Australian Biochemist

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

April 2022, Volume 53, Number 1

ISSN 1443-0193

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The Australian Biochemist
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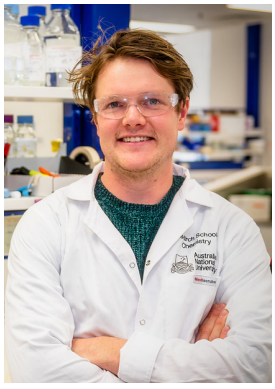

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ComBio2022 Provisional Programme Timetable

TUESDAY 27 September

15:00 - 18:00	**Registration**

WEDNESDAY 28 September

07:30 onwards	**Registration**
08:30 - 08:50	**Opening**
08:50 - 09.30	**Plenary 1: Opening Keynote Lecture:** *Jennifer Doudna*
09:35 - 11.05	Concurrent Symposia 1
11:05 - 11:30	**Morning Tea**
11:30 - 12:10	**Plenary 2:** *Jamie Cate*
11:30 - 12:10	**Plenary 3:** *Siobhan Brady*
11:30 - 12:10	**Plenary 4:** *Emma Teeling*
12:15 - 12:55	**Plenary 5:** *Jodi Nunnari*
12:15 - 12:55	**Plenary 6: Annals of Botany Lecture:** *Niko Geldner*
12:55 - 14:00	**Lunch Break**
14:00 - 15:30	Concurrent Symposia 2
15:30 - 15:55	**Afternoon Tea**
15:55 - 16:35	**Plenary 7: ASBMB Education Plenary:** *Martin Westwell*
15:55 - 16:35	**Plenary 8: ASPS Jan Anderson Award & Lecture:** *TBA*
15:55 - 16:40	**Plenary 9: ANZSCDB President's Medal Award & Lecture:** *TBA*
	Includes the Presentation of the ANZSCDB Emerging Leader Award
16:40 - 18:10	Concurrent Symposia 3
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THURSDAY 29 September

08.30 - 09:10	**Plenary 10:** *Roy Parker*
08:30 - 09:10	**Plenary 11:** *Cristina Lo Celso*
08:30 - 09:10	**Plenary 12:** *Lisette Waits*
09:15 - 10:45	Concurrent Symposia 4
10:45 - 11:30	**Morning Tea and Poster Teasers**
11:30 - 13:00	Concurrent Symposia 5
13:00 - 14:30	**Lunch/Exhibition/Posters**
13:30 - 14:30	Poster Session A
14:30 - 16:00	Concurrent Symposia 6
16:00 - 16:25	**Afternoon Tea**
16:25 - 17:05	**Plenary 13: ASBMB Lemberg Medal Award & Lecture:** *LeannTilley*
16:25 - 17:05	**Plenary 14: ASPS Peter Goldacre Award & Lecture:** *TBA*
16:25 - 17:05	**Plenary 15: GSA M.J.D. White Award & Lecture:** *TBA*
17:05 - 17:45	**Plenary 16: ASBMB Shimadzu Medal Award & Lecture:** *Michael Lazarou*
17:05 - 17:45	**Plenary 17: ASPS R.N. Robertson Award & Lecture:** *TBA*
17:05 - 17:45	**Plenary 18: GSA Ross Crozier Award & Lecture:** *TBA*
17:45 - 18:05	**ASBMB & NZSBMB Award Presentations:** ASBMB Eppendorf Edman Award, SDR Scientific Education Award, Fred Collins Award & Fellowships Awards, 50 Year Members Awards, NZSBMB Custom Science Award **ASPS Award Presentations:** ASPS-FPB Best Paper Award, ASPS Teacher's Award **GSA Award Presentations:** GSA Alan Wilton Award, GSA D.G Catcheside Prize, GSA Excellence in Education Award Annual General Meetings

FRIDAY 30 September

08:30 - 09:10	**Plenary 19:** *Tony Hunter*
08:30 - 09:10	**Plenary 20:** *Daniel St Johnston*
08:30 - 09:10	**Plenary 21:** *Wolfgang Haak*
09:15 - 10:45	Concurrent Symposia 7
10:45 - 11:30	**Morning Tea and Poster Teasers**
11:30 - 13:00	Concurrent Symposia 8
13:00 - 14:30	**Lunch/Exhibition/Posters**
13:30 - 14:30	Poster Session B
14:30 - 14:45	Passport Draw
14:45 - 16:15	Concurrent Symposia 9
16:20 - 17:00	**Plenary 22: ASBMB Grimwade Keynote Lecture:** *Cynthia Kenyon*
17:00 - 17:20	**Closing Ceremony and Award Presentations**
17:20 - 18:30	**Closing drinks**

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 email editor@asbmb.org.au.

