive elements in their fetal globin gene promoters.

Accordingly, one therapeutic strategy is to mimic these naturally occurring mutations and boost fetal globin expression using CRISPR gene editing. The key point is that one does not necessarily require homology directed repair because a short deletion in the repressor binding site will work. One just needs a single guide RNA and a single cut.

One problem, however, was that despite more than 30 years of work, no one understood which transcription factors bound the key motifs in the fetal globin promoter. In other words, no one knew the molecular mechanism behind the repression. In the absence of this knowledge, there was understandable caution surrounding tinkering with the fetal globin promoters.

Since we have experience in studying transcription factors and gene repression, we turned our attention to searching for the relevant repressors that bound the key elements. Using a simple candidate gene strategy, we identified ZBTB7A (LRF) and BCL11A as key repressors that bound and shut down fetal globin expression. Our discovery of ZBTB7A initiated a project that was published in *Science* in 2016 and established ZBTB7A as a critical repressor, and our recent paper in *Nature Genetics* showed how both proteins bind the promoter directly and silence fetal globin expression.

The stage is now set for using CRISPR gene editing to disrupt these or other elements in blood stem cells to reactivate the fetal globin gene and, hopefully, treat sickle cell and related blood disorders.

Merlin Crossley
University of New South Wales

Members of Merlin Crossley's lab, from left: Cath Lim, Gabbie Martyn, Jasmine Yik, Beeke Wienert, Lana Ly, Kate Quinlan, Merlin Crossley, Dixie Papast, Manan Shah, Beth Stout, Lu Yang and Alex Knights.

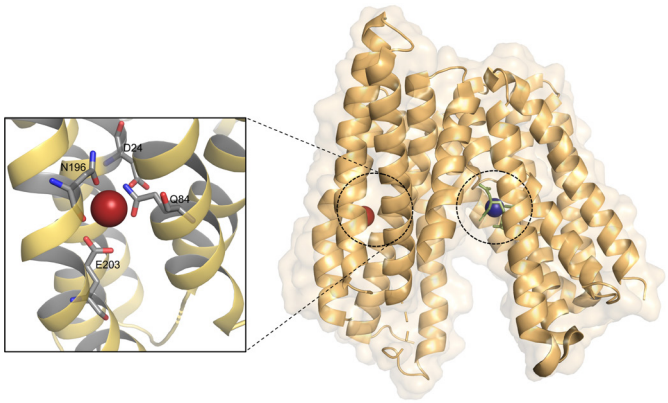
Publications with Impact

Calcium Activates Metal-efflux Activity of the Ferroportin Transporter Family

Deshpande CN*, Ruwe TA, Shawki A, Xin V, Vieth KR, Valore EV, Qiao B, Ganz T, Nemeth E, Mackenzie B, Jormakka M*. Calcium is an essential cofactor for metal efflux by the ferroportin transporter family. *Nat Commun* 2018;9:3075.
***Corresponding authors: m.jormakka@centenary.org.au, chandrika.deshpande@sydney.edu.au**

Iron is essential for almost all living organisms, including all mammals, due to its involvement in a number of metabolic and catalytic processes. In humans, both iron deficiency and overload can account for some of the most common diseases, such as iron-restricted anaemia and haemochromatoses. Ferroportin (Fpn) is the only known exporter of cellular iron, transporting dietary and recycled iron into the blood plasma. As such, Fpn activity plays a central role in human iron homeostasis on both systemic and cellular levels. The homeostatic role of Fpn has been extensively characterised. However, the lack of structural and functional information has impeded our understanding at a molecular level, and thus, has prevented effective pharmacological targeting of this system. A major step forward in this quest was the recent crystal structures of a bacterial Fpn orthologue (*Bdellovibrio bacteriovorous*; BbFpn) which ascertained Fpn as a major facilitator superfamily type fold, comprising 12 transmembrane helices organised into N- and C-terminal domains. Although the BbFpn structure provided detailed insights into this protein family, the substrate binding site, ion coupling and the molecular mechanism underlying alternating-access transport remained inconclusive. In collaboration with researchers from the University of Cincinnati College of Medicine and David Geffen School of Medicine at UCLA, we explored ion coupling mechanisms in Fpn and identified the substrate site using biophysical analyses, functional assays and site-directed mutagenesis.

Our transport studies in two heterologous expression systems (*Xenopus* oocytes and HEK293T cells), as well as binding studies using isothermal titration calorimetry, demonstrate that Ca^{2+} is required for human Fpn transport activity. However, while iron efflux is stimulated by extracellular Ca^{2+} in the physiological range, transport of Ca^{2+} does not occur. To rationalise this, we determined the crystal structure of a Ca^{2+}-bound BbFpn and established that Ca^{2+} is an essential cofactor in facilitating a conformational change critical to substrate transport. This observation illustrates a calcium-dependent regulatory function for Fpn transport activity. As such, the transport activity of Fpn could be limited in conditions of hypocalcemia, which is characterised by low ionised calcium levels in blood plasma (ie, $[iCa^{2+}] < 1.0$ mM), common in patients with primary hypoparathyroidism, chronic kidney disease and hypomagnesemia.



Overall structure of the Ca^{2+}-bound inward facing BbFpn and close up view of the Ca^{2+} site. The Ca^{2+} ion (red) and coordinating residues in grey are shown in ball-and-stick. Ni (blue) and EDTA (green) molecule shown in ball-and-stick occupy the putative substrate binding site located in the C-terminal domain.

In a serendipitous discovery, the Ca^{2+}-bound BbFpn structure also revealed a substrate pocket occupied by a divalent transition metal complexed with a chelator. A clear non-protein electron density in this pocket was unambiguously assigned to a Ni-EDTA complex carried through from the protein purification procedure. Although EDTA is not a physiologically relevant molecule, the presence of a chelator raises the possibility for a more complex transport mechanism for the Fpn proteins, whereby the metal is transported in complex with an anion or a poly-carboxylate metabolite.

Findings from this study advance our understanding of mechanisms relating to iron efflux by Fpn and may facilitate development of novel and more effective strategies for Fpn-directed therapeutics.

The team of authors from the Centenary Institute involved in this study. From left: Vicky Xin, Chandrika Deshpande and Mika Jormakka.

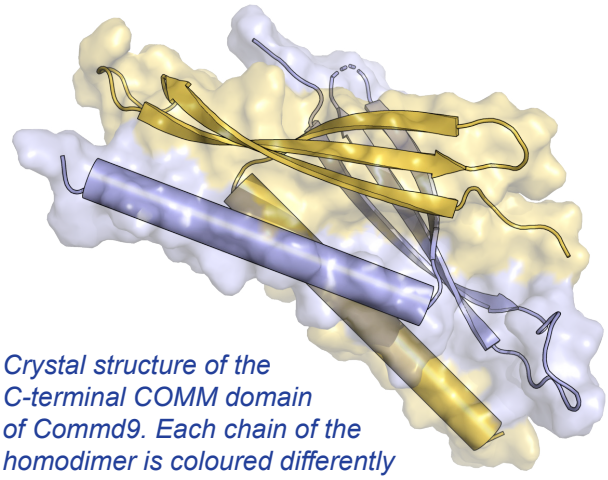
Chandrika Deshpande and Mika Jormakka
University of Sydney

Publications with Impact

First Structural Insights into the Commander Complex

Healy MD, Hospenthal MK, Hall RJ, Chandra M, Chilton M, Tillu V, Chen KE, Celligoi DJ, McDonald FJ, Cullen PJ, Lott JS, Collins BM*, Ghai R*. Structural insights into the architecture and membrane interactions of the conserved COMMD proteins. *eLife* 2018;7:e35898.
***Corresponding authors: Rajesh Ghai: r.ghai@uq.edu.au, b.collins@imb.uq.edu.au**

The COMMD proteins are a conserved family of proteins with a central role in intracellular membrane trafficking. Members of this family are known to form higher order oligomers that are in turn incorporated into the larger 'commander' complex, which localises to the early endosomal membrane to mediate the transport of several key transmembrane receptors. Despite the apparent significance of this complex, its structure and mechanistic function remain to be elucidated. In our recent work, we provided a first glimpse into the mechanism of self-assembly of COMMD proteins, with a comprehensive analysis of the structural, biophysical and biochemical properties of a number of the key COMMD family members.



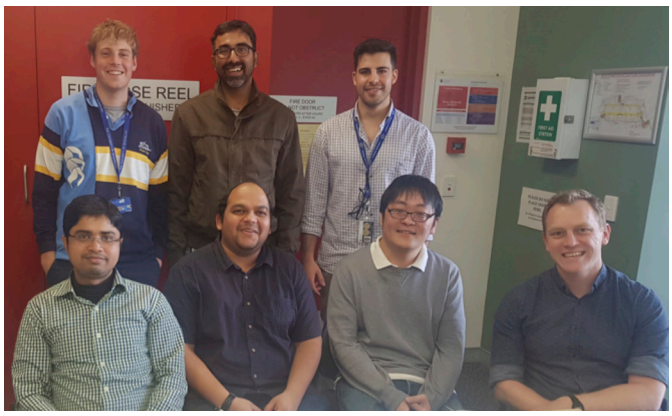
Crystal structure of the C-terminal COMM domain of Commd9. Each chain of the homodimer is coloured differently (PDB ID: 6BP6).

The human COMMD protein family contains ten members, with the hallmark features of a conserved C-terminal domain called the COMM domain, and a variable N-terminal domain proposed to ascribe unique functions to each of the members. These family members are known to interact with two relatively uncharacterised coiled-coil domain-containing (CCDC) proteins 22 and 93 to form the higher order CCC complex, which in turn assembles with a trimeric assembly called retriever to form the 'commander' complex. This complex is critical for mediating the trafficking of key transmembrane receptors including ATP7A and LDLR.

To begin to answer the many questions that surround the COMMD protein family, the Collins and Ghai labs at the Institute for Molecular Bioscience, University of Queensland, and the lab of Shaun Lott at the University of Auckland, teamed up to solve the crystal structures of both the N-terminal and C-terminal domains of Commd9. Interestingly, these structures revealed that C-terminal COMM domain forms obligatory dimers, with approximately one third of the domain's surface area involved in a homodimeric interaction. This dimeric organisation was also confirmed using multiangle laser light scattering (MALLS) for the full-length protein as well as several other family members. The N-terminal domain of Commd9 was shown to possess an α-helical fold, that despite low sequence homology, is conserved in its structure for all COMMD family members.

After solving the crystal structures of the individual domains, we used SEC-SAXS to examine the full-length solution structures of Commd9, Commd1 and Commd7, revealing a conserved but flexible architecture where the structure of individual domains is maintained but there is some minor variability in their overall orientations.

From here we began to examine the biochemical properties of these proteins, given that high-throughput proteomics studies have revealed the existence of a large multisubunit assembly involving multiple COMMD proteins in heteromeric complexes. To investigate this, we used a coexpression method which revealed that the COMMD proteins form promiscuous heterodimers with one another through the C-terminal COMM domain. Further to this, we were able to reconstitute one particularly prominent complex of Commd5–Commd10, and using SEC-MALLS, we demonstrated that coexpression and purification of these proteins resulted in the formation of a tetrameric complex. Finally, to assess the incorporation of the COMMDs into the larger CCC complex, we used a combination of pull downs and BLiTz



Ghai and Collins lab members involved in the research. Back, from left: Michael Healy, Rajesh Ghai and Ryan Hall. Front, from left: Mintu Chandra, Vikas Tillu, Kevin Chen and Brett Collins.

methods. This allowed us to demonstrate and quantitate the direct molecular interactions between Commd9 and the coiled-coil proteins CCDC22 and 93.

Our work shows that the ability to self-assemble and form heteromeric complexes is a core property of the COMMD proteins. It provides a clear structural explanation for how homo- and heterodimers are formed by the different family members. This research begins to suggest mechanisms for how different domains could contribute to the formation of larger assemblies, how they associate with biological membranes, and how they become incorporated into the CCC and commander complexes through interactions with the CCDC proteins. As COMMD-containing complexes emerge as key regulators of cellular trafficking and signalling and transcription, the details of these molecular interactions and the systems that regulate them remain outstanding questions to be answered.

Michael Healy, Rajesh Ghai and Brett Collins
Institute for Molecular Bioscience,
University of Queensland

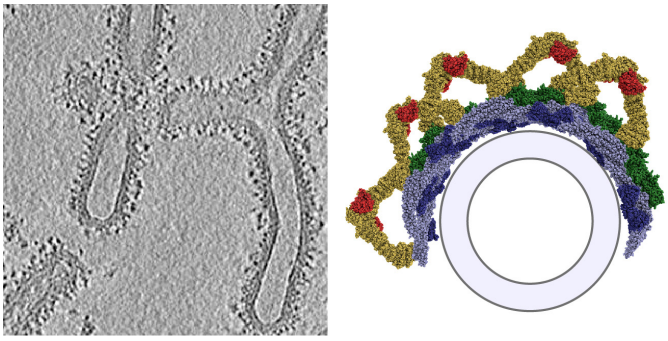
A Snapshot of the Retromer Coat on Membrane Tubules

Kovtun O, Leneva N, Bykov YS, Ariotti N, Teasdale RD, Schaffer M, Engel BD, Owen DJ*, Briggs JAG*, Collins BM*. Structure of the membrane-assembled retromer coat by cryo-electron tomography. *Nature* 2018;561(7724):561-564.
***Corresponding authors: b.collins@imb.uq.edu.au, djo30@cam.ac.uk, jbriggs@mrc-lmb.cam.ac.uk**

Eukaryotic cells transport proteins and lipids between different compartments using protein-coated vesicles and tubules. The retromer complex is conserved in all eukaryotes and is required for generating cargo-selective tubulovesicular carriers from endosomal membranes to control the cellular localisation and homeostasis of hundreds of transmembrane proteins. In humans, its disruption is associated with major neurodegenerative disorders including Parkinson's disease. The architecture of the membrane-associated retromer coat has been visualised using cryo-electron microscopy (cryoEM), in a major collaboration between the University of Queensland Institute for Molecular Bioscience, the Medical Research Council Laboratory for Molecular Biology (UK), the University of Cambridge Institute for Medical Research (UK) and Max Planck Institute (Germany).

Retromer is a heterotrimeric protein complex consisting of Vps35-Vps26-Vps29 subunits, which forms complexes associated with different cellular trafficking routes by interacting with sorting nexin (SNX) proteins that contain phox homology (PX) and bin/amphiphysin/rvs (BAR) domains (Vps5 and Vps17 in yeast), or with SNX proteins lacking BAR domains such as SNX3 or SNX27. BAR domains form antiparallel homo- and heterodimers that are able to sense and/or modulate membrane curvature. In work led by Natalya Leneva and Oleksiy Kovtun, the Vps35-Vps26-Vps35 retromer heterotrimers from *Chaetomium thermophilum* were co-assembled with recombinant homodimeric Vps5 to form coated membrane tubules *in vitro* and the resulting structure analysed by cryoEM. The pleomorphic nature of the resulting tubules rendered them inaccessible to common structural analysis approaches. State-of-the-art subtomogram averaging methods established in John Briggs' group then came into play. In this approach, a specimen is imaged in an electron microscope from different angles allowing its tomographic reconstruction, and the resulting tomogram is subdivided into smaller volumes called subtomograms. Multiple cycles of iterative alignment and averaging of the subtomograms reveal the repeating element of the heterogenous biological assembly presented in the specimen. This allowed us to discern the spatial positions of all elements of the retromer coat as well as their structures.

The tubules are coated by two separate protein layers. The inner layer is composed of Vps5 homodimers assembled in a pseudo-helical polymer on the membrane surface. The retromer complex itself then docks onto the surface of the Vps5 layer through the Vps26 subunit. 'Arches' of the Vps35-Vps26-Vps29 trimers then



Left: slice from a three-dimensional cryoEM tomogram of retromer-Vps5 coated tubules. Right: stylised model of the retromer coat (PDB ID: 6H7W).

assemble into a second exterior layer connected through Vps26 dimers at the base and Vps35 dimerisation at the tips. This results in an architecture where Vps29 is positioned at distal tips of the coat, and we speculate this is important for the binding of regulatory proteins such as TBC1d5 and Varp that are known to bind the Vps29 subunit. Notably, the coat itself is structurally heterogeneous, as revealed by the cryoEM tomograms, and this hints at a structural plasticity that is likely important for the dynamic assembly and disassembly of the tubules *in vivo*.

Next, Yury Bykov examined a dataset of cryo-electron tomograms of ion beam milled *Chlamydomonas reinhardtii* cells collected by Benjamin Engel and Miroslava Schaffer at the Max Planck Institute for protein-coated tubular membranes. In some tubule coats, arch-like features could be directly observed in the tomograms, and the structure of these coats *in situ* revealed a retromer assembly essentially identical to that determined *in vitro*.

Overall, these results provide significant new insights into how the retromer coat in particular, and membrane tubules more generally, can be assembled spontaneously by protein–protein and protein–membrane interactions. It will now be interesting to see how cargo molecules can be incorporated into these structures, and if the same principles of retromer self-assembly are conserved in humans.

Lead authors Oleksiy Kovtun and Natalya Leneva.

Brett Collins
Institute for Molecular Bioscience, University of Queensland

PHASEFOCUS LIVECYTE

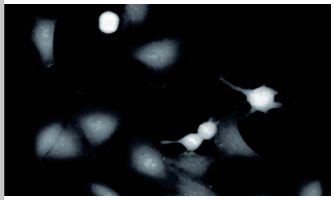
Label-free, high contrast imaging & analysis

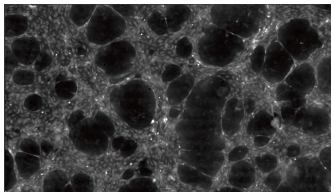
Measure the morphology and motion of every cell

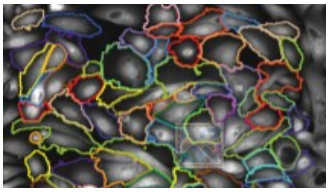
KEY BENEFITS:

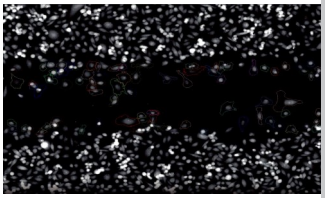
- **The Livecyte is a unique system for live cell analysis**, that enables the study of phenotypic and kinetic behaviour of individual cells and cell populations over hours or days.
- **The advanced Ptychographic imaging technology**, generates high contrast, high fidelity images and quantitative data without the need for cell labelling.
- **Large fields of view** with high resolution ensures highly motile cells are not "lost" during long time course measurements.
- Low power laser dramatically **reduces phototoxicity**, especially useful for sensitive primary cells and stem cells.
- Fully integrated Phase and Fluorescence workflows.

CONTACT US FOR A QUOTE


Mitosis and mitotic index


Angiogenesis assays

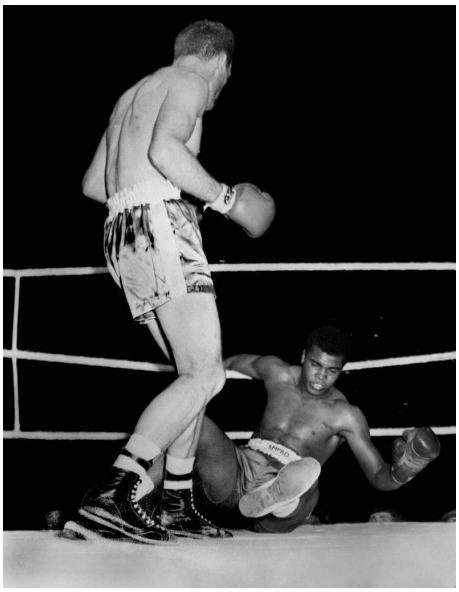

Cell proliferation & motility


Wound healing assay

ATA Scientific Pty Ltd | enquiries@atascientific.com.au | www.atascientific.com.au | +61 2 9541 3500

Saved by the Bell

Terry Mulhern, Department of Biochemistry and Molecular Biology, University of Melbourne



In June 1963, a young Muhammad Ali – still known at that time as Cassius Clay – had the first of his two bouts against British heavyweight Henry Cooper. This fight is one of the few times an opponent knocked Ali down. Seconds before the end of the fourth round, Cooper landed a massive left hook that dropped Ali to the mat. Although dazed, Ali's instincts kicked in and he bounced straight back up as the bell sounded. However, for the next few minutes he didn't even know he was in London. Ali's trainer, Angelo Dundee, recognised this and stalled for time. He showed the referee that one of Ali's gloves was torn; and getting a replacement gave Ali enough time to recover his senses. When the next round eventually started, Ali came out and, against all odds, won the fight.

Why does Ali's experience strike a chord with me? Well, it demonstrates how you can bounce back from adversity and how important it is to have 'someone in your corner' to look out for you and give you time and space to recover. Eight years ago, I had a mental health crisis, but I was lucky enough to have someone in my corner.

All through 2010, I was under enormous pressure – I had two grants, but both were due to expire at the end of the year. My publication output was poor and I felt myself hurtling towards a precipice. In response, I was working longer hours than ever, and this was affecting my personal life. In September of that year, my son was born – which was wonderful, but it had a downside. Essentially, I didn't sleep for the next eleven months.

Although I can joke about it now, severe lack of sleep compounded the anxiety I was feeling. My decision-making skills slipped away. I withdrew into myself. I no longer found joy in my pastimes. I verbally lashed out at those closest to me. It became a struggle just to get out of bed in the morning. I'm embarrassed to admit that I didn't realise that I had depression. With hindsight, depression has always been there in my family – just no one ever talked about it. These days, my siblings and I are much more open about our feelings and the treatments we have explored.

In my time at the University of Melbourne, I have worked under five Heads of Department, each with different strengths. However, I consider myself very lucky to have had Professor Paul Gleeson as my Head at that time. He is a good listener and he understands people. Through the performance review process, we worked out that a Teaching and Research role was not a good fit for me. I was achieving excellence in the classroom, but despite enormous commitment and effort, I just wasn't good at running a lab. Together, we came up with a plan. We agreed that if I hadn't turned things around by the end of 2012, we would explore the opportunity of the new Teaching Specialist role. Three key members of our teaching staff were about to retire, including two who for decades had carried the load in our very large second year classes. I felt I was the right person to take on that role. In that decision, I found purpose.

I don't know what would have happened if I *did* get a grant at the end of 2012. It was possible – I published more in that year than any other in my career. October rolled around and I held my breath. When grants were announced, the relief of *not* getting one was palpable. In the new year, I successfully applied to change work categories, but it wasn't smooth sailing, yet. There were difficult conversations with my research assistant and postdoc; and there was a PhD student who still needed to be shepherded to completion. In mid-2013, I walked out of the lab for the last time. It would be great to say that 'I never looked back', but that would be lying. In that moment, the self-esteem that I had painstakingly rebuilt with the help of my psychologist, washed away like a child's sandcastle. For a long time, I wrestled with the demon of professional 'failure'. Fortuitously, I had a lot of long service leave owing, so with Paul's blessing, I went part-time for a year. Rather than withdrawing into myself again, I found new hobbies and interests. Also, I didn't just become a Teaching Specialist overnight. I had prepared myself for the transition by completing the Melbourne Teaching Certificate. Bit by bit, I came to terms with the changes and developed a new self-image as 'teacher'. In 2014, we appointed another Teaching Specialist, Dr Heather Verkade. Having a like-minded colleague to bounce ideas off was a godsend. Together and separately, there have been numerous Learning and Teaching Initiative grants and education research papers. By the time you read this, our PhD student, Allen

Espinosa, will have submitted his thesis 'Confronting misconceptions in large Biochemistry and Molecular Biology classes through active learning strategies'. Earlier this year, I received the David White Award for Teaching Excellence – our university's highest accolade for teaching in science and medicine. I'm happier, healthier and my life is more balanced.

I benefited from having a manager who could help me talk through my problems, reflect on my strengths and weaknesses and give me an opportunity to bounce back. As my career progresses, I hope I can be that person in someone's corner.

We all need to recognise the warning signs of depression. Do a self-check on the beyondblue website. You can also talk to you GP. If you are thinking about suicide – there is help available, 24 hours a day. Call Lifeline Australia on 13 11 14 to talk to someone trained to help in a crisis.

Life After Grant/Fellowship Rejection

Tatiana Soares da Costa, La Trobe Institute for Molecular Science

You have just found out after waiting for months that you didn't get the grant/fellowship you applied for. So, was it all just a waste of time? Here are some tips on how to keep motivated after a set back and make yourself more competitive for the next round!

1. Give yourself some time

In the days and weeks after you get a rejection, all you can think about is the amount of time you spent putting the application together, the sleepless nights, the stress and the number of people who gave up their time to read your application just to get a rejection. You need time to get over the disappointment. Why did this happen to me? Unfortunately, you are not alone and there will be plenty of people you can talk to about your frustrations.

2. Check your competitors

I always find it helpful checking who was successful in getting the grants/fellowships I applied for. Check what their field of research code (FoR) is to give you an idea of what areas are being funded. At this day and age, a lot of researchers have public CVs so you can check what is setting these researchers apart from others. You can also ask your Research Office for successful applications. It always makes me feel better to know that I missed out because there were simply better applicants with more impressive track records than me. If you are applying for the same scheme again, at least you will know what the bar is. Work hard in the months leading up to your next application by building your track record. It is also important to work on 'selling yourself' and highlighting your strengths. Why should you be funded to carry out this particular work?

3. Address the reviewers' comments

Once you have the motivation to look at your unsuccessful application again, read through the reviewers' comments thoroughly. Can you change the proposal to make your ideas clearer? Are there any experiments you can do to strengthen your hypothesis and improve feasibility? Was there a particular aim that raised a lot of concerns that should be revised? Do you have the best team to carry out the proposed work? Why does this project need to be funded now? There is no point in resubmitting an application if you have not addressed all the issues raised. Your revised version should be a significant improvement from the rejected application. This still will not guarantee that you will be successful but at least you are putting your best foot forward. If you do not receive reviewers' comments, contact the funding agency and ask if they can provide feedback on your application.

4. Get mentors outside your area of expertise

Most of us have mentors in our niche areas. But I always find it useful getting feedback from researchers on slightly different fields. For most grant/fellowship applications, your application (and especially the first page) should be intelligible to a wide scientific audience. It is important to have a good understanding of the nature of the panel assessing your grant/fellowship so your ideas are pitched to the right audience. Don't just assume that the people reading your grant will be experts in your area. I would rather get harsh comments while I am drafting an application than to be rejected after months of work.

5. Strategise your next move

Do you want to resubmit your application in the next round? If so, you will only have a couple of months to polish it up before your institution's deadline. Would your time be better spent building your track record and collecting data? Make sure you read the guidelines for the scheme as they may change from year to year. Let your Research Office know about your plans so they can support you in the best way they can.

As a researcher, you do need to become resilient with rejections. Just think of it as a way to improve your ideas and build your track record. Good luck with your next application!

Tatiana can be contacted via Twitter (@Tatiana_Biochem), LinkedIn (Dr Tatiana Soares da Costa), Instagram (tatiana_soares_da_costa) and email (T.SoaresdaCosta@latrobe.edu.au).

The ASBMB Education Feature is coordinated by Susan Rowland (s.rowland1@uq.edu.au) and Nirma Samarawickrema (nirma.samarawickrema@monash.edu). We welcome your contributions!

Constructing Knowledge in Purpose-built Teaching Spaces: an Approach to Active Learning in Biochemistry and Molecular Biology

Daniel Czech, School of Biomedical Sciences, Monash University

Constructivism is a philosophy of learning in which students actively build their own knowledge and understanding (1), as opposed to the passive didactic transfer of information. In many ways, this student-centred approach has always had a strong presence in biochemistry and molecular biology education through practical labs. While these practicals are usually the most popular mode of learning from the student's perspective, many practicals retain semi-didactic elements, such as recipe-based instruction. In our Introduction to Bioinformatics unit, we have begun to incorporate aspects of active learning in order to shift towards a student-centred pedagogy. This shift has in large part been driven by new purposefully designed teaching spaces at Monash University which emphasise and facilitate student interaction and collaboration.

Fig. 1. *Exploring structural biology with PyMOL software in The Round.*

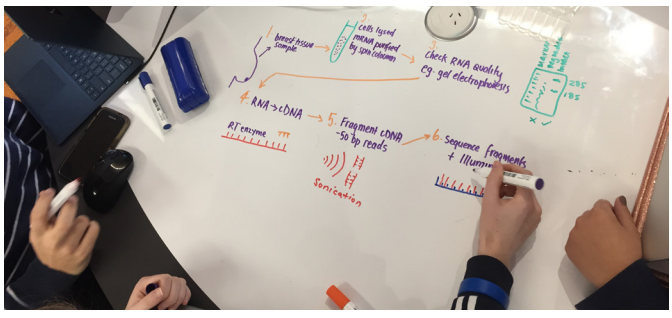


Fig. 2. *Whiteboard tables facilitating peer collaboration and active learning.*

Fig. 3A. *Piecing together sequencing reads in the 'RNA-seq Puzzle'.*

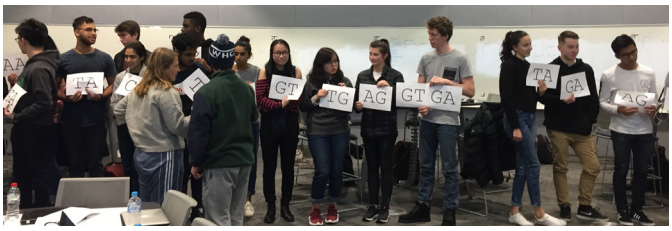


Fig. 3B. *Embodying DNA sequence in the 'Reading Frame Game'.*

In complete juxtaposition to traditional tiered lecture theatres that distance students from lecturers and place emphasis squarely on the academic delivering content, The Round is a student-centred large-scale oval teaching space which positions groups of students around a central map table (**Fig. 1**). In this space, the lecturer acts as a facilitator of learning and has immediate access to all students in the space. Surrounding the entire circumference of the room are whiteboard walls for each table group which can be displayed to the entire class of 150 students at the press of a button. In this space, students work collaboratively and have opportunities to discuss their understanding with both peers and teachers. Students also use whiteboard tabletops to illustrate their understanding, which facilitates group discussion and allows teachers to identify misconceptions in a much deeper and more effective manner than traditional means such as lab reports or question sheets (**Fig. 2**). In conjunction with pre-class activities that enable students to explore content before class, and post-class activities which consolidate or extend learning after class, active learning spaces such as The Round offer an innovative and effective approach to learning and teaching.

Two examples of new activities designed to engage students in active learning are the 'RNA-seq Puzzle' (**Fig. 3A**) and the 'Reading Frame Game' (**Fig. 3B**). These activities were intended to stimulate interaction and collaboration while problem solving, also allowing individuals to actively build understanding of relevant concepts in their own mind. As the present interventions remain an early foray into active learning in our teaching, it is anticipated that through new ideas, student feedback, and ongoing development and refinement, active learning will become a central pedagogy in our unit, and commonplace in higher education.

Reference

1. Piaget J. *Psychology and Epistemology: Towards a Theory of Knowledge.* 1971. Grossman, New York.

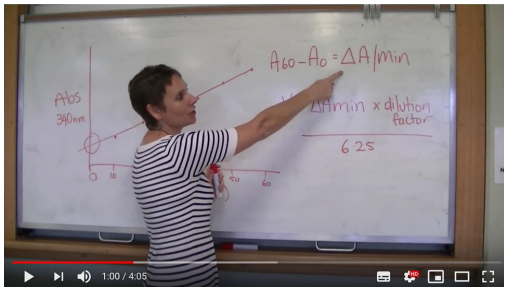
Daniel is an Assistant Lecturer in the School of Biomedical Sciences at Monash University.

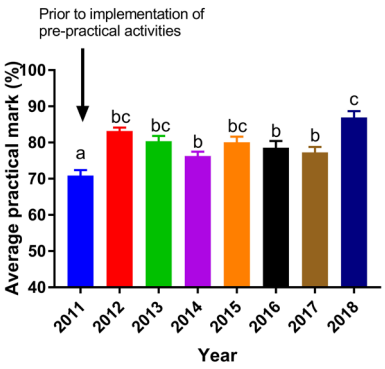
Making the Most out of the Precious Face-to-Face in Biochemistry Practicals

Beth Loveys and Chris Ford,

School of Agriculture, Food and Wine, University of Adelaide

We all know that the time we spend face-to-face with students is invaluable for their learning and, as teachers, we are always searching for ways to value-add to face-to-face sessions. One approach that has worked for me in a second year biochemistry course is 'flipping the laboratory'. Fortunately, this doesn't mean turning the lab upside down! Instead, I prime the students with relevant information and methods before they come to class so that the in-class time can be used more effectively. Central to flipped classroom pedagogy is the idea that pre-class learning should introduce foundational concepts and focus on the lower 'remember' and 'understand' levels of Blooms Revised Taxonomy.





Making effective use of class time linking theory to practice. Improvements have been seen in practical grades since the introduction of pre-class activities.

Biochemistry students working in the laboratory.

Animal and Plant Biochemistry II has a reputation for being content-heavy and difficult for many students. Over the last eight years, my colleague, Associate Professor Chris Ford, and I have initiated many changes to the course aimed at reducing the 'fear factor' and making biochemistry more accessible and relevant.

One of these changes has been the implementation of online, pre-practical activities. All teachers hope their students will arrive in the laboratory prepared for the class; the reality, of course, is that students are often not prepared and are therefore disengaged and confused. Many students do not read the relevant material in their laboratory manual – this makes it difficult for them to form the link between theory and application. To address this problem, I developed interactive, online pre-class activities, thus 'flipping the laboratory' to encourage students to prepare.

Using this approach, I have developed pre-practical online activities for my students on many topics: enzyme kinetics, photosynthetic reactions and carbohydrate metabolism. The pre-practical activities provide students with examples and interactive activities including video demonstrations of relevant lab techniques. Check-point multiple choice questions with unlimited attempts help

students gain confidence. Understanding foundational concepts is critical for deeper learning. Once students are engaged in a course, it is easier to maintain their interest in difficult and challenging content. I have found that in class, we now have more time for solidifying the link between theory and practice.

Students have been surveyed each year since these pre-class activities were implemented and feedback is extremely positive: 85% of students felt they were better prepared for practical classes after completing the activities and 90% felt the check-point questions clarified areas of confusion. The average mark for the practical component of the course increased from 70% in 2011 (pre-flip) to over 85% in 2018 (see figure).

As teachers, we hope to inspire students to discover knowledge for themselves. Providing an environment where they feel safe to try techniques that help them understand the theory presented in lectures is a great start! We are hopeful that, as a consequence, our students come to see that learning is a process, not simply a means to an end.

After completing two postdoctoral positions in the UK and ACT, Dr Beth Loveys took up her position as a teaching focused academic in the School of Agriculture, Food and Wine at the University of Adelaide in 2011. Beth teaches across a diverse range of courses including Animal and Plant Biochemistry, Foundations in Plant Science, Viticultural Science, Introductory Wine Making, and Plant Production and Global Climate Change. In 2015, Beth was awarded an OLT citation for Outstanding Contribution to Student Learning, and in 2018, was awarded the Australian Society of Plant Scientists Education Award.

Associate Professor Chris Ford is currently Interim Head of School in the School of Agriculture Food and Wine. Prior to this, Chris was the Head of Learning and Teaching, and also has an active research laboratory examining the biochemistry of flavour compounds in wine.

ASBMB Education Feature

Interview with an Education Focused Academic

Tracey Kuit, School of Biological Sciences, University of Wollongong, interviews Rebecca LeBard

Dr Rebecca LeBard BSc (Hons) PhD GCHE, School of Biotechnology and Biomolecular Sciences, University of New South Wales

National Committees and Awards

- Vice President Communications, Australian Society of Microbiology (2017–present)
- Australian University Teaching Award, Citation for Contributions to Student Learning (2016)
- VC Award for Teaching Excellence, University of NSW (2015)

Rebecca is an education focused academic with over ten years' experience in higher education. Rebecca's research and scholarship in education focuses on the importance of mathematics to STEM students and intervention strategies to enhance student success in biology. Rebecca is also a molecular microbiologist investigating how plasmid DNA is inherited in Archaea, and how molecular markers can be used to trace sources of water pollution, and the production of secondary metabolites.

What led you into science then molecular biology?

I remember my mother describing her fascinating work as a lab technician at Lincoln University in New Zealand. She exposed me to the idea that there were interesting jobs out there, which particularly stood out at a time when there weren't that many jobs for women. Around this time, my father employed a female CFO. My father recalls a colleague rushing in, worried he had not realised that he was employing a woman! Whilst in school, I found science, and laboratory work in particular, fascinating. I was lucky enough to have two female science teachers who had both been involved in biological research at university. One teacher had a PhD and they both shared stories of their research, building upon my interest in science.

Can you describe a standout educational moment in your science training?

In terms of my undergraduate education, I was always fascinated by molecular biology. I remember being captivated by drawing and understanding the processes of transcription and translation. For me, it was the exposure to laboratory work that truly engaged me – visualising microorganisms on agar plates, working with *Drosophila* experiments in genetics and mixing all sorts of reagents in biochemistry.

What keeps you passionate about educating?

Interacting with students! Students today seem more confident and interact more in lecture classes. My role is to facilitate their learning, which is easier when they are actively involved in the learning journey. I partner with students in curriculum design and the design of assessment criteria and methods of feedback. It is really important for me to understand what students enjoy and what supports their learning. Additionally, in science there are always interesting things happening and appearing in popular media. I enjoy working with my students to seek out the real science hidden behind a catchy title.

What changes or big trends do you see in molecular biology teaching?

The enhancement to information technology available for education has been one of the biggest changes to how we teach. As an example, I have created virtual laboratories to support student learning on the regulation of gene expression in bacteria. Traditionally, laboratory work, although fascinating and very engaging, could be overwhelming for some students. During laboratory classes, students are trying to learn and connect theoretical content whilst developing their hands-on practical and data interpretation skills. Unfortunately, some students can be so focused on the practical work that they miss the reasoning behind the methodology. Virtual laboratories allow the student to complete the lab before and after the hands-on class, providing time to reflect and be more thoughtful about their laboratory learning.

Context-based Undergraduate Biochemistry for Health Science (CUBHS) Instruction: Bridging the Foundational–Clinical Gap

Katherine Fernandez, School of Chemistry and Department of Biochemistry and Molecular Biology, Monash University

There is an ongoing debate on the relevance of biochemistry in the health sciences (namely: nursing, pharmacy, psychology and medical laboratory science) and medical education. The debate stems from the fact that much of the teaching of foundational sciences (such as biochemistry) has been focused on the didactic delivery of hard-core theories and concepts with very little emphasis on clinical applications. This has resulted in a foundational–clinical gap between biochemistry and the health sciences. In turn, it has led to the negative perceptions of biochemistry among health science and medical undergraduates and their educators (1,2).

However, the inclusion of biochemistry into health science and medical curricula remains valid. As Gwee *et al.* (3) assert, since clinical practice of health professionals is based on scientific knowledge, biochemistry remains indispensable to their curricula. To address this foundational–clinical gap, the consensus is for biochemistry to be taught in the context of clinical practice (4,5).

Context-based learning: background

Mazzeo defines context-based teaching and learning as one that 'seamlessly link the learning of fundamental knowledge to concrete applications in a specific context that is of interest to the student' (6). This strategy has been adopted in the undergraduate and medical education in recent years (7,8). It fulfills the following suggestions of the Association of Faculties of Medicine in Canada (2009) that biochemistry must be: **1.** learnt in relevant and immediate clinical contexts for future practice and **2.** consciously linked to future utility.

From left: Chris Thompson, Kathy Fernandez, Tina Overton and Nirma Samarawickrema.

Context-based Undergraduate Biochemistry for Health Sciences (CUBHS)

To reinforce connections between biochemistry and clinical knowledge of future health professionals, CUBHS instructional resources will be developed and utilised in the classrooms.

CUBHS, my research project, under the supervision of Professor Tina Overton, Dr Chris Thompson and Dr Nirma Samarawickrema, aims to determine the effects of researcher-developed CUBHS instructional resources on student perception of relevance, achievement and attitude. Expertise of educators and clinical practitioners will be used as basis for the appropriate clinical contexts of specific biochemistry topics.

Ultimately, the goal of CUBHS instruction is to attempt to bridge the foundational–clinical gap between biochemistry and the health sciences.

References

1. Scalise K, Claesgens J, Wilson M, Stacy A. *Chem Educ Res Pract* 2006:7(3);170–184.
2. Afshar A, Han Z. *Med Sci Educ* 2014: 24;339–341.
3. Gwee C, Samarasekera D, Chay-Hoon T. *Med Sci Educ* 2010:20(3).
4. Bandierra G, Boucher A, Neville A, Kuper A, Hodges B. *Medical Teacher* 2013:35(5).
5. Chaney S, Pelley J, Seifert W. *Med Sci Educ* 2010:20(3);280–283.
6. Mazzeo C (2008) *Supporting student success at California community colleges.* Career Ladders Project for California Community Colleges.
7. Overton T, Byers B, Seer M (2009) Context and problem-based learning. *In: Eilks I, Byers B (eds), Innovative Methods of Teaching and Learning Chemistry in Higher Education.* Royal Society of Chemistry, London.
8. Kalchik S, Oertle M (2010) *The theory and application of contextualised teaching and learning in relation to programs of study and career pathways.* Office of Community College Research and Leadership-Transition Highlights Issue 2.

Katherine Fernandez is a PhD student in the School of Chemistry and Department of Biochemistry and Molecular Biology, Monash University.

SDS Page: Short Discussions for Students Page

How to Write for a Non-academic Audience

Tatiana Soares da Costa, La Trobe Institute for Molecular Science

I recently attended ComBio2018 in Sydney, where fantastic career development workshops for PhD students and ECRs were held. A resonating message from these sessions was that we should be communicating our research more and more to the general public. As scientists, we often get to communicate our findings by publishing research articles and books or speaking at conferences to a specialised audience. Yes, some journals/books/conferences are broader than others but typically you are still communicating to fellow scientists in your research communities. In the August 2017 issue of the magazine, we discussed how to get your elevator pitch ready: 'Selling your Research in Less than 3 Minutes'. But how do you write for a non-academic audience? This may feel scary and extremely difficult to a lot of us. Here, I have put together some tips on how to structure your piece to get your point across clearly with maximum impact.

1. Title matters

This is just as true for non-academic writing as it is for journal articles and grant applications. Titles need to be catchy and set the tone for the rest of the piece. This often dictates whether someone will read your article or not. Titles should also contain the right keywords to appeal to your targeted audience and let the readers know what the article is about. Buzzwords are commonly used to capture attention but make sure you deliver what you have promised. *Don't raise the expectation unless you can deliver.*

2. Decide on content

Now that you have a catchy title and have got the attention of your reader, *you need to hold your audience!* Do you want to try to explain a complex scienctific idea or technique? Do you want to write an opinion piece on a timely issue? Do you want to suggest a policy change? Try to think of the key point you want to come across and develop ideas around it. Talk to the editor to get an idea of what they are after and run ideas past family members and friends.

3. Keep it to the point

Your piece should convey one message. No matter how lay you make the description of these concepts, you can lose readers who are forced to understand and piece together four or five concepts. Avoid jargon and use simple short sentences. Improve readability by using subheadings and bullet points. Use of figures to visually break up your article to make it look less imposing to read is always a good idea. They are also a great way to reinforce your message. As a researcher, we are used to formulating ideas based on evidence. When you are writing for a non-academic audience, the 'big picture' takes centre stage. While you may have discovered something else interesting as a part of your research, keep this idea for a follow-up or different article.

4. Increase your visibility

Build your public profile through active engagement with your community. Keep your institutional webpages and LinkedIn profiles up-to-date, post on social media and get involved with outreach activities. Taxpayers are funding your research and the least you can do is let them know how you are using their money and how your research may benefit them in the future. If you want to learn more about the power of social media, check out our August 2018 SDS-PAGE article.