Identification of a Central Role of RNA Regulation in Platelet Biogenesis

Heazlewood S[#], Ahmad T[#], Mohenska M, Guo BB, Gangatirkar P, Josefsson EC, Ellis S, Ratnadiwakara M, Cao H, Cao B, Heazlewood C, Williams B, Fulton M, White J, Ramialison M, Nilsson SK[+], Änkö ML[+*]. RNA binding protein SRSF3 confers an essential role in megakaryocyte maturation and platelet production. *Blood* 2022; In print.
[#]Equal first authors, [+]Joint supervisors
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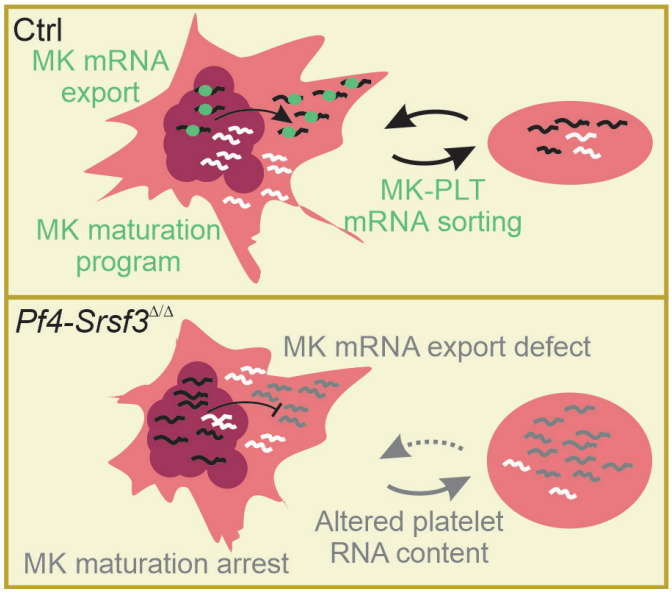
In vitro and cell line models have demonstrated that RNA binding proteins are required at every step of RNA biogenesis and thereby, greatly modify the RNA repertoire of cells. But how do RNA binding proteins function in the context of an organism and in specific cell types? SRSF3 (serine/arginine-rich splicing factor 3) belongs to the family of SR protein splicing factors that regulate many steps of RNA metabolism. We established a systemic *Srsf3* knockout mouse model to investigate SRSF3 functions *in vivo*. *Srsf3* deletion was lethal at an early embryonic stage; additionally, 50% of heterozygous pups died before weaning. We were curious to understand why, so we carried out a systemic analysis of all tissues of the heterozygous knockout mice. To our disappointment, we could not detect any gross morphological defects in the heterozygous mice that survived to adulthood. Instead, we observed a consistent reduction in their platelet counts. And here the *Blood* story begins.

RNA processing is increasingly recognised as a critical control point in the regulation of different haematopoietic lineages. The discovery of frequent mutations in splicing factor genes such as *SF3B1, U2AF1* and *SRSF2* in myelodysplastic syndrome (MDS) patients first demonstrated the critical role of post-transcriptional gene regulation during haematopoiesis. Beyond MDS, the role of RNA regulators in the control of different blood cell lineages remains largely unknown. Prompted by our observation in the systemic *Srsf3* knockout mice, we generated a mouse model where *Srsf3* deletion was restricted to megakaryocytes, the parent cell of platelets. Megakaryocytes are unusually large cells with a polyploid nucleus that shed their cytoplasm to produce platelets. Strikingly, SRSF3 depletion in megakaryocytes led to a greater than 90% reduction in platelet counts. Moreover, the small number of SRSF3-knockout platelets generated were dysfunctional. Interestingly, the megakaryocyte numbers or ploidy were not altered in the knockout mice. Instead, we demonstrated that the SRSF3-deficient megakaryocytes became arrested during their maturation. Our mouse model in fact enabled, for the first time, a molecular definition of the megakaryocyte stage that most efficiently produces platelets *in vivo*.

What about the RNA biology of this story? Megakaryocytes are very rare cells and constitute only 0.01% of the bone marrow; thus, many biochemical assays were out of the question. We performed sequencing-based RNA profiling of megakaryocytes at different maturation stages and uncovered that SRSF3 was required to reprogram the megakaryocyte transcriptome during maturation. One of the best-known molecular functions of SRSF3 is the regulation of nucleocytoplasmic mRNA export. We used cell line



The RNA-binding protein SRSF3 (green) is essential for megakaryocyte (MK) maturation and platelet biogenesis. It plays a critical role in controlling megakaryocyte and platelet RNA metabolism.

models to show that SRSF3 controlled the export of key megakaryocyte mRNAs that likely contribute to the maturation arrest observed *in vivo*. The plot thickened when we looked at the platelets. Although platelets do not have a nucleus, they contain a rich repertoire of RNAs and RNA-processing machineries such as the translating ribosomes. Sequence profiling of platelet RNAs demonstrated that SRSF3 may function as a cytoplasmic RNA adaptor required for the sorting of distinct megakaryocyte RNAs into platelets. In the absence of SRSF3, the RNA repertoire of platelets was drastically altered, correlating with the functional deficits of the platelets.