5. Practice, practice and practice

Translating detailed scientific knowledge into lay terms for the public to understand is a skill that takes some practice. Knowing which words or phrases are common knowledge and which ones are going to cause blank looks or confusion is the first thing to get down pat. While you would have a good understanding of the sheer number of proteins produced in the human body, some members of the public may only associate proteins with meat! So where can you get experience on non-academic writing? Try starting your own blog or social media page, volunteer to be a Wikipedia editor and submit pieces to magazines and newspaper such as *The Conversation* and *Lateral*. You are also welcome to submit articles to the *Australian Biochemist* by emailing editor@asbmb.org.au!

Tatiana can be contacted via Twitter (@Tatiana_Biochem), LinkedIn (Dr Tatiana Soares da Costa), Instagram (tatiana_soares_da_costa) and email (T.SoaresdaCosta@latrobe.edu.au).

Off the Beaten Track

Written by former researchers who have now established careers outside of research, Off the Beaten Track is intended to give the readers insights into the range of alternative careers available to them. Authors describe the paths they have taken to arrive at their present career and provide a detailed description of exactly what the job entails on a day-to-day basis.

Application of Scientific Skills in Frontline Biosecurity

Jessica Lye, Team Lead, Extension and Communication, cesar

I am one of those lucky people who has travelled many times for the sake of my work and the industries for which I work. I have stood on the ferrosols of Ulverstone, Northern Tasmania, watching the peels from harvested onion glisten in the morning sunshine against a cultivated, red Tasmanian hillside, and watched the sun set on that same day over trellises loaded with cucumber and bitter melon outside of Darwin. I have travelled on fishing boats around Punjinka, the tip of Australia, while on the hunt from an elusive leafmining insect, and travelled the wild and splendid landscape of Cape York Peninsula. I have visited the most productive and vibrant horticultural regions in Australia, from Coffs Harbour, to Hawkesbury, Bustleton, the Burdekin, Lindenow, Yarra Valley, Murray Bridge, Katherine and more, and driven 4000 km throughout the United States in search of knowledge that can only be gained outside of Australia.

Why? Because for the past five years I have worked in the field of exotic plant pest biosecurity, first for the vegetable grower Peak Industry Body, AUSVEG, and now as Team Lead, Extension and Communication, at **cesar**, a research consultancy specialising in wildlife conservation and developing sustainable pest management solutions in agriculture. It is work that has involved a mix of skill sets and activities, such as science communication, training, critical analysis, project design, industry engagement, performing risk assessments and cost-benefit analyses, reviewing literature, strategising research and development, and developing of pest eradication plans.

A large part of my work has involved representing the vegetable and potato industries on a special technical committee – the Consultative Committee on Emergency Plant Pests (the CCEPP). The CCEPP is formed as a part of our plant biosecurity emergency response system when we detect a new plant pest in the country. It assesses the potential to eradicate a pest based on its biology, the control tools we have on hand, and the resources needed. This is a role that allowed me to make good use my background in biology and scientific training. Another important part of my work has involved educating growers about our complex biosecurity system, how it works, and what to expect if there is a pest incursion, as well as delivering training in development of farm biosecurity plans.

Farm visit in Hawkesbury with Greater Sydney Local Land Services.

But, you may be thinking, what kind of career path leads into *plant pest biosecurity?* I work with people who come from all sorts of backgrounds, such as natural resource management, farming, environmental science, agricultural science, project management, policy development, economics and more. For my own part, I began with an interest in biology and a Bachelor of Science in Zoology and Genetics at Monash University. This was followed by Honours in plant biotechnology and a PhD working on the genetic basis of zinc ion transport using *Drosophila melanogaster* as a model organism.

I have never been one for following the traditional path. My interests are broad, and I tend to follow them where my career is concerned. There was a crystallising moment during my PhD where I realised that performing research without the likelihood of observing its adoption was not for me. As I have grown older, I have become more confident and outgoing, and I have found enjoyment in public speaking, attending meetings, collaborating, and communication in all of its various forms.

At that point, I had never considered agriculture as a career path, but I knew that science communication and aiding research adoption was a direction that I wanted to pursue. With no job at National Geographic on offer, I took various casual jobs that allowed me to develop my communication skills. These employment opportunities

Off the Beaten Track

Setting up suction trap at vegetable farm in Werribee, Victoria.

added depth to my resume, and when an intriguing opportunity arose describing work in biosecurity, I went for it.

One of the parts of my role that I enjoy the most is learning about pests found overseas and contributing to industry's research and development initiatives that will increase our 'preparedness'. Examples include work on the vegetable leafminer, currently found in the Torres Strait and on the Cape York Peninsula, and the spotted wing drosophila, not currently found in Australia. When we are able to increase awareness and the potential for early reporting, as well as develop surveillance and diagnostic protocols for these pests, I feel a great sense of satisfaction that our national food security has become a little bit safer.

The hardest part of my work has been observing the hardship that food producers encounter during pest incursions, either due to quarantining of properties, or market access disruptions. Due to these experiences, I have become a proponent of investing more funds into biosecurity preparedness activities at national, state and regional levels.

Agriculturalists are a wonderful bunch to work with for someone who has a scientific background. They embrace technologies and new knowledge and acknowledge that our sustainability challenges will be addressed through adaptation and innovation. I feel invigorated every time I visit a grower and learn about some piece of research that has made their job a bit easier, more effective or less costly. Where I was once heavily involved in the research side of research and development , I now identify strongly with the extension element.

Having come from no background in farming, I have needed to become a sponge when learning about farming systems, and the challenges our food producers face, not only in terms of crop protection, but other costs involved in growing a quality product. Constantly asking questions has enabled me to gain a farm level, regional level and national level understanding of farming systems and the direction of crop protection technologies and challenges in Australia. This learning has also extended to developing an understanding of global challenges – a crucial perspective for anyone working in biosecurity. The learning never ends, and I am now back at university, studying Agriculture at the University of New England (online and part time, of course).

Working in plant pest biosecurity has also given me valuable insights and experiences in agrochemical usage, food trade and food safety. Through working in such a dynamic and varied field as horticulture, I feel that I have developed the ability to adapt, learn quickly and pivot my thinking when supplied with new information. In short, I believe my experiences since leaving the laboratory bench has made me a more agile thinker, who can oscillate between a big picture view and delving right down into the detail.

In 2016, I was lucky to receive the AgriFutures Australia Rural Women's Award (Victoria), an award that identifies and supports emerging leaders who have the desire, commitment and leadership potential to make a greater contribution to primary industries and rural communities. Through this award I was able to complete a month-long study tour in the United States to investigate how exotic plant pests are managed and eradicated within their biosecurity system.

I am currently a member of the Rural Women's Award Alumni, Australian Science Communicators and the Australian Society for Horticultural Science, through which I hope to mentor other researchers who are interested in extension or biosecurity as a career path.

Jessica on Twitter:
@cesaraustralia
@jessicalye
@UrbanPBN

Giant African land snail. Photo taken while in Florida, visiting the Florida Department of Agriculture and Consumer Services.

Great Expectations

X-Ray Vision

Professor Jennifer Martin AC FAA FRACI CChem
Director of the Griffith Institute for Drug Discovery, Griffith University

It's funny thinking about one's career in retrospect, and contemplating how you've ended up where you have. For me, there have been risks that have taken me to new places and new directions, as well as a fair share of dodgy decisions.

Jennifer Martin. Photo credit: Ashleigh Stevenson, ABC TV Queensland.

Where it All Began

As an undergraduate I assumed that those who were training me – academics – always knew they wanted to be academics, they knew how to get there, and they had had a smooth, direct path to arrive where they were at. Nothing could be further from the truth, of course, as I learned from my own journey. Bumps and hurdles, curveballs, personal and professional, abounded. I certainly didn't start out knowing that I would be an academic. Far from it.

For one thing, I was born into a very poor family. My parents and their parents had all left school aged 13 or 14. No one in the earlier generations had ever gone into tertiary studies. Dad was a truck driver. Mum was a nurse. Unlike them, I had the opportunity for further education. I also had strong female role models who, either through necessity or chance, had taken paths that diverged from the norm for women of low socioeconomic status. Mum became charge nurse in a hospital operating theatre – while raising nine children. Her sister, a nun, also had a successful nursing career in a major city hospital. And my year 11/12 Physics and Chemistry teacher was a woman. Being a woman wasn't a barrier to achieving life goals. At least that's how it seemed then.

In my final year at high school, when it came time to select preferences for tertiary education, there was simply no alternative. I loved animals, wanted to care for them, patch them up and make them well. Vet Science was my top choice. Mum suggested that I include Medicine (at two alternate universities) as my second and third choices. Then the career counsellor threw in a curve ball. "Why not," she said, "include Pharmacy as the next choice?" Mmm, that wasn't something I'd considered before. But yeah, that sounded good. Without much thought, Pharmacy became my fourth choice.

As it turned out, I did well at HSC – English, Chemistry, Physics, Maths A and Maths B – but not well enough to get into Vet Science. And I didn't get into Medicine either. However, I was selected into the Pharmacy degree, taught at the Victorian College of Pharmacy at that time. Supremely disappointed, I accepted the offer. Never mind, my new plan was to do well and transfer to Vet Science after first year. But… two things happened to change that plan. The first was first year Physiology pracs. It didn't take long to realise that I didn't have the stomach for animal work. The second was that happily, I loved the Pharmacy course. The concept that a chemical interacts with a protein to generate a pharmacological effect was quite simply a revelation. The course content, pracs and staff were fantastic. I never did transfer over to Vet Science.

In the end, I aced the course earning the Gold Medal and several other awards. That early success set me up for a competitive scholarship for a Masters degree. I certainly hadn't planned to do a research degree when I first started out. And it was a risk moving into research when my peers were moving into well-paying positions as pharmacists. But I chose to immerse myself in the joy of learning computational chemistry, opioid-receptor biology, structure-activity relationships, and the thrill of new discoveries. It was a successful Masters degree with four papers published.

A Dilemma

Then came a quandary. What next: pharmacy or research? At the time, what I really wanted to do was travel. I took another risk. I planned a trip overseas including a trek through Nepal, a visit to India and a working holiday in Europe. On the advice of my Masters supervisor Peter Andrews, I also applied for PhD scholarships in the UK. If I was awarded a scholarship, I would move into research. If not, I would return to Australia to be a pharmacist. The decision would be left to fate. For several months before leaving Australia, I applied for every scholarship going. And over that same period, I received every rejection letter going. Looked like

fate was suggesting a career in pharmacy. C'est la vie.

Before I knew it, I was at Melbourne Airport ready to leave on the trip of a lifetime, and waving goodbye to family. But at the boarding gate an urgent message came through from the Dean of the Pharmacy College, Geoff Vaughan. He'd received news that I'd been awarded a prestigious Royal Commission for the Exhibition of 1851 Science Research Scholarship. Celebration time! I wouldn't be returning to Australia in six months after all, I would be undertaking a DPhil at Oxford University and would be away for four years. In the end, I received five scholarships, awards and bursaries for this higher degree by research (it was well worth all those applications after all). Ever since then, I have had a soft spot for the

A young Jenny Martin about to head into passport control at Melbourne Airport, on her way to Nepal and - little did she know it at the time - then on to a DPhil at Oxford. Photo credit: AJ Martin.

international terminal of Melbourne airport!

Oxford was incredible. It still feels like a dream, a golden time. I had to keep pinching myself to make sure it was real. I was embedded in a lab full of protein crystallographers, and was trained by internationally renowned scientists. My supervisors were Peter Goodford (drug discovery and computer-aided drug design) and Louise Johnson (protein crystallography of glycogen phosphorylase) and my project focused on developing inhibitors of glycogen phosphorylase as potential antidiabetic agents. Beyond my research project, there were fascinating seminars to attend, researchers of every kind to share meals with at College, historic museums to wander through, beautiful buildings to visit, and quaint customs to discover. Abiding memories include playing lawn tennis on the freshly mown courts in south Parks, attending a Royal Garden Party at Buckingham Palace, getting Centre Court tickets to Wimbledon in the ballot, and visiting castles, cathedrals, battlefields galore. For someone who loves history, as I do, it was the ultimate theme park.

Career Disruptions

Nevertheless, after the DPhil was awarded, four papers published, and four years in the UK, I was homesick and longing for a bit of sun. As luck would have it, a new private university had opened in Queensland, and I accepted a three-year postdoctoral position there. That was a poor career choice. Within six months of arriving, Bond University closed the entire science and technology school. Along with scores of others, I was unemployed. After many frantic applications, I was offered a postdoctoral position with John Kuriyan at Rockefeller University in New York. I delayed taking up the post for a few weeks, so I could attend a sister's 21st birthday party. I'm glad I did. As it turned out, that celebration was the last time my family would all be together.

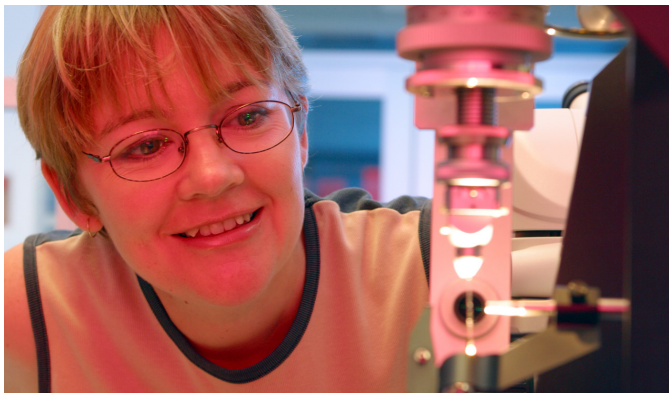
Six months after arriving in New York, I was all set up. I had furnished my studio apartment on the 17th floor of 63rd and York, successfully navigated the subway, and had hosted several visitors from Australia. My protein crystallography research was beginning to progress, crystals of the bacterial dithiol oxidase DsbA had appeared! Then, one Friday morning, the world fell in. It began like any other workday. I was in the lab around 8am, and spent a few hours purifying proteins from bacterial cultures, preparing to set up crystallisation trays. By late morning, I needed a break and returned to the office shared with three other postdocs. Unusually, there was no one else around, but a note had been left on my desk. The message said that I should call the number written below: a Melbourne number, and not one I recognised. Turned out that it was a hospital emergency department. Alarm bells! My sister came on the phone to tell me that our brother Peter had died in a car accident. Some hours after that terrible news, I was on a flight to Melbourne. It was surreal. That morning I'd been purifying protein, now I was on my way home for a funeral.

Peter's untimely death impacted family members in different ways. For me, it meant insomnia for several weeks, and guilt for not being there. It cemented in my mind that I would not live overseas anymore, even if the opportunities were better. I knuckled down, completed the work I was doing and generated two high profile first author papers on the bacterial protein DsbA, a protein I continue to work on today. Just over two years after starting at Rockefeller University, I took up an ARC QEII Fellowship at the Centre for Drug Design and Development at the University of Queensland, where I established the first protein crystallography group in Queensland.

A Lab of One's Own

I was fortunate to be awarded that Fellowship, but not so fortunate with my first grant applications. Rejection, rejection, rejection. Research outcomes were slow and papers even slower. It was a hard slog, and two years passed before the first paper was published from my

Great Expectations



Jenny Martin in the first protein crystallography lab established in Queensland. Photo credit: University of Queensland.

independent lab. Things gradually picked up as I began to attend conferences, and eventually I was invited to speak at these conferences and to organise sessions or even entire programs for conferences (eg ComBio99!). My research focus developed into protein structure in health and disease (specifically antibiotic resistance, diabetes) and encompassed redox biochemistry, membrane fusion, and – most recently – membrane proteins. After more than two decades, I moved from the University of Queensland to Griffith University, to take on the role of Director of the Griffith Institute for Drug Discovery.

Gender Equity

Over the past few years, I have become more and more concerned that there were fewer and fewer people like me (women) as I progressed up the ranks. The gender balance had been 50% at undergraduate, postgraduate, and postdoctoral level, but after that there seemed to have been a steady attrition of women. Now I was often the only woman in the room at important meetings – and very few people seemed to be worried about this imbalance. In 2009, when I was awarded an ARC Laureate Fellowship, I felt that I had a platform to address gender inequity. So it was that I joined the Science in Australia Gender Equity (SAGE) steering committee of the Australian Academy of Science. After many teleconferences, meetings, and workshops, SAGE announced in 2014 the launch of the Athena SWAN Pilot in Australia. That was one of the proudest moments in my life. But not quite the proudest moment. That came earlier this year when the Australia Day Honours were announced, and my name was on the list as a Companion of the Order of Australia. There is no way for me to thank the people who nominated me and those who supported my nomination because I don't know who they are. So, instead, when you can't pay back the good will and support you've received from others the only thing to do is to pay it forward. There will be no greater feeling of achievement for me than seeing those I have nominated for an Order of Australia being recognised for their leadership. I encourage you to do the same, to nominate people you respect, trust, admire – people who are your role models – for the Order of Australia.

Acknowledgements

My journey has only been possible because of the love and support of family and friends; the encouragement and opportunities provided by mentors, sponsors and colleagues who believed in me and helped me overcome intense shyness, fear of public speaking, and impostor syndrome; and the wonderful, extraordinary, inspiring people I get the privilege to work with every day. I have been incredibly fortunate and am many times blessed. Thank you all.

If you'd like to find out more, do read my blog cubistcrystal@wordpress.com or follow me on twitter @Jenny_STEM

Jenny Martin receives the Companion of the Order of Australia from the Governor-General, General Sir Peter Cosgrove AK MC, at a ceremony in May 2018. Photo credit: Irene Dowdy: id photo.

Competition: Crossword

All correct entries from ASBMB members received by the Editors (editor@asbmb.org.au) before 31 January 2019 will enter the draw to receive a gift voucher. With thanks to Shaun Gaskin.

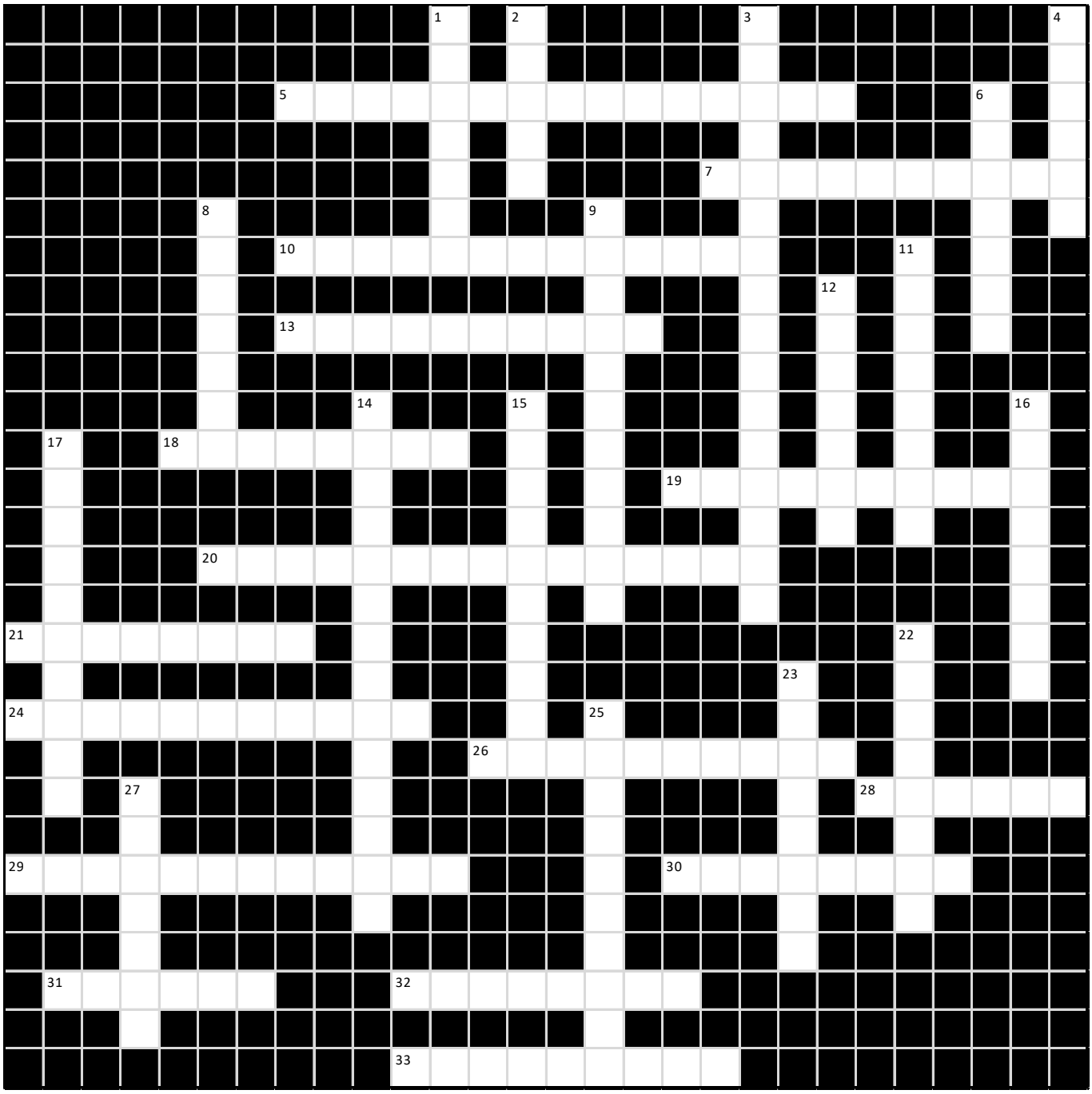
Across

5. This equipment can be used to separate macromolecules
7. An enzyme that catalyses the synthesis of a polymer from monomers
10. A protein structural motif consisting of two interacting α helices in which Leu residues in every seventh position are a prominent feature of the interacting surfaces (2 words)
13. A chemical that causes cancer
18. A _ _ _ _ _ _ _ _ blot probes for RNA
19. Signalling protein released in response to the presence of several types of pathogens
20. A covalent linkage formed by oxidation between two cysteine SH groups (2 words)
21. A small molecule required for enzyme activity
24. The electron transport chain is sometimes referred to as the _ _ _ _ _ _ _ _ _ _ _ chain
26. An RNA virus containing a reverse transcriptase
28. Plant or animal at an early stage of development
29. Metabolism of sugar in the absence of oxygen
30. Cancer causing gene
31. Vital components of a PCR reaction mixture
32. Proteins commonly associated with DNA in eukaryotes
33. A specialised cell which functions as a depot for lipid

Down

1. Short segment of single-stranded DNA that is an intermediate in DNA synthesis
2. A _ _ _ _ _ can differentiate to form memory cells or antibody-producing cells (2 words)
3. Small signalling molecule facilitating communication between neurons
4. The _ _ _ _ _ _ sequence is immediately upstream of the initiation codon
6. A base found in DNA and RNA
8. In glass (2 words)
9. Complex assembled at the centromere of each chromosome during mitosis
11. The form in which carbohydrates are store in the liver and muscles
12. Two stereoisomers with more than one chiral centre that differ in configuration at one of their chiral centres
14. A protein with a metal ion as its prosthetic group
15. An enzyme with all of its subunits and cofactors required for activity
16. The study of reaction rates
17. Stage of embryogenesis when a unicellular layer at the surface surrounds the yolk mass
22. These are cofactors for many enzymes and can be found in a healthy diet
23. Monosaccharide found commonly in honey, fruit and some vegetables
25. An organism which contains transfected DNA in the germ line
27. A _ _ _ _ _ _ _ cell cannot pass on its genes to later generations

Competition: Crossword



'Puzzlebox' Result

The winner of the August competition is Crystall Swarbrick, Duke-NUS Graduate Medical School, Singapore. Congratulations to Crystall, who will receive a gift voucher.

Solution: BIOCHEMISTRY

ASBMB Medallists and Awardees at ComBio2018

ASBMB President Leann Tilley with Lemberg medallist, Jamie Rossjohn.

Dale Pavlovski of Merck with Merck Research medallist, Mehdi Mobli (right).

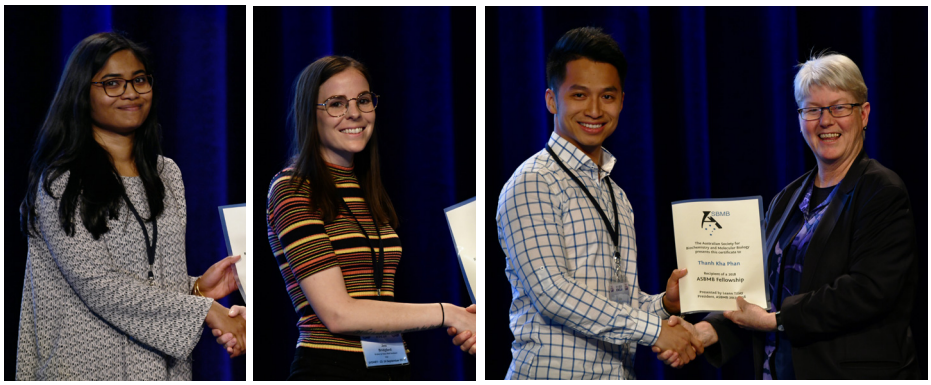
Catherine Youloundas of Beckman Coulter with Beckman Coulter Discovery Science awardee, Bostjan Kobe.

Ray Smith of Shimadzu with Shimadzu Education awardee, Tracey Kuit.

Kim Dewar of Eppendorf South Pacific with Eppendorf Edman awardee, Rajesh Ghai.

ASBMB President Leann Tilley with Bioplatforms Australia awardee, Simon Cobbold.

Louise Sternicki receives the Fred Collins Award from Cathie Jilovsky, Fred Collins' daughter.



From left: Hafna Ahmed, Jess Bridgford and Thanh Kha Phan receive ASBMB Fellowships from ASBMB President Leann Tilley.

Report on ComBio2018

Elizabeth Harry, Convenor of ComBio2018

ComBio2018 was a huge success. And I reflect on what made this conference successful. The key is having the best people on the team. I started with selecting 20 people to put together the scientific program – the stream coordinators. I then chose from them a Program Chair and a Deputy Program Chair, Dr Annemiek Beverdam, University of New South Wales and Professor Brent Kaiser, University of Sydney, respectively. I couldn't have asked for a better team. Annemiek as Program Chair was exemplary: a committed, energetic and clever leader of the program, with inclusion of diversity always front and centre. Brent was a fabulous support for Annemiek and they coordinated beautifully to produce a superb scientific program on schedule.

Conference Chair, Liz Harry, opens ComBio2018.

I thank all the stream coordinators for their excellent choice of plenary speakers and symposium chairs, and their time in doing this, which is not insignificant. And I thank all the delegates, symposium chairs and the whole conference team for making ComBio2018 such a success.

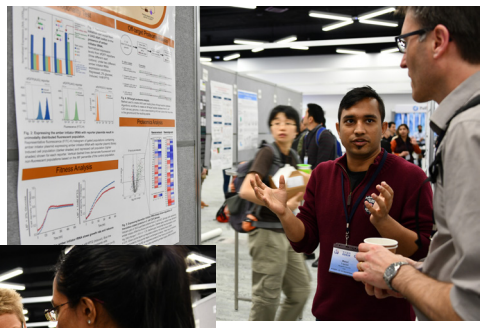
What was so special for me in leading this conference, apart from the fantastic team, was how much diversity there was in the people involved at every level; speakers and chairs. This included a range in the age level, affiliated institutions, field of research, gender and background.

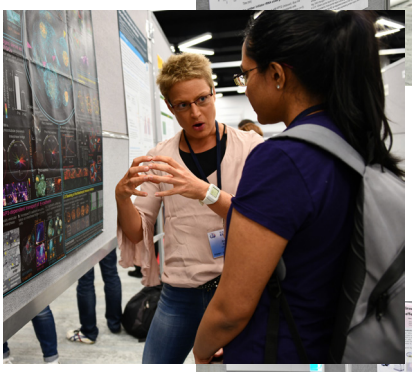
The most frequent comment about the conference was the richness and density of the science in the program. So while there was a lot going on at any one time, people thoroughly enjoyed the sessions they went to. And I believe that diversity is the secret to success. It was wonderful to experience that first hand.

The conference was held at the brand new International Convention Centre Sydney on the Darling Harbour waterfront, from 24 to 26 September in the same three-day format as ComBio2017. It was a fantastic venue, not only with beautiful views of Sydney but we were all clustered together in a secluded section which facilitated maximum interaction and networking.

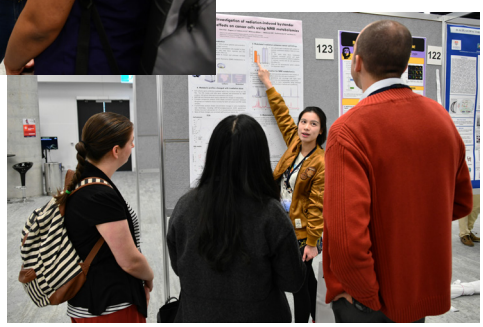
A Poster Teaser session.

The conference was well attended, with 768 registrants, 225 invited speakers and 139 symposium chairs in total. We were fortunate this year to be joined by the Board of Directors for the International Society for Differentiation (ISD) with three plenary speakers, Professor Elizabeth Robertson (University of Oxford), Professor Anna Philpott (University of Cambridge) and Professor Christoph Niehrs (Institute of Molecular Biology, Germany). Other ISD Board Members gave presentations in various symposia. As well as our usual fabulous conference partners, the Australian Society of Plant Scientists and the Australia and New Zealand Society for Cell and Developmental Biology, two New Zealand societies joined us this year, the New Zealand Society of Plant Biologists and the New Zealand Society for Biochemistry and Molecular Biology.





Poster exhibition.



Report on ComBio2018

Above: Plenary Lecturer Ellen Lumpkin.

Left: ASBMB Grimwade Keynote Plenary Lecturer Randy Schekman.

Our international plenary speakers included outstanding scientists from around the globe. To kick off the conference, the first plenary speaker was Professor Randy Schekman, who gave the ASBMB Grimwade Keynote Plenary Lecture. Professor Schekman is a Nobel Prize-winning Professor of Molecular and Cell Biology from the University of California, Berkeley. He gave a terrific update on cellular trafficking and spent the latter part of his talk identifying the need for researchers to be proactive in speaking out about publications and their increasing costs. He was a founder and is retiring Editor-in-Chief of *eLife*.

Other plenary speakers included Professor Tobias Walther, originally from Germany and now residing at the Harvard School of Public Health, who presented his research on lipid storage in health and disease. Professor Keiko Torii, University of Washington, talked about developmental patterning in plants. The ASBMB Keynote Lecture was given by Professor Paula Cannon, University of Southern California, Los Angeles, who demonstrated elegant CRISPR technology in anti-HIV therapy development. The NZSBMB Custom Science Lecture was delivered by Associate Professor Wayne Patrick, Victoria University, Wellington, and addressed real enzymes and how they have changed his view on life. Professor Gary Brouhard, McGill University, Canada, discussed microtubule-associated proteins. Associate Professor Ellen Lumpkin, Columbia University, gave a fascinating talk on the signals that give rise to the sensations of touch, pain and itch. Professor Michael Udvardi, Noble Research Institute Oklahoma, discussed nitrogen-fixing in plants. Professor Nieng Yan, Princeton University, delivered her recent research on the structure and function of membrane transport proteins exemplified by the glucose transporters and Nav/Cav channels. Professor Paula Jameson, University of Canterbury, discussed the many roles of the hormone cytokinin.

Congratulations to all the society award winners for their exceptional research achievements.

As a first, the Career Development Forum was incorporated into the three-day program, and there was a full Education stream. It worked well to have these within the three days of the conference making it more economical for young scientists and encouraged good attendance.

Trade exhibition.

Report on ComBio2018

Social sessions.

The Poster Teasers sessions remain popular – this is where selected student poster presenters give a very short verbal presentation of their poster prior to their actual poster presentations. I thank the Career Development Forum team in organising both the Forum and the Poster Teaser session – seamless!

Without the exhibitors, this conference would not be financially viable. We had 46 booths and six table displays. Thank you to all the delegates for connecting with these important stakeholders and corporate members, there was a high level of interaction with them.

For the second year, the conference dinner was replaced with more extensive networking opportunities. It was a great social program with plenty of time to catch up with long-time friends and new faces at the welcome mixer. Smaller groups got together at the many other venues around the city to catch up on science and life; many of us are good friends.

The expertise of Sally and Chris Jay in weaving the whole ComBio2018 together was, as usual, outstanding. They ensured maximum exhibitor booths and a financially viable and successful conference. What is hidden from the eye is the activity going on, making the hard work conducted look easy.

Finally, I thank all delegates for their attendance, enthusiasm and excellent science.

The next ComBio meeting will be in 2020 in Melbourne as we are now switching to holding these conferences every second year. The Convenor of ComBio2020 is Associate Professor Jackie Wilce, Monash University. Jackie is already planning and I am certain it will be a great success. See you all there!

ComBio2018 ASBMB Poster Prize Winners

Isabelle Capell-Hattam (University of New South Wales)
A novel regulatory step in cholesterol biosynthesis reveals a potentially crucial E3 ligase in cholesterol metabolism and stabilization of mammalian sterol reductases

Alison Kearney (University of Sydney)
New insights into the regulation of Akt by its hydrophobic motif

Ayla Orang (Flinders University)
Harnessing miRNAs to enhance the anti-cancer properties of metformin in colorectal cancer

Aparna Raina (University of Tasmania)
Nucleosome positioning as a potential driver of transcriptomic alterations in prostate cancer

Ryan Separovich (University of New South Wales)
Who's controlling the controllers? Constructing the regulatory network of histone methylation in yeast

Daniela-Lee Smith (University of New South Wales)
Comprehensive identification of crosslinked peptides using a multi-crosslinker, fragmentation and data analysis approach

ComBio2018 Career Development Forum

This year's event was convened by Amy Bottomley (University of Technology Sydney), Heloisa Milioli (Garvan Institute of Medical Research), Arne Ittner (University of New South Wales) and Peta Bradbury (Woolcock Institute of Medical Research), and offered two separate and distinct 45 minute sessions. We had approximately 60 delegates attending this year's Career Development Forum to hear from a range of people discussing the importance of self-promotion, how to engage with either government or industry, and personal perspectives and experiences of the success and setbacks of diverse scientific careers.

The first session was dedicated to discussing a variety of issues that the conveners felt were topical and often under-discussed in many of the current early- and mid-career researcher forums available. **Dr Chloe Warren** (freelance science communicator) discussed her journey post-PhD. Chloe spoke of the importance of networking outside of not only your research field, but also outside of research all together. **Associate Professor Brian Oliver** (University of Technology Sydney) explained why networking is important valuable connections with industry. **Dr Romaric Bouveret** (University of New South Wales) talked about how to be shameless when self-promoting and the importance of creating a public profile. **Dr Melina Georgousakis** (founder of Franklin Women) described the importance of having a mentor and the different types of mentors available. **Associate Professor Phoebe Phillips** (University of New South Wales) discussed with passion why sustaining links with government is important to the future of science and as an early-career researcher, why it is important to communicate your ideas to government.

Career Development Forum speakers, from left: Chloe Warren, Brian Oliver, Phoebe Phillips, Melina Georgousakis and Romaric Bouveret.

Career Development Forum panel, from left: Fabien Delerue, Liz Caldon, Cath Burke, Natalie Chapman and Sheng Le.

The second session was run as an interactive forum that described the reality of science and detailed the success and setbacks from different perspectives. Five speakers from diverse areas of science gave a brief introduction about their experiences when beginning start-ups, changing to industry and also when deciding to stay in academia. **Dr Sheng Le** (Product Manager at Olympus) shared how and when he decided to move into industry. **Dr Liz Caldon** (Group Leader at The Kinghorn Cancer Centre) discussed her decision to stay in academia and strategies to minimise career disruption, drawing on her personal experiences. **Dr Catherine Burke** (co-founder of LongAs) shared her personal path when beginning her start-up. **Dr Fabien Delerue** (Manager of the Transgenic Animal Unit) talked of the trials and tribulations of starting his business model within the confines of university setting. **Natalie Chapman** (Managing Director of Gemaker) spoke of her unconventional career path and how that has shaped her today. The floor was then open to questions from the audience with discussions continuing well into the break.

Peta Bradbury on behalf of the Career Development Forum Convenors

Education at ComBio2018

Education scholars' writing room at ComBio2018.

This year, the Education presence at ComBio 2018 was enhanced and expanded. For the first time, the Education sessions had a presence on every day of the conference. As well as the Education Symposia on Monday, we ran an Education scholars' writing room on every day of the conference to give a space for attendees to write and work together.

In the Symposia, Professor Erin Dolan, the Georgia Athletic Professor of Innovative Science Education, University of Georgia, was sponsored by the Education SIG to speak on researching and publishing in Science Education. It was exciting to hear from Erin, who is the Editor in Chief of *Cell Biology Education – Life Sciences Education.* Erin's generosity and wisdom was fantastic, and many of us came away with new approaches to researching, writing and publishing our work.

Maurizio Costabile, Tracey Kuit and Rebecca LeBard spoke at a session aimed at educators thinking about applying for a teaching award. The presentation drew on the experience of the three presenters who have won local, national and international teaching awards. The presentation covered the benefits of applying for a teaching award and it also addressed the question of defining 'excellence' in teaching. Examples of the types of evidence that can be used in supporting a teaching award application were discussed and a list of do's and don'ts for applications were covered. The presentation is available on the Members tab of the Education section of the ASBMB website. Susan Rowland and Tracey Kuit addressed how to write an education grant. The slide set for this workshop is also available on the Members tab of the Education section of the ASBMB website. This workshop was a hands-on session, where we worked with group members on their current and future project plans. In particular, we addressed the question of deliverables, and the value proposition that funders may see in our work.

In addition to the workshops, we had posters and talks from Amber Willems-Jones on science communication and inquiry learning; Anne Galea on embedding science communication skills in the curriculum; and Kathy Fernandez on her PhD project around biochemistry teaching for health sciences students. Tracey Kuit delivered the 2018 ASBMB Shimadzu Education Award Lecture on creating opportunities for self-reflection in large courses. Beth Loveys delivered the 2018 Australian Society of Plant Scientists Teaching Award Lecture on flipping the laboratory. You can read more about Beth's work in the Education section of this issue of the *Australian Biochemist*, while Tracey has contributed an interview with with Rebecca LeBard from the University of New South Wales.

Thank you to Maurizio Costabile and Janet Macaulay, who joined us in chairing sessions.

Susan Rowland and Nirma Samarawickrema
ComBio2018 Education Stream Chairs

From left: Janet Macaulay, Erin Dolan and Susan Rowland.

Education Symposia attendees.

Beth Loveys.

Tracey Kuit.

Get Krafty with Your Patent Applications to Make Sure They Can Withstand the Heat!

A series of regular articles on intellectual property. In this issue, Sarah Hennebry, Patent Attorney, FPA Patent Attorneys, discusses the importance of describing the claims in your patent applications.

In previous articles, we considered the importance of the patent claims, and how the claims of the patent define the legal monopoly granted to the patentee. But how important are the other parts of the patent document?

This article explores the importance of the full patent specification and considers a couple of recent decisions from the Australian Patent Office where patent applications came under fire for failing to meet "disclosure" and "support" requirements.

Content of a patent document

OK, so I know that patent applications are not the most entertaining documents to read and can make even the most dedicated reader a little cross-eyed! But there are good reasons for all the apparently repetitive statements (which are in fact all stating something slightly different!).

Before getting into why all the detail is important, here is a brief outline of the general structure/content of a patent application, for those readers who need a refresher:

Firstly, the 'Field of the Invention' and 'Background' set the scene for the invention described in the patent application.

The Background provides an outline of the problem to be solved and why others might have failed to solve the problem. So in the context of a treatment for cancer, the Background might explain what some of the current treatments are, what the disadvantages of those treatments might be (side effects, costs, lack of efficacy), and that there is a need for new or alternative treatments for cancer.

Generally, the Background is written in a way so as to leave the reader understanding that there is a problem, but having not much of an idea of how to solve that problem. The 'Summary of the Invention' and 'Detailed Description' then reveal to the reader the inventiveness of the patent applicant.

The Detailed Description is – as the title suggests – the most detailed part of the application and further explains the advantages and surprising aspects of what the inventors have produced. The Detailed Description teaches how to perform the invention, including how to identify and test any variables or parameters important to the invention and how to determine if the invention has worked.

For example, in the context of a patent application which is directed to new antibodies for treating cancer, the Detailed Description should explain, among other things:

- how to make the antibodies;
- the sequence of the antibodies (typically this should be protein and DNA sequence encoding the antibody, details of the CDR and framework regions);
- if there can be any variation in the antibody sequences which would not impact on the function or capacity of the antibody to bind its target;
- what the antibodies do (eg, which cancers do the antibodies treat?) and evidence to support this, or if there is no direct evidence, an explanation as to why it is expected that the antibody would work;
- who should be treated with the antibodies (eg, how do you identify a patient having the relevant cancer who would benefit from treatment with the antibodies?);
- how to administer the antibodies to someone needing treatment (eg, predicted dose range, formulation, mode of administration – intravenous, intramuscular etc); and
- how to determine if the treatment with the antibodies has been successful.

The Detailed Description typically also includes an 'Examples' section, which may include details of the experiments conducted which led to the invention. For example, this section might provide details of the experiments which lead to the generation of the new antibodies, details of how the ligand binding and affinity of the antibodies was tested (including, if relevant, which ligands it does not bind to), any details from animal or other models which indicate a likely use of the antibodies – what conditions will they treat, and the outcome of any experiments where the antibodies were modified and what impact this had on function.

How is the patent application assessed?

Many of you will know that in order to have a patent granted, the claims of the patent application must be found to be novel (ie, new) and inventive (ie, non-obvious). However, a novel and inventive claim is not always enough to obtain a patent for an invention and most jurisdictions also have requirements relating to the quality of the remainder of the application.

Firstly, a patent application needs to provide sufficient information for a person working in the same field

Get Krafty with Your Patent Applications to Make Sure They Can Withstand the Heat!

(a 'person skilled in the art') to be able to perform the invention. This requirement is also referred to as the 'enablement' requirement or the 'sufficiency' requirement.

The requirements for sufficiency in many countries, particularly Australia have changed in recent years. Previously, it was only necessary for the specification to teach 'one way' of performing the invention. However, in most jurisdictions, the disclosure must now be more comprehensive, and teach the skilled person how to perform everything that falls within the scope of a claim.

In Australia, the Patent Office considers the disclosure in the patent application to be sufficient if the specification is clear enough and complete enough for the skilled person to perform the invention. An enabling disclosure is one that provides the person skilled in the art with sufficient information to achieve what is claimed, *without undue burden or the need for further invention.*

What does this mean? Pages and pages could be written on what constitutes an enabling disclosure, and clearly, the extent of the information required will vary depending on the nature of the invention. For the purposes of this article, it is sufficient to understand that the more information and teaching of how to perform the different permutations of the invention, the better.

In addition to the disclosure requirements of the specification, the claims of the application must not be directed to more than what the specification tells the skilled person to do. This is called the 'support requirement'.

The support requirement is intended to ensure that a patent applicant does not claim more broadly than their contribution to the field. For example, merely asserting that a pharmaceutical composition will treat a given disease, will not provide adequate support for a claim to this use. However, providing details and the results of experiments (including *in vitro*, or preclinical experiments) which 'credibly and plausibly demonstrate' that the composition is useful for treating diseases sharing a common molecular pathway may go a long way to providing the requisite degree of support.

Understanding the requirements for support and disclosure can be tricky – in particular because of the subjective nature of the assessment in some instances, and variations in the approaches of Patent Offices in different countries for assessing these requirements.