Overall, the failure of SRSF3-deficient megakaryocytes to reprogram their transcriptome and load platelets with RNA molecules required for normal platelet function demonstrate that SRSF3-mediated RNA processing forms a central part of platelet biogenesis. The human homologues of SRSF3-regulated genes are associated with human platelet diseases and their loss-of-function mutations display phenotypic similarities with the loss of SRSF3 in megakaryocytes. Thus, determining how platelets get their RNA advances the knowledge of post-transcriptional gene regulation in thrombopoiesis and platelet disorders.

Minni Änkö, Head of Functional RNAomics Laboratory, Tampere University, Finland, and Hudson Institute of Medical Research, Australia

Minni Änkö.

HIF-1α Puts the Brakes on Pathological Fibrosis Post Myocardial Infarction

Janbandhu V*, Tallapragada V, Patrick R, Li Y, Abeygunawardena D, Humphreys DT, Martin EMMA, Ward AO, Contreras O, Farbehi N, Yao E, Du J, Dunwoodie SL, Bursac N, Harvey RP*. ***Hif-1a*** **suppresses ROS-induced proliferation of cardiac fibroblasts following myocardial infarction.** ***Cell Stem Cell*** **2022; In print.**
***Corresponding authors: v.janbandhu@victorchang.edu.au, r.harvey@victorchang.edu.au**

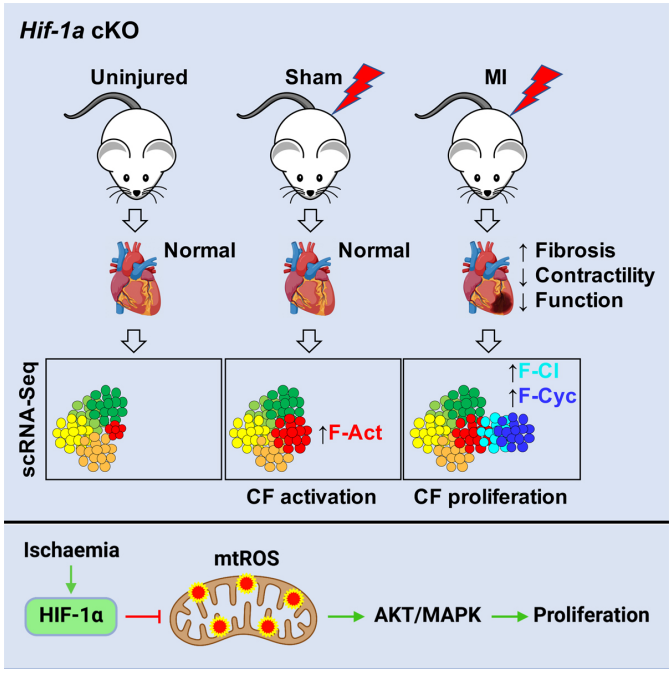
Pathological fibrosis is associated with virtually all forms of cardiovascular (CV) disease. After acute myocardial infarction (MI), dying cardiomyocytes (CMs) are replaced by a non-compliant collagen-rich scar. This protects the heart against rupture, but also severely affects cardiac function. Heart failure is in epidemic proportions, so interventions that limit the progression of cardiac fibrosis would be a significant advance. However, even after years in development, few antifibrotic drugs have shown clinical efficacy. Cardiac fibroblasts (CFs) are the central players in the fibrotic cascade. These fascinating changeable cells act as sentinels, progenitor cells, extracellular matrix (ECM) factories and electromechanical transducers. They show stem cell behaviours which can be altered by the tissue environment. Innovative experimental antifibrotics now include inhibitors of the epigenetic drivers of fibrosis and engineered T-cells targetting activated CFs. However, our understanding of CF biology has been limited by poorly characterised cell states, lack of specific markers, pathway pleiotropy and reliance on linear *in vitro* models of CF activation and differentiation.

Addressing such limitations, our recent work, and that of others, have provided the first comprehensive analyses of CF heterogeneity and dynamics in CV disease using single cell transcriptomics. These studies have revealed unexpected cell heterogeneity and non-linear dynamics, paving the way for more nuanced selection of therapeutic targets.

The work highlighted here was performed at the Victor Chang Cardiac Research Institute, with colleagues at the Garvan Institute and Duke University, USA. Motivated by work showing that stem cell populations reside in a hypoxic niche, which is essential for maintaining stem cell status, we explored the role of HIF-1, a master transcriptional regulator of the hypoxic response, in CFs using conditional gene targeting. Under hypoxic conditions, the HIF-1α subunit is stabilised, allowing its translocation to the nucleus, dimerisation with HIF-1β and activation of genes that minimise oxygen consumption, reduce reactive oxygen species (ROS) formation and restore oxygen delivery. HIF-1 has previously been studied in CMs and endothelial cells where it is essential for fetal CM proliferation and adaptive tissue responses.