So now that you know why disclosure and support in a patent application is important, what are some examples of the importance of these in practice? A couple of recent Australian Patent Office decisions have highlighted the criticality of ensuring that the claims pursued in an application are adequately supported and enabled.

Kraft application melts under the heat of scrutiny

The Patent Office considered an application by Kraft Foods directed to a 'heat-resistant' chocolate product and process for making the chocolate. Mars opposed the grant of the patent on the basis (among other objections), that the claims were not supported by the disclosure in the application.

It is unnecessary to reproduce all the claims at issue, other than to state that claim 1 was directed to:

a process for the manufacture of a heat resistant chocolate, comprising combining ….[component A] and [component B], to form a chocolate mass….wherein the chocolate mass comprises 1 to 15% of dextrose monohydrate as component B or part thereof.

Claim 7 was directed to a product made by the process defined in claim 1. Claim 13 was also directed to a product, but made no reference to the process in which it was made, simply stating the percentage fat, dextrose and total moisture in the product.

What is interesting here is that the Patent Office considered the claims to be novel and inventive and that the patent application provided a sufficient teaching to the skilled person to perform the invention. However, the Delegate for the Commissioner considered that a number of claims were either not supported by the disclosure, or were not clear.

In considering the question of support, the Delegate determined what he considered to be Kraft's 'contribution to the art'. He found this to be the controlled release, under certain conditions, of water from 1 to 15 wt% of hydrated materials (including at least 1 wt% dextrose monohydrate) during production to yield a heat resistant chocolate.

Having determined the contribution to the art, the Delegate considered that the claims did not clearly define the conditions under which the process releases the water of hydration, nor was this implicit in the claims. The Delegate therefore considered claim 1 to exceed the technical contribution to the art and was therefore not supported.

In relation to claim 13, the Delegate considered that the claim encompasses *all* heat resistant compositions that comprise the defined ingredients, including products that owed nothing to the teaching of the invention. Accordingly, this claim was also found to lack support (for exceeding the contribution to the art).

So what can Kraft do now? The Patent Office has provided a two-month period in which Kraft can suggest alternative claims. If the claims are deemed supported by the application, then Kraft may still obtain a patent

Get Krafty with Your Patent Applications to Make Sure They Can Withstand the Heat!

to its invention, albeit with narrower claims than initially allowed.

All coffee and no crema make for a frothy patent application

Another recent decision from the Australian Patent Office considered an application directed to a single serve capsule for producing crema-free coffee. While the claims were found to be novel and inventive, the Delegate found that the claims were not supported and that the specification failed to sufficiently disclose the invention.

The claims were directed to a single serve capsule for producing a crema-free coffee beverage, wherein the capsule was defined by reference to a "base body in which a textile fabric and beverage substance are arranged." Claim 1 also defined various parameters relating to: 1) the beverage substance (ie, coffee granules), including the amount, form, physical characteristics, and 2) the textile fabric, including the weight per unit area and permeability.

The Detailed Description included test results from seven different capsules. Of the tested capsules, only a subset produced a crema-free coffee. However, the specification did not provide any explanation to the skilled person as to why certain capsules worked, while others did not or how to predict whether or not a capsule would be useful for providing crema-free coffee.

The Delegate considered that the skilled person would not be able to determine from the information provided in the application, which combination of parameters would be needed to produce crema-free coffee.

While the Delegate considered the skilled person could trial different combinations of parameters, this would amount to more than routine trial and the skilled person would need to conduct prolonged research, or take an inventive step to arrive at the invention. Accordingly, the Delegate found that the claims were not enabled, and the specification did not sufficiently disclose the invention, because the skilled person was placed under undue burden to achieve the invention.

The Delegate found that the contribution to the art was limited to specific test capsules described in the application (Test series 2, 3 and 8–12), which produced crema-free coffee. As the claims were considered to include capsules that would not produce crema-free coffee, the claims were found to extend beyond the contribution to the art. Consequently the claims were found to also lack support.

What does this mean for me and my patent applications?

It should be clear that the detailed description of the patent application is just as important as the claims of the application for ensuring the validity of your patent.

Recent Patent Office decisions highlight the importance of ensuring that your patent application properly explains how to perform the invention, and ensuring that the patent claims do not extend beyond the contribution made to the field by the inventors. Importantly, the second decision considered in this article highlights the dangers of including negative data without an explanation of the significance of this data to the reader in light of the patent claims.

Your patent attorney will be able to provide guidance on what information will maximise the prospects that your patent claims will be deemed supported by the application, and that your patent application provides a sufficient disclosure as to how to perform the invention.

NEW FACES ON COUNCIL

Three changes to Council Membership will be made in 2019. Leann Tilley will become Past President and we acknowledge and thank her for her commitment and dedicated work in promoting and supporting the ASBMB activities. We now welcome Joel Mackay into the role as President. Finally, Terry Piva (our former Treasurer) has taken over from Paul Gleeson as FAOBMB representative. We thank Paul for his service on the Council.

Contact details for 2019 Council members can be found in the Directory on page 61.

Briony Forbes
ASBMB Secretary

News from the States

Compiled by Erinna Lee

Australian Capital Territory

Contributed by Matthew Johnson

It has been an exciting year for biochemistry and molecular biology in the ACT, with the Canberra Protein Group holding regular meetings for over a year with attendances of 50 or more people. Over the past year, the protein group hosted some exciting speakers from ANU, CSIRO and industry. Most notably, Daniel Eriksson from the Australian Synchrotron conducted a workshop on the new MX beamlines. The Canberra Protein Group has also attracted sponsorship for meetings from GE and Cell Systems Biology. The group, formed by Simon Williams and Matthew Johnson, will soon apply to be an ASBMB Special Interest Group and will serve as a platform to communicate ASBMB news to the research community in the ACT.

New South Wales

Contributed by Kate Quinlan

I was handed the baton by Katherine Michie in late-2017. Katherine did a wonderful job as NSW State Representative and I am grateful for her hard work.

This year ASBMB NSW funded the ASBMB Prize for Biomedical Science ($300) to the student with the best overall performance in all courses of the Bachelor of Biomedical Science program at the University of Newcastle, awarded at a ceremony in April 2018. We also supported the ASBMB Biochemistry Prize ($300) for Charles Sturt University which was awarded to student Danielle Harper at the Faculty of Science Executive Dean's Award and Prize Ceremony held in Wagga Wagga in May 2018.

The 2017 ASBMB University of Newcastle School of Biomedical Sciences and Pharmacy Prize was awarded in April 2018 to Kyne Hanlon. From left: Kyne Hanlon, Professor Hubert Hondermarck (Head of the Discipline of Medical Biochemistry) and Dr Karen Mate (Program Convenor for the Bachelor of Biomedical Science Program).

ASBMB NSW has sponsored the NSW Science Teachers Association Young Scientist Awards for several years now. The ASBMB Award is given for the best high school student project with a biochemistry or molecular biology theme. I am in the process of judging the 2018 entries for this prize and am very impressed by the standard of the finalists. With high school students like these, the future of biochemistry and molecular biology is looking bright!

Queensland

Contributed by Ben Schulz

ASBMB QLD would like to acknowledge the fantastic work of Dominic Ng, who has stepped down after holding the role of QLD State Representative from 2015–2017. Dominic has kept the branch a hive of activity in internal activities, award sponsorships, and outreach.

The branch has continued its sponsorship of undergraduate prizes at Queensland universities, including the Griffith University and Queensland University of Technology ASBMB prizes.

The partnership between the QLD branch and the Science Teachers Association of Queensland (STAQ) has also continued, with ASBMB QLD sponsoring the annual Queensland Science Competition. ASBMB prizes were awarded in primary and secondary student categories. It was very pleasing to see the high quality of all students' entries. Queensland science has a bright future!

South Australia

Contributed by Mark Corbett

The major event for South Australia last year was the hosting of ComBio, which was admirably convened by Dr Michael Michael and his capable team. It was a fantastic event covering the usual diverse range of topics that stimulated new ideas and new collaborations.

Together with EpicSA, the RNA SIG has a monthly seminar series that gives students and postdocs from all of the major research centres in Adelaide good opportunities to present their work to an educated audience for vital peer review. Seminars this year have covered a range of exciting topics by local researchers including integrative genomics, application of RNA-Seq to medical genomics, transcriptional regulation in cancer, novel splicing mechanisms and RNA modification.

The Adelaide Protein Group is now in its tenth year and continues to grow in strength. The annual student awards event attracted over 25 abstracts and sent Centre for Cancer Biology student Alexander Lewis to ComBio this year after taking out the award with his talk 'Dual sphingosine kinase and Bcl-2 inhibition exhibits synergistic cell death in acute myeloid leukemia'. The other finalists were Byron Shue (University of Adelaide) and Pawanrat Tangseefa (SAHMRI).

The APG also ran its early- and mid-career researcher awards featuring six rapid talks covering structural biology, CRISPR modification, plant biology, functional

genomics and post-translational modification. The award was won by Julie Ann-Hulin of Flinders University.

The ASBMB SA branch was a bronze sponsor of the Oliphant Awards (named after former state governor and nuclear physicist Sir Mark Oliphant). This competition covers a range of research projects, models and essays from primary and secondary school students from around the state. The entries included a working model of an aquaculture and hydroponics co-culture system, research projects on bread making and plant growth as well as multiple essays on CRISPR technology and gene therapy. It is interesting to read the differing opinions of the technology in younger compared to older students with those in lower grades having some very strong opinions on the dangers of using this technology in humans, while the older students took a more balanced view. We also continued our support of the Flinders University Centre for Neuroscience donating $250 to their student award scheme.

Looking forward, I hope to establish stronger networking with local ASBMB members, as perhaps many don't know yet that I exist. I encourage our local members to get in touch so I can support your initiatives. With the opening of the new UniSA Cancer Research Institute building this year alongside the SAHMRI and the University of Adelaide Health and Medical Sciences, building a critical mass for biomedical research (including many outstanding members of the ASBMB) has been created that will benefit the state in the long term. Now is a good time to use the ASBMB to build your collaborative network.

Victoria

Contributed by Erinna Lee

The ASBMB VIC branch continues its tradition of sponsoring a diverse range of activities within Victoria. All sponsored events share the common goal of promoting the communication and development of science, in particular Biochemistry and Molecular Biology, amongst both established and aspiring future scientists. In addition, events sponsored promote networking and fostering new collaborations. Detailed below are the events sponsored in 2018 by the Victorian branch of the ASBMB.

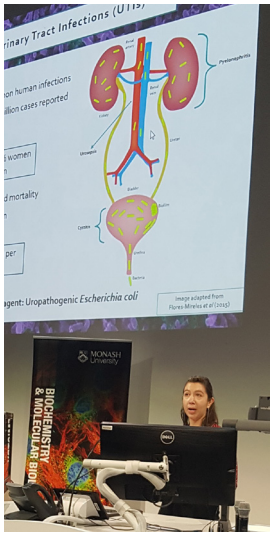
The University of Melbourne Department of Biochemistry and Molecular Biology ran an Advanced Biochemistry Workshop that was held at the Bio21 Institute over two days in July 2018. The program consisted of research talks, Bio21 tours, a careers session and an Honours/Masters information session. The workshop was attended by up to 80 second and third year undergraduate students.

The Melbourne Protein Group is a Special Interest Group of the ASBMB, which aims to provide forums for early career researchers, including PhD students, to present their work and engage with like-minded Victorian researchers in protein science. The 17th

Students find out more about what being a researcher is all about at the University of Melbourne Advanced Biochemistry Workshop.

annual Melbourne Protein Group Student Symposium was held at Monash University on Thursday 12 July, chaired by Sarah Atkinson and Doug Fairlie. More than 70 enthusiastic Honours and PhD students gathered in Clayton to hear from keynote speakers Dr Erinna Lee (La Trobe University and Olivia Newton-John Cancer Research Institute) and Dr David Thal (Monash Institute of Pharmaceutical Science), who both gave engaging and inspiring talks. Career speaker Dr Janet Newman (CSIRO) gave an entertaining look at her crystallographic journey from academia to industry.

Six student speakers from research institutes around Melbourne also presented their latest work. Gabriela Constanza (La Trobe University) was awarded the Tilley Oral Award for most outstanding oral presentation in a highly competitive field. Steven Heaton, Blake Mazzitelli, Riley Metcalfe and Kristen Scicluna were awarded Poster Prizes, sponsored by ASBMB.



Gabriela Constanza receives the Tilley Oral Award for most outstanding oral presentation at the Melbourne Protein Group Student Symposium.

The ASBMB VIC branch continues its commitment to supporting Women in Science initiatives and once again sponsored the Lorne Conference on Protein Structure and Function Women in Science bursary. This year's awardees were Liz Miller (MRC Laboratory of Molecular Biology), Elizabeth Hinde (Bio21) and Urmi Dhagat

News from the States

The Lorne Conference on Protein Structure and Function continues to strive towards gender balance in all aspects of their conference, which includes the award of Women in Science Bursaries.

(Bio21), who all received funding to assist with costs associated with bringing children to the meeting. The initiative was also supported by the Walter and Eliza Hall Institute, La Trobe Institute for Molecular Science, Monash University and University of Sydney.

The ASBMB VIC branch has also committed sponsorship to supporting the annual Science Talent Search to be held at La Trobe University, AussieMit and the Melbourne Biometals Symposium in 2018.

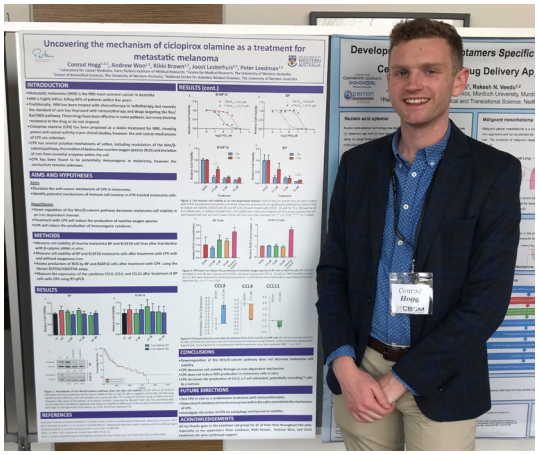
Western Australia

Contributed by Monika Murcha

After a smooth handover from Nic Taylor, I have taken over as the WA representative for ASBMB. During 2018, ASBMB WA branch has continued its support at the annual Combined Biological Sciences Meeting held at the UWA University Club on 31 August 2018. We supported a $300 prize to the most outstanding student poster on molecular and biochemical research. The prize was awarded to Conrad Hogg, an Honours student in the Laboratory of Cancer Medicine at the Harry Perkins Institute of Medical Research, for his poster entitled 'Uncovering the mechanisms of ciclopirox olamine: an anti-fungal drug repurposed for the treatment of metastatic melanoma'. This annual meeting promotes biological science research in WA and promotes and interaction of WA researchers and students across institutes and industry.

Next year, the WA branch will be involved in hosting ASBMB 2019 Conference at the Esplanade Hotel Fremantle from 1–3 October. The conference will focus on the themes of RNA biology, drug design and gene editing. We have already confirmed several outstanding plenary speakers such as Tom Blundell (Cambridge University), Lingling Chen (Shanghai Institute of Biochemistry and Cell Biology) and Li Yang (CAS-MPG Partner Institute for Computational Biology).

With such an exciting year ahead, I am looking forward to representing the ASBMB in the West and seeing you all at ASBMB 2019.



Conrad Hogg receives the most outstanding student poster prize for molecular and biochemical research at the 2018 Combined Biological Sciences Meeting.

Australian Society for Biochemistry and Molecular Biology Inc
PUBLICATION SCHEDULE FOR *AUSTRALIAN BIOCHEMIST*, volume 50, 2019

Issue	ASBMB Content	Copy Deadline	Issue Date
April 2019 50(1)	Profiles of medal, award and fellowship winners Nominations for Executive/Council	Monday 11 February	Monday 1 April
August 2019 50(2)	Nominations for medals, awards and fellowships Notice of AGM/proposed constitutional changes	Monday 10 June	Monday 5 August
December 2019 50(3)	Annual reports/finances ASBMB 2019 reports	Monday 7 October	Monday 2 December

The Program for ASBMB 2019 (Perth) will be placed on the webpage http://asbmb2019.com.au/
The *Proceedings of the Australian Society for Biochemistry and Molecular Biology* is published in conjunction with the Annual Conference of the Society. The electronic version of the Proceedings (Volume 51) will be made available online.

Bioplatforms Australia Award

Defining the Metabolic Capacity of the Malaria Parasite Via Global Stable Isotope Labelling

Simon Cobbold.

My research focus is the malaria parasite, which remains a major burden to global health. Despite recent advances in controlling the disease, the emergence of antimalarial resistance means that the inroads made in tackling this disease could be reversed without novel antimalarials becoming available. Most existing antimalarials and leads within the development pipeline target metabolic processes of the parasite. Yet, despite successful targeting of metabolic enzymes, we lack a complete understanding of the metabolic capacity of the malaria parasite.

This leads to the question, if metabolic enzymes are such good antimalarial targets, how many are left in the malaria parasite to target for antimalarial therapies?

My research takes advantage of high-resolution high-accuracy mass spectrometry and stable isotope labelling to define the full metabolic capacity of the malaria parasite and identify novel reactions and enzymes that genomic reconstructions have missed. I have established a novel pipeline for detecting and systematically characterising endogenously produced metabolites in the parasite, and I then use CRISPR/Cas9 molecular editing to characterise prospective genes that encode novel and unexpected metabolic enzymes.

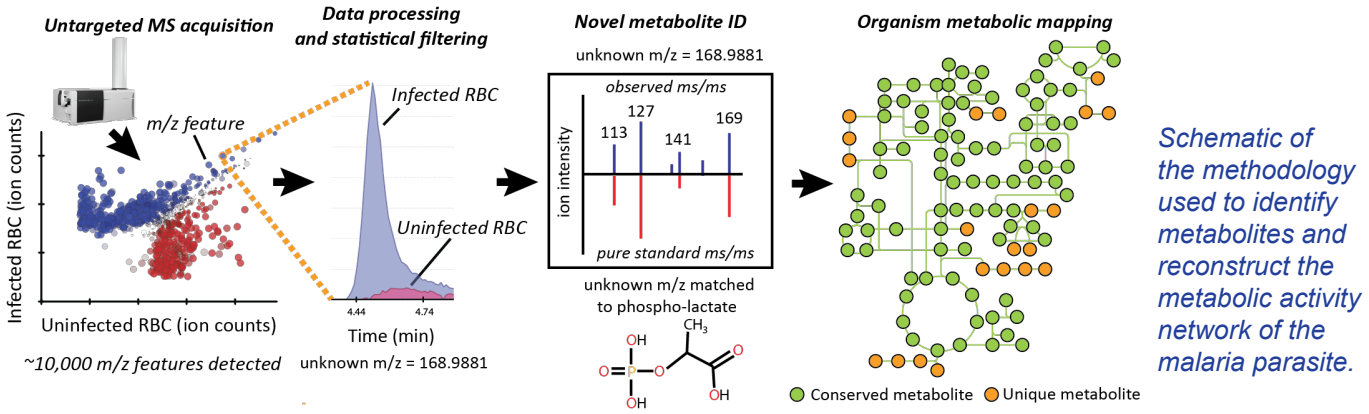
Earlier in 2018, I was awarded the Bioplatforms Australia Award and was very grateful to the Society and Bioplatforms Australia for the recognition of the research I conduct. The award has been immensely helpful in pursuing this research project and in particular performing key follow-up and validation experiments to demonstrate the power of this metabolomic approach, but also revealing key insights into parasite metabolism and biology.

Two key insights have been revealed from this approach. Firstly, many novel metabolites that are not predicted from canonical metabolic pathways are as a result of side reactions or errors catalysed by specific enzymes (enzyme promiscuity generating 'damaged' metabolites). While the extent to which enzyme promiscuity occurs *in vivo* is poorly understood, there is increasing evidence that the products of these side reactions can have potent allosteric properties and/or can cause metabolic dysfunction if they accumulate. Well characterised examples of enzyme promiscuity include the methylglyoxal forming reactions in glycolysis (catalysed by triosphosphisomerase) and the racemisation of amino acids catalysed by some transaminases. Intriguingly, we have found several 'damaged' metabolites within this research project and subsequent validation demonstrated that a specific metabolic repair enzyme is necessary to suppress their accumulation and maintain normal metabolic flux and parasite growth.

The second key insight to be uncovered in the malaria parasite is that it appears much of the regulation and coordination of metabolism occurs at the metabolite level itself. That is to say, with limited transcriptional responses or conventional signalling pathways, the malaria parasite maintains metabolic flux via 'intermediate removal', dephosphorylating intermediates of a pathway and thereby removing them from the pathway flux. This provides a layer of control over metabolism that is highly sensitive to slight environmental and metabolic fluctuations and may ensure the parasite can flourish in its unusual niche.

All this research is dependent upon the Agilent 6545 LC-MS Q-TOF at the Metabolomics Australia Bio21 node. Therefore, my work is intimately linked to Bioplatforms Australia and the instrumentation and support provided through Metabolomics Australia.

Simon Cobbold is a postdoctoral researcher at the Bio21 Institute, University of Melbourne.



Schematic of the methodology used to identify metabolites and reconstruct the metabolic activity network of the malaria parasite.

ASBMB Fellowship Report

Party in the USA (Ubiquitin Signalling Assembly)

Jess at the Grand Canyon North Rim, Arizona.

I was so grateful to be awarded an ASBMB Fellowship at the completion of my PhD. This award allowed me to travel to Aspen Snowmass, Colorado, USA, to attend the FASEB (Federation of American Societies for Experimental Biology) Scientific Research Conference on Ubiquitin and Cell Regulation (17–22 June). This conference is known as the 'mother of all ubiquitin conferences' and brought together leading international experts in the ubiquitin field, as well as early career researchers and students. The conference explored protein ubiquitination in relation to structural, molecular and cellular biology, showcasing new discoveries that have expanded our understanding of ubiquitin and ubiquitin-like proteins, in particular in areas such as cancer biology, neurological and infectious diseases.

This conference provided an intimate environment where early career researchers and students like myself were able to interact with invited speakers over breakfast, lunch and dinner. While bringing together researchers from all other world, I was the only attendee from Australia and one of only four from the Southern Hemisphere! My submitted abstract had been selected for a talk and I received some really great and helpful feedback on the research I presented. Mine was the only work to be presented on the malaria parasite and it felt great to share my unique perspective and experience. This was also the final conference presentation I will give of my PhD research and it was a lovely way to conclude four years of hard work!

The location of Aspen Snowmass provided a beautiful backdrop for the conference. Although this region is more famous for its winter sports, the milder summer climate was lovely and provided an opportunity to engage in summer activities, such as white water rafting along the Colorado River and hiking through the beautiful mountains. It was incredible to see the Maroon Bells in real life, rather than on the desktop of my MacBook! The conference concluded with a music concert on the slopes of Snowmass, which was a great opportunity to get to know my new conference friends better. During my trip to Colorado, I was also able to visit the Grand Canyon and was amazed by the beauty and vastness of this incredible natural formation.

Finally, I would once again like to express my thanks to the ASBMB for providing the opportunity to complete this travel. It was an incredibly rewarding experience and a reminder of how lucky I am to be able to pursue the thing I am most passionate about as a career and to be able to do so in a beautiful environment!

Jess Bridgford is a postdoctoral researcher in the Structural Biology Division of the Walter and Eliza Hall Institute for Medical Research.

Jess at the Maroon Bells, Aspen, Colorado.

ASBMB Fellowship Report

Suzhou – Where Immunology Meets Ancient History

Thanh Kha Phan.

I have been a massive fan of ancient Chinese culture since I was a kid. I was always excited whenever reading a Chinese history book, in which old stories never got old but instead were vividly relived through my imagination. That often got me in trouble with my mum, as I would rather stay up late to wander through my *Three Kingdoms* world than finish my biology homework. Needless to say, she was utterly surprised (and pleased) that I became a cell biologist, instead of a Chinese historian, or an archaeologist. Nevertheless, experiencing ancient China remained a major bucket list item, and I even started learning Chinese earlier this year. Little did I know my opportunity to visit China would come soon after. I was announced as a 2018 ASBMB Fellowship awardee, which allowed me to attend the Frontiers of Immunology in Health and Disease conference, held by Cold Spring Harbor Asia, in Suzhou (historically part of Eastern Wu, one of three major states in Three Kingdoms period). This was such a perfect opportunity for an innate immunity and *Three Kingdoms* fanatic like me.

I arrived in Suzhou a few days before the conference to get myself familiarised with the area, which (purposely and conveniently for me) covers about a 150 km radius encompassing Shanghai, Hangzhou and Suzhou itself. I found myself completely lost in the hustle and bustle of modern Shanghai, in the picturesque charm and culinary brilliance of Hangzhou, and the oddly nostalgic antiquity of Suzhou. I loved wandering the old towns, imagining life in the past and feeling thousands of years of history re-enacting in front of my eyes.

Following that were five intense days at the conference. The meeting featured impressive, high-quality scientific presentations and open discussions from enthusiastic scientists from all over the world, with diverse interests in immunology. I was stunned to see so much new and exciting immunology research happening across the globe, from the recent discovery of new lymphoid cell subsets to novel immune checkpoints and lots more. More excitingly, I was there, listening to some of the most prominent immunology researchers, particularly Dr Tak Wah Mak who is renowned for his discovery of T-cell receptor and CTLA-4. His talk on the present and future of immunology research as well as his encouraging message to young researchers in the audience profoundly inspired me. I also had an interesting discussion with Dr Feng Shao, a respected pyroptotic cell death researcher, on a few aspects relevant to my current postdoctoral studies.

I was also fortunate enough to give an oral presentation on my PhD work at the Hulett laboratory, pioneers in characterising the interaction between phosphoinositides and human antimicrobial peptides and its importance in mediating tumour cell membrane permeabilisation, fungal cell killing and inflammation. It was thrilling and nerve-wracking at the same time, considering the size and the profile of my audience. I was very relieved to learn that my work attracted a fair bit of attention afterwards.

Encountering ancient China, advertising my PhD findings and making connections for my postdoctoral work in one journey – it was certainly a sweet bargain. Attending the Frontiers of Immunology in Health and Disease conference was undoubtedly a one-of-a-kind experience for me, which substantially contributed to my research progress and career development. I am deeply grateful for the support from the ASBMB for this opportunity.

Old Suzhou water town.

Thanh Kha Phan is a postdoctoral researcher at the La Trobe Institute for Molecular Science, La Trobe University.

ASBMB Fellowship Report

MSMS: Manchester Summer of Mass Spectrometry

It has been an honour to receive the Fred Collins Fellowship during the fourth year of my PhD. This allowed me to travel to the University of Manchester, England, to complete experiments for my PhD in the laboratory of Professor Perdita Barran.

Professor Barran is a world leader in native mass spectrometry (MS) and ion mobility of small molecules and proteins. Her expertise was utilised to assist the structural analysis of fungal biotin protein ligases, enzymes with the potential as targets for novel antifungal therapeutics. Typical structural techniques (such as X-ray crystallography and NMR) have not been successful for these enzymes, so I have utilised MS approaches. Whilst I had begun MS experiments at the University of Adelaide with Tara Pukala, this opportunity gave me the chance to complete further structural investigation with different techniques, including collision induced unfolding ion mobility and hydrogen deuterium exchange. These experiments revealed novel insights to these enzymes, providing exciting data for my PhD and publications.

It was a fantastic opportunity to experience working in another, much larger lab, having completed Honours and my PhD in the same lab. The exposure to a wide range of different mass spectrometers provided a great learning opportunity to discover many different applications of MS. It was also interesting to see the variety of projects and collaborations within the lab, from biological applications of MS through to instrument and method development. It was fitting to complete an MS-based placement in Manchester, as this is home to one of the most prominent MS manufacturers, the Waters Corporation.

The Barran Group by the Science Bee.

The Manchester Museum of Science and Industry, located in Manchester's old passenger railway station and warehouse that was built in the 1830s.

Minack Theatre built into the cliffs of the Cornish coast.

The castle on Saint Michael's Mount in Cornwall.

Manchester turned on a beautiful sunny stay for my visit with temperatures in the mid to high-20s. This perfect but unusual UK weather prompted much warning about the dangers of 'heat-waves', however, I found the weather quite pleasant. Weekends gave me the opportunity to explore this city, including the cathedral, the Museum of Science and Innovation, and the various decorated artistic bees installed around the city, as the worker bee is symbolic of Manchester and its industrial roots. I was also fortunate enough to be located in a great football (soccer) city during the final stages of the World Cup, especially since England made the semi-finals.

Furthermore, I took the opportunity to explore some other UK counties. This included the beautiful Devon with the wind-blasted Dartmoor National Park, Sommerset where I tasted local cheeses and ciders, and Cornwall with its beautiful coastline and beaches. I also visited many cathedrals, abbeys, and castles, and enjoyed the vastly different green landscapes of England.

Louise Sternicki is completing her PhD at the University of Adelaide, South Australia.

Forthcoming Meetings

ASBMB 2019

1–3 October 2019
Fremantle Esplanade Hotel, Perth

Call for Abstracts: 29 January 2019

Registration Opens: 1 April 2019

The conference is the biannual meeting of the Australian Society of Biochemistry and Molecular Biology (ASBMB). ASBMB 2019 will be held at the Fremantle Esplanade Hotel in Perth's port city of Fremantle, which is within walking distance of a range of reasonably priced restaurants, breweries, hotels and apartments. Plenary speakers include Lingling Chen and Tom Blundell.

Lingling Chen is a molecular and RNA biologist from the Shanghai Institute of Biochemistry and Cell Biology, China. She developed methods for the genome-wide discovery and characterisation of nonpolyadenylated RNAs, which led to the identification of sno-processed lncRNAs and circular RNAs. They also showed that some sno-processed lncRNAs are conspicuously absent in people with the neurodevelopmental genetic disorder Prader-Willi Syndrome.

Tom Blundell is a biochemist and structural biologist from the University of Cambridge, UK. He was a member of the team that solved the first structure of a protein hormone, insulin, and has since made contributions to structural biology of polypeptide hormones, growth factors, receptor activation, signal transduction and DNA double-strand break repair. He has been involved in drug discovery with many drugs moved to clinical trials. He has developed software for protein modelling and understanding the effects of mutations on protein function, leading to new approaches to structure-guided and fragment-based lead discovery.

The program will feature a number of other overseas plenary presentations and a number of society speciality lectures. Poster sessions, 3-minute poster presentations and a E/MCR mini-symposium are also planned. The scientific program of the conference will include the themes:

- Gene Editing
- RNA Biology
- Drug Discovery

Further information
www.asbmb2019.com.au

Conference Chair
Nicolas Taylor – nicolas.taylor@uwa.edu.au

Registration/Exhibition
Jacqui Roberts – jroberts@arinex.com.au

ComBio2020

29 September – 2 October 2020

Melbourne Convention and Exhibition Centre

Early Registration and Abstract Deadline: 26 June 2020

The conference is the combined meetings of the ASBMB, ASPS (Australian Society of Plant Scientists), ANZSCDB (Australia and New Zealand Society for Cell and Developmental Biology) and GSA (Genetics Society of AustralAsia).

We extend a warm invitation to you to be part of ComBio2020 to be held in the recently completed and spectacular extension of the MCEC which offers the latest and state of art' convention and exhibition facilities.

The program will feature a number of overseas plenary presentations from some of the best international scientists together with a number of society speciality lectures. Two poster sessions are also planned. The scientific program of the conference will include the themes:

- Plant Biology
- Development, Stem Cell and Regenerative Medicine
- Proteins, Peptides and Structural Biology
- Biochemistry and Metabolism
- Cell Biology and Signalling
- Genomics, Genome Editing and Systems Biology
- Evolutionary and Ecological Genetics
- Infection and Immunity
- Education

Further information
www.combio.org.au/combio2020

Conference Chair
Jackie Wilce – jackie.wilce@monash.edu

Conference Program Chair
Mark Hulett – m.hulett@latrobe.edu.au

Registration/Exhibition
Sally Jay – combio@asbmb.org.au

44th Lorne Conference on Protein Structure and Function

10–14 February 2019
Lorne, Victoria
This year the conference is offering a dedicated one-day Symposium focused on Drug Discovery and Development in addition to the latest in Protein Science.

Further information
Website:
http://www.lorneproteins.org/
Twitter:
https://twitter.com/LorneProteins

27th FAOBMB Conference

19–22 August 2019
Kuala Lumpur, Malaysia
The 27th FAOBMB Conference will have the general theme of 'Biomolecules: Networks and Systems' with Special Symposia on mosquito-borne illnesses. The Conference is supported by IUBMB on the occasion of MSBMB becoming an Adhering Body of the Union. A YSP event will take place 15–17 August 2019.

Further information
Email: faobmbkl2019@gmail.com
Website: www.faobmbkl2019.com

28th FAOBMB Conference

11–13 June 2020
Colombo, Sri Lanka
The 28th FAOBMB Conference will have the general theme of 'Biochemistry and Molecular Biology for the Future Generation'.

Further information
Email:
collegeofbiochemistssl@gmail.com

ASBMB Welcomes New Members

A warm welcome is extended to the following new members who joined ASBMB from 1 July 2017 to 30 June 2018

OVERSEAS
DR NICHOLAS ASHTON – USA
DR PO-CHIA CHEN – GERMANY
DR SARAWUT JITRAPAKDEE – THAILAND
DR PATRICK SHILLING – SWEDEN
MR SHINYA TSURUSAKI – JAPAN

ACT
A/PROF BRIAN BILLUPS
MS XUEXIN GAO
DR RIPPEI HAYASHI
MS SHAGUFTA IQBAL
MR MATTHIAS NACHTSCHATT
MISS ELIZABETH WHITTY
MISS XIAOJUN YUAN

NSW
DR MEKKAWY AHMED
MS AMJAD ALROSAN
MISS TARA BARTOLEC
MISS TAMIKA BLAIR
A/PROF ROGER BOURNE
MRS YAZMIN BROWN
DR NICOLE BRYCE
DR MICHAEL CAHILL
MISS ROSAMARI CANTO
MS ISABELLE CAPELL-HATTAM
MISS SAYANTANI CHATTERJEE
MISS BIQI CHEN
MS MEGAN CHERRY
MR KENNETH CHINKWO
MRS KATERINA CHRISTOFIDES
MR HUDSON COATES
DR KRISTINA COOK
MISS TAYLA-ANN COROCHER
MISS EMILY CROSS
MISS CLAUDIA D'AMARIO
MRS ROSHALI de SILVA
MS VINITA DESHPANDE
MS FIONA DEUTSCH
DR CLAIRE DICKSON
MS XIAOWEN DUAN
DR DOMINIC GLOVER
MISS KIMBERLEY HANSSEN
DR KARL HASSAN
MS SARAH HENDRIKUS
MS MEREDITH HILL
DR VICKY HOWE
DR PAUL JASCHKE
MISS NATHASHA JAYATILLEKE
DR CHRISTOPHER JONES
MISS ALISON KEARNEY
MS LYNN-JEE KIM
MR DESMOND LI
DR LIANG LI
MISS SHIVANJALI LINGAM
MR LOK MAN
MS RITI MANN
MISS DAYNA MASON
MRS RESMI MENON
A/PROF ANDREW MOORHOUSE
MS ELISE NEEDHAM
DR LEZANNE OOI
MS LYDIA QIAN
MRS ASHLEY QUIGLEY
MISS STEPHANIE RAYNER
MR ALEXANCER ROOKYARD
MS AZRAH SAMSUDEEN
MR RYAN SEPAROVICH
MR ABDULRHMAN SHATHILI
MISS DANIELA-LEE SMITH
MS NGAIO SMITH
DR TARA SPERANZA
A/PROF VLADMIR SYTNYK
MR DANIEL TAN
MISS SOFIYA TSIMBALYUK
MR DANIEL TURKEWITZ
DR STELLA VALENZUELA
PROF ANTOINE VAN OIJEN
MR RUSSEL VINCENT
MS EMILY VOHRALIK
MS JIA WANG
MS ASHLEY WONG
MISS JOHANNA WONG
DR GUANG YANG
PROF HONGYUAN YANG
DR CINDY YUET-YIN KOK
MS ARMELLA ZADOORIAN

NT
MR DIMITRIOS MENOUHOS

QLD
DR KATHIRVEL ALAGESAN
MS ELIZABETH ALLOTTA
MR FAISAL ALTEMANI
DR BRONWYN BULMER
MISS SIEARA CLAYTOR
MS YI CUI
Dr ZHENLING CUI
MR XING GUI
MISS MELISSA HILL
MISS JIAYUE JIANG
MISS MARIE KALKAUS
MR ZACHARIE LeBLANC
DR ALANNA SORENSON
A/PROF ROHAN TEASDALE
DR LUCIA ZACCHI

SA
MR YU CHINN CHEY
DR BLAGOJCE JOVCEVSKI

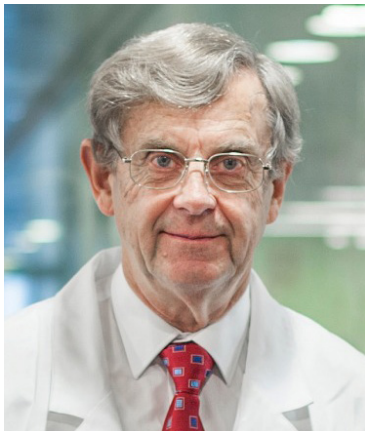
TAS
MS APARNA RAINA
MS EMMA WILKINSON

VIC
MISS MARIAH ALORRO
MR GAUTHAM BALAJI
DR RICHARD BERRY
DR KRISTIN BROWN
A/PROF MATTHEW CALL
MS ALISON CHEONG
MR SAI VARA PRASAD CHITTI
MRS KATHERINE FERNANDEZ
MR MIRIAM FUENTES GUIRADO
MISS KAREN GU
MR JOSHUA HARDY
DR JACKI HERAUD-FARLOW
MR JING YUAN HOW
DR MARK HULETT
MR KEVIN HUYNH
MS LAURA JENKINS
MR ALAN JOHN
MISS NARELLE KEATING
DR CHEN LI
MS TANYA LUPANCU
PROF JOHN MARIADASON
MR NAGARAJ MOILY
DR LAWRENCE MOK
MR IRVIN NG
MRS TIEN NGUYEN
DR BHUPINDER PAL
MR SRI RAMARATHINAM
MS CAMILLA REEHORST
MR ASHLEY ROZARIO
MR DHANASEKARAN SAKTHIVEL
MISS BO SHI
MR BRADLEY SPICER
MS REBECCA STEPHENS
MISS HEMA SUBAS SATISH
DR SAUMYA UDAGEDARA
DR DONNA WHELAN

WA
MRS KAMALPREET BRAR
MS CHI CAO
MRS DONA JATATUNGA
MS KARA PERKS
MR SEBASTIAN POHL

ASBMB Honours Loyal Members

In 2018, Tony Burgess, Christopher Driver, Ross Fernley, Ronald Hill, Ross Lilley and Margaret Smith reached the milestone of 50 years membership to the Society. They received certificates in recognition of their outstanding loyalty.



Tony Burgess.

Ross Fernley.

Ronald Hill (left) and Ross Lilley attended ComBio2018 where they were awarded certificates by ASBMB President Leann Tilley.

ASBMB Annual Reports

President's Report

ASBMB President Leann Tilley.

ComBio2018

ComBio2018, under the leadership of Convenor Professor Liz Harry (Director, The ithree institute, University of Technology, Sydney) was held at the new International Convention Centre Sydney on the Darling Harbour waterfront, and was an outstanding success. Annemiek Beverdam (University of New South Wales) did a fantastic job as Chair of the Program Committee, working with Deputy Chair Brent Kaiser (University of Sydney), a plant molecular physiologist. Marc Kvansakul (La Trobe University) served as Treasurer and Tatiana Soares da Costa (La Trobe University) as Social Media convener. The Early Career Development forum was contained within the jam-packed three-day meeting.

ASBMB coordinates ComBio as a national scientific conference with colleagues from the ANZSCDB and ASPS Societies. This year, the New Zealand Society for Biochemistry and Molecular Biology (NZSBMB) and the New Zealand Society of Plant Biologists (NZSPB) agreed to join ComBio2018; and the International Society of Differentiation held their annual meeting as part of the conference.

The ComBio2018 team put together a fantastic Program that featured outstanding international speakers, alongside a range of high calibre Australian presenters, with good gender, age and regional diversity. The 2018 meeting had themes in Plant Biology Developmental, Stem Cell and Regenerative Biology Immunology, Infection, Host Proteins and Structural Biology, Omics, Epigenetics and Bioinformatics, Cell Biology and Signalling, Biochemistry and Metabolism, Emerging Technologies and Education.

We were very pleased to attract Professor Randy Schekman (2013 Nobel Prize for Machinery Regulating Vesicle Trafficking) as the Grimwade Keynote Plenary speaker. He was a major drawcard and delighted and challenged the audience with his work and ideas. He also participated in an ECR lunch. I thank the University of Melbourne for providing the Grimwade speaker support that enabled us to attract Randy Schekman as a high profile speaker.

Other Plenaries of particular interest to ASBMB members included: Paula Cannon, University of Southern California, USA (CRISPR/ Gene editing/ HIV) as the ASBMB-supported speaker, Nieng Yan, Princeton University, USA (Structural Biology/ cryoEM); Elizabeth Robertson, University of Oxford, UK (Transcriptional regulators of mammalian development); Gary Brouchard, McGill University, Canada (Cytoskeletal morphology); and Ellen Lumpkin, Columbia University, USA (Signal Transduction).

I would like to thank Sally Jay for her efforts in the organisation of the ComBio2018 meeting. Particularly worthy of mention is the excellent support from Trade this year. A high level of income from the trade exhibition will result in a substantial surplus.

ASBMB 2018 Award recipients

Congratulations to Professor Jamie Rossjohn, Monash University, who delivered an inspiring 2018 Lemberg Medal lecture on immune sensing of non-peptidic antigens. Associate Professor Mehdi Mobli, University of Queensland, delivered the Merck Medal lecture on probing the structural details of ion-channel function using venom peptides. Congratulations also to Professor Bostjan Kobe for the award of the Beckman Coulter Discovery Science Award. The Eppendorf Edman Award was presented to Dr Rajesh Ghai, University of Queensland; the Shimadzu Education Award to Dr Tracey Kuit, University of Wollongong; and the Bioplatforms Australia Award to Dr Simon Cobbold, University of Melbourne. The ASBMB Fellowships were awarded to Ms Louise Sternicki, University of Adelaide (including the Fred Collins Award); Dr F. Hafna Ahmed, Australian National University; Dr Jessica Bridgford, University of Melbourne; and Dr Thanh Kha Phan, La Trobe University.

I was pleased to celebrate the following colleagues who have been members of the Society for 50 years: Professor Tony Burgess, Dr Christopher Driver, Dr Ross Fernley, Dr Ronald Hill, Assoc Prof Ross Lilley and Dr Margaret Smith. Dr Ross Lilley and Ronald Hill (54 yr) attended ComBio2018 to collect their certificates.

ASBMB 2019 meeting

The 2019 ASBMB meeting (1–3 October, Fremantle) represent the first of the new style stand-alone ASBMB meetings. Nic Taylor, Charlie Bond and their Local Organising Committee are organising a three-day meeting at Esplanade Hotel in Fremantle, building on the very successful ASBMB-supported meeting that is already held biannually, in Western Australia. The themes are: RNA Biology, Gene Editing, Drug Discovery. Invited plenaries will include: Professor Lingling Chen, China (long non-protein coding RNAs) and Professor Sir Tom Blundell (fragment based drug discovery); with co-support from the Grimwade Fund, University of Melbourne.

ComBio2020

ComBio2020 will be held 29 September–2 October at the Melbourne Convention Exhibition Centre. Associate Professor Jackie Wilce will serve as Conference Chair and

Dr Mark Hulett as Program Chair. They are very organised and the planning is already well underway.

2021 ASBMB meeting

We have been approached by Associate Professor Wayne Patrick and Associate Professor Monica Gerth regarding a proposal for a joint ASBMB–NZSBMB–NZSM–Federation of Asian and Oceanian Biochemists and Molecular Biologists (FAOBMB) meeting in New Zealand in 2021. The proposal is in keeping with our commitment to interact with New Zealand colleagues every three years.

Bid for IUBMB Congress in Melbourne in 2024

Australia will host the 26th International Congress of Biochemistry and Molecular Biology (IUBMB World Congress) in 2024 in Melbourne. A strong delegation presented a successful bid to the IUBMB Executive Committee on 4 June 2018 at the COEX Convention Center in Seoul, Korea.

The Congress will be held 22–26 September at the Melbourne Convention and Exhibition Centre with the theme Biomolecular Science: Discover, Create, Innovate. The Congress will be hosted by ASBMB and will build on the well-established arrangements for ComBio meetings involving ASBMB, ANZSCDB and ASPS. The Australian Society for Microbiology (ASM) and the NZSBMB have agreed to hold their annual meetings as part of the Congress. Importantly, the FAOBMB have also agreed to join the 2024 Congress in Melbourne. The meeting will be a joint IUBMB 26th Congress, FAOBMB 17th Congress and ComBio 19th Conference.

The conference will explore the future of biomolecular science in Australia and internationally. The Program will highlight and explore major topics, questions and controversies in biomolecular research. The Congress will be a launch-pad for a strategic vision for biomolecular science in Australia for the next decade. Forums will be held to engage with decision makers and Government. An industry engagement program will showcase the best of Australian translational science. Media engagement events will offer the opportunity to present work to the public.

Additional societies are being approached to build the meeting into a major platform for showcasing Australian science. A Prospectus has been prepared that highlights the excitement of the meeting and the opportunities for and benefits of engagement with IUBMB2024 in Melbourne. The organisers anticipate a very exciting conference, with high value and low costs for delegates, and with a robust bottom line.

The Local Organising Committee Executive comprises: Professor Leann Tilley, University of Melbourne (Chair); Professor Christina Mitchell, Monash University (Deputy Chair); Associate Professor Danny Hatters, University of Melbourne (General Secretary and Meeting Chair); Professor Andy Hill, La Trobe University (Program Chair); Associate Professor Terry Piva, RMIT University (Treasurer); Professor Paul Gleeson, University of Melbourne (FAOBMB Representative), Dr Tatiana Soares da Costa, La Trobe University (Communications Representative); and Professor Janet Macaulay, Monash University (Education Representative).

Council matters: thanks, honours and changes

I am very pleased that Council saw fit to recognise a number of distinguished biochemists and molecular biologists who have rendered notable service to the Society as Honorary Members of the Society. Professor Peter Gunning (University of New South Wales) is best known for his discovery of key principles underlying the architecture of cells and is recognised for his services as ASBMB President, 2013–2014. Associate Professor Marie Bogoyevitch is well known for her work on signal transduction, especially the regulation of protein kinases, and is recognised for her services as ASBMB Secretary, 2007–2010, and Chair of ComBio2015. Professor Paul Attwood is known for his work on enzymology and protein histidine phosphorylation, and is recognised for his services as ASBMB Secretary, 2011–2015. Sally Jay was awarded Honorary Membership in recognition of her work as Secretary for Sustaining Members, 1998–present.

I would like to thank Associate Professor Marc Kvansakul (La Trobe University) for his work this year in the role of Treasurer. Congratulations to co-Editors Dr Suresh Mathivanan and Dr Tatiana Soares da Costa (both La Trobe University) who are doing a wonderful job revitalising the *Australian Biochemist*. Thanks to Liana Friedman, Professional Editorial Assistant for the *Australian Biochemist*, for her efforts on behalf of the Editorial team. Thanks to Terry Piva as ASBMB's FAOBMB representative and for his role as Treasurer for the IUBMB bid. I thank the State representatives, Kate Brettingham-Moore (TAS), Erinna Lee (VIC), Matthew Johnson (ACT), Kate Quinlan (NSW), Ben Schulz (QLD), Mark Corbett (SA) and Monika Murcha (WA). We are very keen to involve the State Representatives in efforts to revitalise the membership and to articulate the activities of the Society to members. I extend particular thanks to Professor Briony Forbes for her tireless work as ASBMB Secretary. There is an enormous amount of behind-the-scenes work and she is the backbone of the Executive group. I am very pleased that Professor Joel Mackay (University of Sydney) will take up the position of President of ASBMB in 2019, and I look forward to working with him in 2019.

As this is my last Council report as ASBMB President, I would like to thank everyone for their support during my term. ASBMB and ComBio are evolving rapidly, thanks to the enormous efforts of all involved. I am confident that both the Society, and the meetings we organise, will continue to prosper and will meet the needs of the next generation of biochemists and molecular biologists.

Professor Leann Tilley, President

ASBMB Annual Reports

Treasurer's Report

ASBMB Treasurer Marc Kvansakul.

Relevant summaries of the full audited report (1 July 2017 to 30 June 2018) should be read in conjunction with this statement.

The overall position of the Society is better than that of 2017. We recorded a healthy operating profit of $14,589, whereas a small operating loss of $4,821 was recorded in 2016–2017 and a small profit of $3,946 in 2015-2016. This year's outcome builds on the substantial improvement to the Society's financial position compared to the losses sustained in the 2012–2015 period ($94,574 in 2014–2015; $84,646 in 2013–2014; $88,567 in 2012–2013). The major reason for the increase in profit was the success of ComBio2017 in Adelaide. ComBio2017 was the first three-day conference we have run, and like Brisbane in 2016, was held a week after the common university break.

In addition to the highly positive financial outcome from ComBio2017, recent cost cutting measures have also impacted positively. These include shifting the *Australian Biochemist* to an electronic format, and using video Council and Executive meetings, which has worked very well.

The major sources of income for ASBMB are membership revenue, ComBio profit and bank interests. Overall, our revenue for 2017–2018 was up $15,909 from 2016–2017. Membership revenue remains the major source of income for the Society (68% total income in 2017–2018) which has remained stable compared to last year. Advertising income increased to $2,480 compared to $800 in 2016–2017. Sally Jay is to be commended for maintaining ASBMB's strong relationship with the large number of trade exhibitors at ComBio, as their presence contributes to the success of this conference. ComBio2017 in Adelaide generated income of $44,073 (our profit share was $25,382), which was a significant increase ($14,692) to that generated by ComBio2016. The ComBio2017 audit was finalised in March and the profit has since been distributed to all member societies. Corporate support for our named awards remains strong and, on behalf of the Society, I thank them for their support of these awards. Interest on our accounts remained steady in 2017–2018 due to stability in the official interest rate.

Net expenditure in the 2017–2018 financial year was down $3,501 compared to the previous period (2016–2017), enabling the Society to make a healthy profit during this year. Expenses incurred in running the National Office were a little less than in 2016–2017. We are fortunate that Sally and Chris Jay manage the National Office with a high degree of effectiveness while keeping their costs relatively stable. Our flagship publication is the *Australian Biochemist* and it is available to members as a downloadable PDF. This has significantly reduced the cost of publishing this magazine. Both previous Editor Chu Kong Liew and current co-Editors Suresh Mathivanan and Tatiana Soares da Costa, along with Editorial Officer Liana Friedman, are to be commended for their work in putting the magazine together. Reduced meeting costs were achieved by the Executive and Council holding teleconferences. The distribution of funds to the states and SIGs were a little below that in 2016–2017.

The overall financial position of the ASBMB improved compared to that recorded in 2016–2017. As the balance sheet indicates, we enjoy total assets of $543,737 and a total equity of $431,609 when liabilities are taken into account. Cash holdings have increased compared to 2016–2017, offsetting fewer trade and other receivables. During the past year, we have thus modestly increased our asset base, aided by the profit we made ($14,589). As indications are that ComBio2018 will return a very substantial profit, we should be able to continue on our path to rebuild our financial asset base after several years of recording losses. It remains imperative that the Society, through its State Representatives and SIG leaders, undertakes an active recruitment drive to attract more members.

Whilst this year's conference was a three-day meeting in Sydney, it generated a healthy profit, despite being held a week later than usual. Consequently, I remain optimistic that despite issues with timing of ComBio, we can continue to use income derived from ComBio to support many of our activities. Now that most aspects of the Society's expenditure have now been minimised, we must look at ways we can generate new sources of income in order to maintain our financial base. One way we can help the Society as members is that we should actively promote the ASBMB and its benefits, and encourage colleagues and postgraduate students to become members.

I have many people to thank in my role as the ASBMB Treasurer. Members of the ASBMB Executive are always constructive and supportive, Sally and Chris Jay (ASBMB National Office), Ian Price (ASBMB Bookkeeper), Priestleys (ASBMB accountants) and Mr Brian Hiley (ASBMB auditor). This was my first report as Treasurer after taking over from Terrence Piva. I would like to thank him for making the transition into this role very straightforward, and leaving the Society on an upward financial trajectory.

Associate Professor Marc Kvansakul, Treasurer

ASBMB Annual Reports

Executive Officers' Report

Your Executive Officers submit herewith the financial statements of the Association for the year ended 30 June 2018, together with the Auditors' Report thereon and in accordance with Section 73 of the Associations Incorporation Act 1991 report as follows.

EXECUTIVE OFFICERS

The Executive Officers throughout the year were: Professor Leann Tilley (President); Professor Michael Ryan (Past President); Professor Joel Mackay (President Elect); Professor Briony Forbes (Secretary); Associate Professor Terrence Piva (Treasurer, until 31/12/2017); Associate Professor Marc Kvansakul (Treasurer, from 1/1/2018); Associate Professor Suresh Mathivanan (Editor); Professor Paul Gleeson (FAOBMB Representative, until 31/12/2017); Associate Professor Terrence Piva (FAOBMB Representative, from 1/1/2018).

PRINCIPAL ACTIVITIES

The principal activity of the Association in the course of the financial year was the advancement of the science and profession of both biochemistry and molecular biology.

OPERATING RESULTS

During the year, the Association produced an operating profit of $14,589 (2017: operating loss $4,821).

STATEMENT BY EXECUTIVE OFFICERS

In the opinion of the Executive Officers the financial statements, consisting of the Statement of Profit and Loss and other Comprehensive Income, Statement of Financial Position, Statement of Changes in Equity, Statement of Cash Flows and Notes to and forming part of the Financial Statements:

(a) Presents a true and fair view of the financial position of the Association as at 30 June 2018 and its performance for the year ended on that date in accordance with Australian Accounting Standards – Reduced Disclosure Requirements.

(b) At the date of this statement, there are reasonable grounds to believe that the Association will be able to pay its debts as and when they fall due.

Signed in accordance with a Resolution of the Executive Officers.

Professor Leann Tilley, President
Associate Professor Marc Kvansakul, Treasurer

Independent Auditor's Report

REPORT ON THE FINANCIAL STATEMENTS

We have audited the financial report of the Australian Society for Biochemistry and Molecular Biology Incorporated (the association) which comprises the statement of financial position as at 30 June 2018, the statement of profit or loss, statement of comprehensive income, statement of changes in equity and statement of cash flows for the year then ended, notes comprising a summary of significant accounting policies and other explanatory information, and the certification by members of the committee on the annual statements giving a true and fair view of the financial position and performance of the association.

EXECUTIVE OFFICERS' RESPONSIBILITY

The committee of the association are responsible for the preparation and fair presentation of the financial statements in accordance with Australian Accounting Standards – Reduced Disclosure Requirements and the Associations Incorporations Act 1991, and for such internal control as the directors determine is necessary to enable the preparation of a financial report that is free from material misstatement, whether due to fraud or error.

BASIS FOR OPINION

We conducted our audit in accordance with Australian Auditing Standards. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Report section of our report. We are independent of the association in accordance with the ethical requirements of the Accounting Professional and Ethical Standards Board's APES 110: Code of Ethics for Professional Accountants (the Code) that are relevant to our audit of the financial report in Australia. We have also fulfilled our other ethical responsibilities in accordance with the Code.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

AUDIT OPINION

In our opinion, the accompanying financial report of the Australian Society for Biochemistry and Molecular Biology Incorporated is in accordance with the Associations Incorporation Act 1991 including:

(i) giving a true and fair view of the association's financial position as at 30 June 2018 and of its performance for the year then ended; and

(ii) that the financial records kept by the association are such as to enable financial statements to be prepared in accordance with Australian Accounting Standards – Reduced Disclosure Requirements.

MC Andreassen (Partner)
Priestleys Chartered Accountants

AUSTRALIAN SOCIETY FOR BIOCHEMISTRY AND MOLECULAR BIOLOGY INCORPORATED

STATEMENT OF FINANCIAL POSITION AT 30 JUNE 2018

	2018 $	2017 $
CURRENT ASSETS		
Cash and cash equivalents	472,633	452,363
Trade and other receivables	71,104	79,961
Other current assets	112	2,873
TOTAL CURRENT ASSETS	**543,849**	**535,197**
NON-CURRENT ASSETS		
Property, plant and equipment	-	-
TOTAL NON-CURRENT ASSETS	**-**	**-**
TOTAL ASSETS	**543,849**	**535,197**
CURRENT LIABILITIES		
Trade and other payables	112,128	118,065
TOTAL CURRENT LIABILITIES	**112,128**	**118,065**
TOTAL LIABILITIES	**112,128**	**118,065**
NET ASSETS	**431,721**	**417,132**
EQUITY		
Retained surplus	431,721	417,132
TOTAL EQUITY	**431,721**	**417,132**

STATEMENT OF CASH FLOWS FOR THE YEAR ENDED 30 JUNE 2018

	2018 $	2017 $
CASH FLOWS FROM OPERATING ACTIVITIES		
Receipts from members	95,500	95,473
Conference income	38,046	6,477
Other income	16,077	13,141
Payments to suppliers and employees	(140,014)	(154,120)
Interest received	10,661	10,853
Net cash provided by/(used in) operating activities	**20,270**	**(28,176)**
CASH FLOWS FROM INVESTING ACTIVITIES		
Payment for property, plant & equipment	-	-
Net cash provided (used) by financing activities	**-**	**-**
Net increase/(decrease) in cash held	20,270	(28,176)
Cash at the beginning of the financial year	452,363	480,539
Cash at the end of the financial year	**472,633**	**452,363**

REVENUE

	2018 $	2017 $
Operating activities		
Administration Fund		
Subscriptions – ordinary, student, retired and Sustaining Members	90,238	86,103
Conference income	25,382	16,380
Advertising and insert in proceedings and magazines	2,480	800
Other Income	12,020	10,600
	130,120	**113,883**
Non-operating activities		
Interest received – Administration Fund	10,731	10,640
Donations	127	546
	10,858	**11,186**
Total Revenue	**140,978**	**125,069**

EXPENSES

	2018 $	2017 $
Other expenses from ordinary activities		
Affiliate memberships	14,415	15,020
Awards and medals	19,400	13,900
Conference support costs	10,351	10,370
Council expenses	4,887	5,316
Insurance	1,176	1,116
National Office costs	38,831	42,270
Magazine costs	9,707	6,974
Other costs	3,456	3,659
State allocations	9,216	11,892
Website expenses	-	6,523
Remuneration of auditor		
- audit or review services	2,850	2,150
- other services	2,100	2,200
ASBMB Fellowship – Research Fund	10,000	8,500
	126,389	**129,890**

CASH AND CASH EQUIVALENTS

	2018 $	2017 $
Cash at bank – Administration Fund	472,633	452,363
	472,633	**452,363**

TRADE AND OTHER PAYABLES

	2018 $	2017 $
Current		
Accrued expenses – Administration Fund	2,406	2,336
ComBio/OzBio conference receivables	32,720	41,925
Other deposits paid	278	-
Advances to state committees	35,700	35,700
	71,104	**79,961**

RETAINED SURPLUS

	2018 $	2017 $
Administration Fund		
Retained surplus at beginning of the year	417,132	414,595
Net surplus (deficit) attributable to the Fund	14,589	2,537
Retained surplus at the end of the year	**431,721**	**417,132**
Research Fund		
Retained surplus at beginning of the year	-	7,358
Net surplus (deficit) attributable to the Fund	-	(7,358)
Retained surplus at the end of the year	**-**	**-**
Total Retained surplus at the end of the period	**417,132**	**417,132**

All sums given in Australian Dollars.

Our Sustaining Members

ASBMB welcomes the following new Sustaining Members:

Cyagen Biosciences, China

DKSH Australia Pty Ltd, VIC

Liebherr, VIC

LI-COR®

The culmination of years of innovation, the LI-6800 Portable Photosynthesis System is part of a new era of photosynthesis learning and discovery. The sensor head design gives you automated control over all of the environmental conditions to which the leaf is subjected – temperature, CO_2 concentration, humidity, light, and flow rate – for unprecedented measurements of plant physiology. Improved plumbing in the sensor head, along with tighter tolerances on gas analyzers and the CO_2 mixer, are all part of Rapid Sensing™ Technology. These advancements unlock new research possibilities for you, including:

Fast Survey Measurements

System achieves stability in as little as 45 seconds, for the fastest survey measurements of any portable photosynthesis system – without sacrificing data accuracy or precision.

Rapid Response Curves

A patented air flow division inside the sensor head reduces diffusion and allows for a rapid exchange of air from the leaf chamber to the gas analyzers, making new techniques like the Rapid A-C_i Response (RACiR™) Method possible.

Integrated Gas Exchange and Fluorescence

The LI-6800 is capable of making simultaneous gas exchange and chlorophyll fluorescence measurements over the same 6cm^2 leaf area, making it possible to study the role of alternative electron sinks and more accurately estimate mesophyll conductance.

gloria.lekai@licor.com
www.licor.com

cyagen

Cyagen is the world's leading provider of custom mouse and rat models. Cyagen's services have become well known for the top quality, 100% money back guarantee, and competitive prices. To date, we have delivered over 26,000 custom knockout, knockin and transgenic lines for its increasing customer base in over 1,000 universities and companies worldwide, contributing to the publications of over 2,300 high quality research papers.

We work closely with a wide range of clients from leading academic institutions, such as University of Cambridge, University of California, San Francisco, University of Oxford and so on. We hope to help you accelerate your research sincerely!

Main Services

- **Mouse model generation:** including knockout, knockin, humanization, transgenic, CRISPR and more.
- **Rat model generation:** including transgenic, knockout, knockin and CRISPR.
- **TurboKnockout®:** our ground breaking accelerated ES-cell based approach which can provide conditional models on a CRISPR timeline without off target effects and CRISPR limitations.
- **CRISPR/Cas9 based service:** comes with a germline guarantee, affordable price and complete project management from vector construction through F1 breeding and genotyping.
- **PiggyBac transgenic service:** get your single copy transgenic mice in as fast as 3 months.

Cyagen US Inc
Tel: +1 408-969-0306
Email: service-apac@cyagen.com
www.cyagen.com

abcam

Expand your Immunological Skills with Abcam!

New training courses from Abcam:

Abcam offers a set of free online training programs that give you the tools you need to develop your skills and further your science. We introduce you to essential protocols and practices and take you from beginner to expert in some of the most popular immunoassays. Courses include Western Blot, Antibody Basics, Fluorescent Imaging, Immunohistochemistry and Flow Cytometry. Complete the courses to receive a digital certificate for your efforts! Register online at go.myabcam.com/training

Also take advantage of our new protocol book, covering ELISA, WB, IP, IHC, ICC and ChiP! The Abcam protocol book is available for download at www.abcam.com/protocols/protocols-book containing all the tips and troubleshooting you need!

New enzyme linked immunosorbent assay (ELISA) guide:

ELISA is a widely established technology to detect the presence of antigens in samples. Whether you are considering setting up your own ELISA or use one of our ELISA kits, you will find all the information you need in here. A complete guide to ELISA that takes you from basic ELISA principles through to protocols, analysis, and troubleshooting. You can download a copy of the new Abcam ELISA guide at www.abcam.com/protocols/the-complete-elisa-guide

Our Sustaining Members

LiveCyte: Every Cell Tells a Story

The LiveCyte™ imaging and cell analysis system from Phasefocus is a new modality that employs **Ptychographic Quantitative Phase Imaging (QPI)**. This technology leverages phase shift information to generate high contrast cell images under low levels of light intensity, allowing individual cells to be identified and tracked for prolonged periods without the need for perturbing labels. This ability to image under a more natural environment with reduced risk of phototoxicity not only supports the use of sensitive cell types such as primary and stem cells, but also enables viable cells to be recovered for subsequent analysis.

Benefits of LiveCyte:

- Easy to use live cell imaging system is non-invasive, label and artefact-free.
- Low phototoxicity, ideal for imaging sensitive precious primary cells.
- Continuous field of view with no loss of resolution enables highly motile cells to be tracked during long time-lapse imaging.
- Automated tracking software monitors changes in individual cells, through multiple cell divisions eliminating the need for manual processing.

Livecyte represents a rapid and cost-effective means of gaining deeper insights into biological processes, associated with a wide range of disease conditions with positive implications for drug discovery and development of personalised medicine.

For further details contact us
ATA Scientific Pty Ltd
(02) 9541 3500
enquiries@atascientific.com.au
www.atascientific.com.au

IHC PAP Pen

The Enzo Life Sciences IHC PAP Pen (ADI-950-233) provides a thin, film-like water repellent barrier when a circle is drawn around a specimen on a glass slide. This barrier creates the proper surface tension to hold antibody solution within the target area on the slide. This avoids repeated wipeout around the specimen during staining procedures. Since the reagent is guarded by the hydrophobic circle around the tissue, it minimises the undesirable dilution of the reagents with the wash buffer. This pen can be used for PAP, ABC, immunofluorescence method, frozen sections, and *in situ* hybridisation procedures. Two specimens separated by two circles can be applied to the same slide.

The pen is applicable to microwave staining and *in situ* hybridisation. Circles made by the pen are heat resistant up to 120°C, ready to be used directly on wet slides, insoluble in alcohol and acetone, and withstand rehydration and dehydration steps in alcohol. If desired, circles can be removed by xylene after the staining procedure is complete.

Enzo Life Sciences products are available from Sapphire Bioscience in Australia and New Zealand.

Sapphire Bioscience Pty Ltd
(02) 9698 2022
sales@sapphirebioscience.com
www.sapphirebioscience.com

DAINTREE scientific AUSTRALIA

Daintree Scientific Australia is proud to present GelBox by Coyote Bioscience, the breakthrough high-speed electrophoresis system. Compact in size and lightweight, the GelBox is an ideal solution for labs where space is at a premium. The system integrates a separation system using disposable gel cassettes and electronic imaging system in one device, providing a complete electrophoresis system to analyse PCR products. Run time is 15 minutes and data or images from the GelBox are received through wireless connectivity to your mobile device or laptop.

This portable unit has a footprint of 14.6 x 14.6 x 14.2cm (LxWxH) and weight of 2.5kg. The unit is powered by a 12V DC Universal power supply or 12V DC battery pack.

The precast Gel is composed of agarose gel (0.8%, 1.0%, or 1.2%) with 13 lanes and an effective area of 90mm x 100mm. The gel has a sensitivity of 1ng, resolution of 100bp–6kb and can accommodate a sample volume of 1–10uL. The integrated dye is GelGreenTM from Biotium.

This handy device complements Coyote Bioscience's other specialist equipment, the mini-8 real time PCR system, Theater Slim PCR Cycler, Dry Bath, Tissue Grinders and the MD-Box Lab comprising a carrying case containing full solutions for a mobile molecular diagnostic laboratory.

Like the GelBox, all Coyote's other equipment is portable with a small footprint and powered by 12V DC power (power supply or battery).

Coyote Bioscience molecular diagnostics products are a welcome inclusion to the Daintree product range and a great addition for any lab with limited space.

For information please contact
Murdoch or Moina Macaskill
Daintree Scientific Australia
Web www.daintreescientific.com.au
Phone (03) 6376 3335
Email info@daintreescientific.com.au

Our Sustaining Members

Water Purification System: Wasserlab Autwomatic for Type I, II and III Lab Water

The new Autwomatic Plus 1+2 Water Purification System from Wasserlab is unique in its ability to produce three qualities of purified laboratory water used direct from the mains water supply:

- Type I Ultrapure Water for HPLC, ICP-MS, IC, TOC Analysis, Molecular Biology, PCR, Cell Culture, DNA Sequencing and Monoclonal Antibody Production.
- Type II Pure Water for general laboratory applications such a preparation of microbiological culture media, reagents and buffers, RIA/ELISA, Atomic Absorption and Flame Spectrophotometry.
- Osmotised water for cleaning of feeding autoclaves or washing machines.

This system can be connected directly to the tap water to produce Type I, II and III water to the ASTM standard.

The system is offered in several models, with Type II water production rates of 3, 5 or 10L/hr, and with storage tank options of 10, 30 and 50L.

Type I water is produced at 1.1L/min. An integrated UV lamp (185/254nm) reduced organic contamination to <3ppb and the ultrafiltration module ensure a bacterial counts of <1cfu/mL and endotoxins are <0.03IU/mL.

Dispensing is manual, time-controlled or volume-controlled.

All parameters can be monitored via an 11cm touch screen, and detailed information such as the hours of installation, hours of operation and volumes produced is easily accessible. the cartridge system facilitates quick and easy drip-free changes.

Contact **Capella Science**
02 9575 7512
enquiries@capellascience.com.au
Details at www.wasserlab.com/en

The CLARIOstar® with ACU Enables Real-time Measurements in a Controlled Atmospheric Environment for Assessment of Cell Death

Cell death is an important factor in homeostasis and human disease. Defining the characteristics of cell death and understanding response kinetics of targeted cytotoxic and cytoprotective agents is vital for understanding pathology, treating cancer or neurodegeneration.

Traditional experimental approaches for measuring the pattern of cell death and response kinetics in real time are often time consuming, labour intensive, costly and inadequate. In addition, maintaining an appropriate environment for cell-based applications can be difficult.

BMG LABTECH's CLARIOstar microplate reader with atmospheric control unit (ACU) gives exceptional performance with fluorescence, luminescence and absorbance measurements, whilst providing independent and simultaneous regulation of temperature and gas environments for cell culture. The ACU's unique gas ramping function is extremely useful for hypoxic and ischemia/reperfusion assays, regulating appropriate CO_2 and O_2 concentrations from 0.1% to 20%.

The combination of the CLARIOstar with ACU and use of Promega's RealTime-Glo™ Annexin V Apoptosis and Necrosis Assay provides a walk away solution for monitoring important cellular responses in real time, irrespective of when they occur. This allows researchers to establish the mechanism of action (apoptosis and necrosis) for cell death. In addition, time-dependent dose response curves can be generated from a single experiment.

For further details, read BMG LABTECH's application note at www.bmglabtech.com/real-time-assessment-of-apoptosis-and-necrosis/

LabGear AUSTRALIA

LabGear Australia are the proud exclusive suppliers of Syngene Imaging Systems. Syngene is a world leading supplier of gel documentation systems for rapid, accurate imaging and analysis of fluorescence and visible gels, multiplexed fluorescence westerns, stain-free gels and chemiluminescent blots. Syngene are 100% focussed on the scientific image analysis field and with over 30 years of experience the design of their products for gel documentation and fluorescence/ chemiluminescence imaging are all they have ever focused on developing.

With the Syngene products ranging from the economical NuGenius, the ultimate in compact gel documentation workstations that captures your images using a ground breaking 5 million pixel CCD camera giving superb pixel resolution and unrivalled sensitivity. To the G:BOX XX6/XX9, with the highest resolution cameras for imaging multiple sample types and sizes, from fluorescence 1D and 2D gels to chemiluminescent blots. You can have it all with the Syngene range of instruments, used globally by thousands of scientists. Successfully contributing accurate data to important projects in many of the world's top pharmaceutical companies and major research institutes, making the Syngene your preferred imaging option.

LabGear Australia's technical support team has a full range of spare parts and factory trained engineers that ensures quality service customers. Contact LabGear Australia today on 1800 LABGEAR (1800 522 432) or email sales@labgearaustralia.com.au

Our Sustaining Members

AXT Offers Quantitative Phase Imaging Upgrades for Your Existing Light Microscopes

AXT have recently been appointed the local distributor for Phi Optics, an innovative developer of Quantitative Phase Imaging (QPI) solutions for live cell and tissue microscopy. Phi Optics' modular solutions have been designed as simple add-ons for existing inverted light microscopes giving them detailed analytical capabilities.

The QPI systems from Phi Optics can be used to determine a host of properties of 2D and 3D specimens such as:

- Cell mass
- Cell volume
- Surface area
- Evolution of cells over time

The systems are suitable for imaging live cells, are non-invasive and label-free and require no sample preparation. They allow you to carry out live studies that vary in time from milliseconds to weeks. They also offer seamless overlay with other microscopy channels such as fluorescence.

Phi Optics currently offer two wide field imaging systems:

- GLIM – Gradient Light Interference Microscopy
- SLIM – Spatial Light Interference Microscopy

Both exploit phase shifts of the light passing through your specimens which is influenced by changes in optical density of different cellular components and structures.

While both systems provide details analysis of cells, cell colonies or even tissues, GLIM also offers the ability to work with sample over 350µm thick.

For more information contact
AXT Pty Ltd
02 9450 1359
info@axt.com.au
www.axt.com.au/phioptics

Explore New Possibilities with the FastDNA SPIN Kit for Soil

E Tournier *et al., MethodsX* (2015) 182–191

A comparison of the composition of microbial communities based on coextraction of both DNA and RNA can provide an insight into the ecology of populations, provided that DNA and RNA are subjected to the same extraction bias. This study describes the isolation of soil nucleic acids with simultaneous extraction and purification of DNA and RNA following a cascade scheme involving the FastDNA SPIN Kit for Soil, the FastPrep instrument and the Rnaid Kit and avoiding the use of harmful solvents.

- **Reproducible:** the coextraction protocol was optimized on a sandy clay loam soil. Yields of 26.7 µg of purified DNA and 4.5 µg of purified RNA per gram of soil were obtained with a very good repeatability for both DNA and RNA.
- **Reliable:** the four tropical soils from Madagascar were extractable and gave various DNA and RNA recovery yields sufficiently concentrated to be further analyzed by any other molecular technique.
- **Efficient:** the protocol was efficient on different tropical soils, including Andosol, while their high contents of clays, including poorly crystalline clays, and Fe and Al oxides usually make the nucleic acid extraction more difficult.

Download the complete publication

Learn more on the FastDNA SPIN Kit for Soil

MPBio
Karen MacLeod
Tel +61 2 8824 2100
Mob +61 423 079 728
mpbio.com

A New 3D Culture and Cell Suspension Medium

Fisher Biotec has been appointed as exclusive distributor in Australia for the new Happy Cell® Advanced Suspension Medium (ASM). Happy Cell® is a liquid matrix that has a multitude of uses.

It is a low viscosity cell culture medium that is cost effective, scalable, rapidly deployable and easy to use. It features a modified natural polymer suspension system that can be deactivated for imaging and microscopy or suspended cellular substructures and recovery of cell and tissue samples.

Uses include the formation of 3D multicellular structures, the expansion and growth of single cells, and enhancing the viability of primary cells. When no longer required, this suspension system can be inactivated, thereby simplifying sample preparation, downstream processing and cell harvesting. This medium creates an ideal platform for spheroid growth and high content imaging.

To provide the essential tools for culturing cells, Happy Cell® is available in a range of kit formats for Trial Experiments, and General Purpose Scale-up.

Further information:
https://www.fisherbiotec.com
info@fisherbiotec.com
Freecall 1800 066 077

Our Sustaining Members

BIONEER PACIFIC
Innovation • Value • Discovery

Bioneer Pacific as the Australian arm of Bioneer Corporation is a Melbourne-based company providing an extensive range of quality products for the molecular laboratory including:

- Synthetic DNA & RNA including Oligos, Probes, Gene Synthesis, siRNA, Mimics & Inhibitors.
- Plasmid prep and extraction systems including column-based plasmid Mini, PCR/Gel extraction & purification, RNA extraction as well as automation-based systems.
- Amplification reagents for PCR, qPCR, RT-PCR including Taq, High Fidelity Taq, SYBR green and other specialty enzyme-based reagents. Our RocketScript™ RT-Pre-Mix is thermostable (up to 70°C) and provides exceptional performance especially when complex secondary structures are present.

Website: www.bioneer.com.au
Tel: 1300 414 053
Email: contact@bioneer.com.au

BioNovus
• LIFE SCIENCES •

Nano-Traps are Ideal for Fast, Reliable and Efficient One-step Immunoprecipitations

Nano-Traps pull down your proteins of interest (POI) and their interacting factors from cell extracts or organelles. Nano-Traps consist of a V_HH, also termed nanobody, coupled to an immobilizing matrix. You can use Nano-Traps for a multitude of biochemical analyses such as:

- Immunoprecipitation (IP) / Co-IP
- Mass spectrometry
- Enzyme activity measurements
- ChIP / RIP analysis

Since the introduction the ChromoTek GFP-Trap® which is considered the **gold standard** for fast, reliable and effective one-step immunoprecipitation of GFP-fusion proteins and their interacting factors from cell extracts or organelles, ChromoTek has steadily expanded the range of Nano-Traps.

The following Nano-Traps are now available:

- RFP-Trap®
- mNeonGreen-Trap
- TurboGFP-Trap
- Halo-Trap
- SNAP/CLIP-tag®-Trap
- Spot-Trap
- Myc-Trap®
- GST-Trap
- MBP-Trap
- Dnmt1-Trap
- Mdm4/HdmX-Trap
- MK2-Trap
- p53 N-term-Trap
- p53 C-term-Trap
- PARP1-Trap

All Nano-Traps are available conjugated to agarose beads and a number are also available conjugated to magnetic agarose beads.

Contact us for more information on ChromoTek range of products.

BioNovus Life Sciences
David Antonjuk
Ph: (02) 9484 0931
Email: info@bionovuslifesciences.com.au
Web: www.bionovuslifesciences.com.au

ASBMB Council 2019

PRESIDENT
Professor Joel Mackay
School of Life and Environmental Sciences
University of Sydney
SYDNEY NSW 2006
Ph (02) 9351 3906
Email: joel.mackay@sydney.edu.au

PAST PRESIDENT
Professor Leann Tilley
Department of Biochemistry and Molecular Biology
University of Melbourne
PARKVILLE VIC 3010
Ph (03) 8344 2227
Email: ltilley@unimelb.edu.au

TREASURER
Associate Professor Marc Kvansakul
Department of Biochemistry and Genetics
La Trobe University
BUNDOORA VIC 3086
Ph (03) 9479 2263
Email: treasurer@asbmb.org.au

SECRETARY
Professor Briony Forbes
Medicinal Biochemistry
Flinders University
BEDFORD PARK SA 5042
Ph (08) 8204 4221
Email: secretary@asbmb.org.au

EDITOR and CHAIR OF COMMUNICATIONS
Associate Professor Suresh Mathivanan
La Trobe Institute for Molecular Science
Department of Biochemistry
La Trobe University
BUNDOORA VIC 3086
Ph (03) 9479 2565
Email: editor@asbmb.org.au

EDUCATION REPRESENTATIVE
Associate Professor Susan Rowland
Institute for Teaching and Learning Innovation (ITaLI)
University of Queensland
ST LUCIA QLD 4072
Ph (07) 3365 3089
Email: s.rowland1@uq.edu.au

FAOBMB REPRESENTATIVE
Associate Professor Terrence Piva
School of Medical Sciences
RMIT University, PO Box 71
BUNDOORA VIC 3083
Ph (03) 9925 6503
Email: terry.piva@rmit.edu.au

SECRETARY FOR SUSTAINING MEMBERS
Sally Jay
c/- ASBMB National Office
PO Box 2331
KENT TOWN SA 5071
Ph (08) 8362 0009
Email: asbmb@asbmb.org.au

Directory

COUNCIL FOR 2019

PRESIDENT
Professor Joel Mackay
School of Life and Environmental Sciences
University of Sydney
SYDNEY NSW 2006
Ph (02) 9351 3906
Email: joel.mackay@sydney.edu.au

PAST PRESIDENT
Professor Leann Tilley
Department of Biochemistry and Molecular Biology
University of Melbourne
PARKVILLE VIC 3010
Ph (03) 8344 2227
Email: ltilley@unimelb.edu.au

TREASURER
Associate Professor Marc Kvansakul
Department of Biochemistry and Genetics
La Trobe University
BUNDOORA VIC 3086
Ph (03) 9479 2263
Email: treasurer@asbmb.org.au

SECRETARY
Professor Briony Forbes
Medicinal Biochemistry
Flinders University
BEDFORD PARK SA 5042
Ph (08) 8204 4221
Email: secretary@asbmb.org.au

EDITOR and
CHAIR OF COMMUNICATIONS
Associate Professor Suresh Mathivanan
La Trobe Institute for Molecular Science
Department of Biochemistry
La Trobe University
BUNDOORA VIC 3086
Ph (03) 9479 2565
Email: editor@asbmb.org.au

EDUCATION REPRESENTATIVE
Associate Professor Susan Rowland
Institute for Teaching and Learning Innovation (ITaLI)
University of Queensland
ST LUCIA QLD 4072
Ph (07) 3365 3089
Email: s.rowland1@uq.edu.au

FAOBMB REPRESENTATIVE
Associate Professor Terrence Piva
School of Medical Sciences
RMIT University, PO Box 71
BUNDOORA VIC 3083
Ph (03) 9925 6503
Email: terry.piva@rmit.edu.au

SECRETARY FOR
SUSTAINING MEMBERS
Sally Jay
c/- ASBMB National Office
PO Box 2331
KENT TOWN SA 5071
Ph (08) 8362 0009
Email: asbmb@asbmb.org.au

STATE REPRESENTATIVES

AUSTRALIAN CAPITAL TERRITORY
Dr Matthew Johnson
Research School of Biology
Australian National University
ACTON ACT 2601
Ph (02) 6127 0049
Email: matthew.johnson@anu.edu.au

NEW SOUTH WALES
Dr Kate Quinlan
School of Biotechnology and Biomolecular Sciences
University of New South Wales
SYDNEY 2052 NSW
Ph (02) 9385 8586
Email: kate.quinlan@unsw.edu.au

QUEENSLAND
Dr Benjamin Schulz
School of Chemistry & Molecular Biosciences
University of Queensland
ST LUCIA QLD 4072
Ph (07) 3365 4875
Email: b.schulz@uq.edu.au

SOUTH AUSTRALIA
Dr Mark Corbett
Adelaide Medical School
University of Adelaide
NORTH ADELAIDE SA 5006
Ph (08) 8161 6272
Email: mark.corbett@adelaide.edu.au

TASMANIA
Dr Kate Brettingham-Moore
School of Medicine
University of Tasmania
HOBART TAS 7008
Ph (03) 6226 4609
Email: kate.brettinghammoore@utas.edu.au

VICTORIA
Dr Erinna Lee
Olivia Newton-John Cancer Research Institute
145 Studley Rd
HEIDELBERG VIC 3084
Ph (03) 9496 5726
Email: erinna.lee@onjcri.org.au

WESTERN AUSTRALIA
Dr Monika Murcha
ARC Centre of Excellence in Plant Energy Biology
University of Western Australia
CRAWLEY WA 6009
Ph (08) 6488 1749
Email: monika.murcha@uwa.edu.au

ASBMB NATIONAL OFFICE
PO Box 2331
KENT TOWN SA 5071
Ph (08) 8362 0009
Fax (08) 8362 0009
Email: asbmb@asbmb.org.au
http://www.asbmb.org.au

COPY DEADLINE FOR NEXT ISSUE:
Monday 11 February 2019

SPECIAL INTEREST GROUPS

ADELAIDE PROTEIN GROUP
Contact: Dr Melissa Pitman
Centre for Cancer Biology
SA Pathology
ADELAIDE SA 5005
Ph (08) 8313 0413
Email: melissa.pitman@sa.gov.au

AUSTRALIAN YEAST GROUP
Chair: Dr Alan Munn
Griffith University Gold Coast
PMB 50, Gold Coast Mail Centre
SOUTHPORT QLD 9726
Ph (07) 5552 9307
Email: a.munn@griffith.edu.au

BIOCHEMICAL EDUCATION
Chair: Associate Professor Susan Rowland
School of Chemistry and Molecular Biosciences
University of Queensland
ST LUCIA QLD 4072
Ph (07) 3365 4615
Email: s.rowland1@uq.edu.au

CELL ARCHITECTURE
Chair: Associate Professor Thomas Fath
Dementia Research Centre
Department of Biomedical Sciences
Macquarie University
NORTH RYDE NSW 2109
Email: thomas.fath@mq.edu.au

MELBOURNE PROTEIN GROUP
President: Dr Douglas Fairlie
Olivia Newton John Cancer Research Institute
Austin Hospital
HEIDELBERG VIC 3084
Email: doug.fairlie@onjcri.org.au

METABOLISM AND MOLECULAR MEDICINE GROUP
Chair: Dr Nigel Turner
School of Medical Science
University of New South Wales
KENSINGTON NSW 2052
Ph (02) 9385 2548
Email: n.turner@unsw.edu.au

QUEENSLAND PROTEIN GROUP
Chair: Dr Brett Collins
Institute for Molecular Bioscience
University of QLD
ST LUCIA QLD 4072
Ph (07) 3346 2043
Email: b.collins@imb.uq.edu.au

RNA NETWORK AUSTRALASIA
Chair: Dr Archa Fox
Harry Perkins Institute of Medical Research
6 Verdun Street
NEDLANDS WA 6009
Ph (08) 6151 0762
Email: archa.fox@perkins.uwa.edu.au

SYDNEY PROTEIN GROUP
Chair: Dr Liza Cubeddu
School of Science and Health
University of Western Sydney
PENRITH NSW 2751
Ph (02) 4620 3343
Email: l.cubeddu@uws.edu.au

Melbourne Convention and Exhibition Centre

South Wharf, MELBOURNE **29 September - 2 October 2020**

INVITATION FROM THE CHAIR OF THE CONFERENCE

We extend a warm invitation to you to be part of ComBio2020 to be held at the Melbourne Convention and Exhibition Centre (MCEC). ComBio2020 will be held in the recently completed and spectacular extension of the MCEC which offers the latest and 'state of art' convention and exhibition facilities. Melbourne offers an abundance of budget priced accommodation within walking distance of the MCEC along with numerous restaurants and cafes serving the widest imaginable variety of food. It is always an exciting time of the year for those visiting Melbourne with many sporting and cultural events and the many world class museums, galleries plus an aquarium in the immediate vicinity. ComBio in Melbourne in the Spring of 2020 should be a 'must' for all.

We look forward to welcoming you to Melbourne.

Jackie Wilce
Chair, ComBio2020
on behalf of the ComBio2020 Local Organizing Committee

Conference Streams:

- Plant Biology
- Development, Stem Cell and Regenerative Medicine
- Proteins, Peptides and Structural Biology
- Biochemistry and Metabolism
- Cell Biology and Signalling
- Genomics, Genome Editing and Systems Biology
- Evolutionary and Ecological Genetics
- Infection and Immunity
- Education

KEY DATES:

Earlybird Registration Deadline:
Friday, 26 June 2020

Abstract Submission Deadline:
Friday, 26 June 2020

Guaranteed Hotel Reservation Deadline:
Friday, 7 August 2020

CONTACTS:

Chair
Jackie Wilce
jackie.wilce@monash.edu

Program Chair
Mark Hulett
m.hulett@latrobe.edu.au

Registration/Exhibition
Sally Jay
combio@asbmb.org.au

ComBio2020 incorporates the annual meetings of:

- Australian Society for Biochemistry and Molecular Biology
- Australian Society of Plant Scientists
- Australia and New Zealand Society for Cell and Developmental Biology
- Genetic Society of AustralAsia

FOLLOW US ON

www.combio.org.au/combio2020