We discovered that a subcompartment of CFs enriched in mesenchymal stem cell properties was more hypoxic, more glycolytic and expressed higher levels of HIF-1 than other cardiac populations. In uninjured hearts, specific

Publications with Impact



CF-specific Hif-1a *knockout mice (cKO) are healthy, fertile, and indistinguishable from WT littermates. However, deletion leads to increased mesenchymal colony formation in uninjured hearts and increased CF activation without proliferation following sham injury, suggesting that they have entered a primed (alert) but uncommitted state. After myocardial infarction (MI), there is an approximately 50% increase in CF proliferation and excessive scarring and contractile dysfunction in* Hif-1a *cKO mice, associated with increased ROS in CF mitochondria. Thus, HIF-1α in CFs provides a critical braking mechanism against excessive post-ischemic CF activation and proliferation, and ensuing fibrosis, through regulation of mitochondrial ROS.*
Reproduced from Janbandhu et al., Cell Stem Cell *2022, with permission from Elsevier.*

deletion of *Hif-1a* in CFs led to increased mesenchymal colony formation, whereas in sham operated hearts, as detected using single cell transcriptomics, there was an increase in an early activation state of CFs termed F-Act. F-Act cells expresses higher levels of ECM genes, yet retain a stem-like expression profile, suggesting that they have entered a primed (alert) but uncommitted state. After MI, protective (reparative) fibrosis is driven by CF activation, proliferation and differentiation into contractile myofibroblasts. In CF-specific *Hif-1a* knockouts subjected to MI, we saw an approximately 50% increase in CF proliferation, increased fibrosis and more severe functional decline compared to control MI mice. Increased proliferation was accompanied by an increase in a unique pre-proliferative CFs state (F-CI) as well as proliferating CFs (F-Cyc). These changes in CF proportions were accompanied by depletion of the quiescent CF subpopulation (F-SH) bearing stem cell properties, suggesting that F-SH serves as a significant reserve of CFs with proliferative potential.

The observed pathology in knockout MI hearts did not involve changes in immune cell response, vascular density, CF metabolic state or CF differentiation capacity into myofibroblasts. However, analysis revealed that the trigger for proliferative changes was an early buildup of ROS in CF mitochondria. High ROS can be damaging; however, ROS are essential players in, and amplifiers of, normal signalling pathways, including those involved in stem cell activation and proliferation. Knockout MI CFs did not experience increased oxidative stress relative to MI controls. However, AKT and ERK pathways, involved in CF proliferation, were hyperactivated. Treatment of mice with the mitochondria-targeted ROS generator, MitoParaquat, (which modestly increased ROS levels in CFs) substantially increased CF proliferation. On the other hand, treatment with the mitochondria-targeted antioxidant, MitoTEMPO, rescued *Hif-1a* deletion-associated AKT/ERK hyper-activation in CFs, as well as in cardiac functional phenotypes.

To summarise, in contrast to CMs which become highly oxidative at birth, CFs bearing mesenchymal properties acquires a hypoxic niche and expresses HIF-1. In uninjured hearts, HIF-1 may help preserve CF stem cell qualities, whereas after MI it provides a braking mechanism against ROS build-up in oxygen-starved mitochondria, limiting excessive CF proliferation and fibrosis. This is likely important in human biology since genetic variants in *Hif-1a* and chronic disease states reduce HIF-1 activity. Although dietary antioxidant trials have not shown long-term benefits, redox control in CV disease remains an important frontier that may require precision drugs targeting different cell types and compartments. Our study highlights CFs as important cellular targets and provides new insights into altered cardiac tissue dynamics that underpin fibrosis at a single cell level.

Richard Harvey and Vaibhao Janbandhu
Victor Chang Cardiac Research Institute and UNSW Sydney

From left: Alexander Ward, Vikram Tallapragada, Ralph Patrick, David Humphreys, Vaibhao Janbandhu, Osvaldo Contreras, Richard Harvey and Ella Martin. Image credit: Louise Crealy, VCCRI.

Publications with Impact

Piecing Together How Nuclear Proteins Wrangle RNA

Knott GJ, Chong YS, Passon DM, Liang XH, Deplazes E, Conte MR, Marshall AC, Lee M, Fox AH, Bond CS*. Structural basis of dimerization and nucleic acid binding of human DBHS proteins NONO and PSPC1. *Nucleic Acids Res* 2022;50(1):522–535.
***Corresponding author: charles.bond@uwa.edu.au**

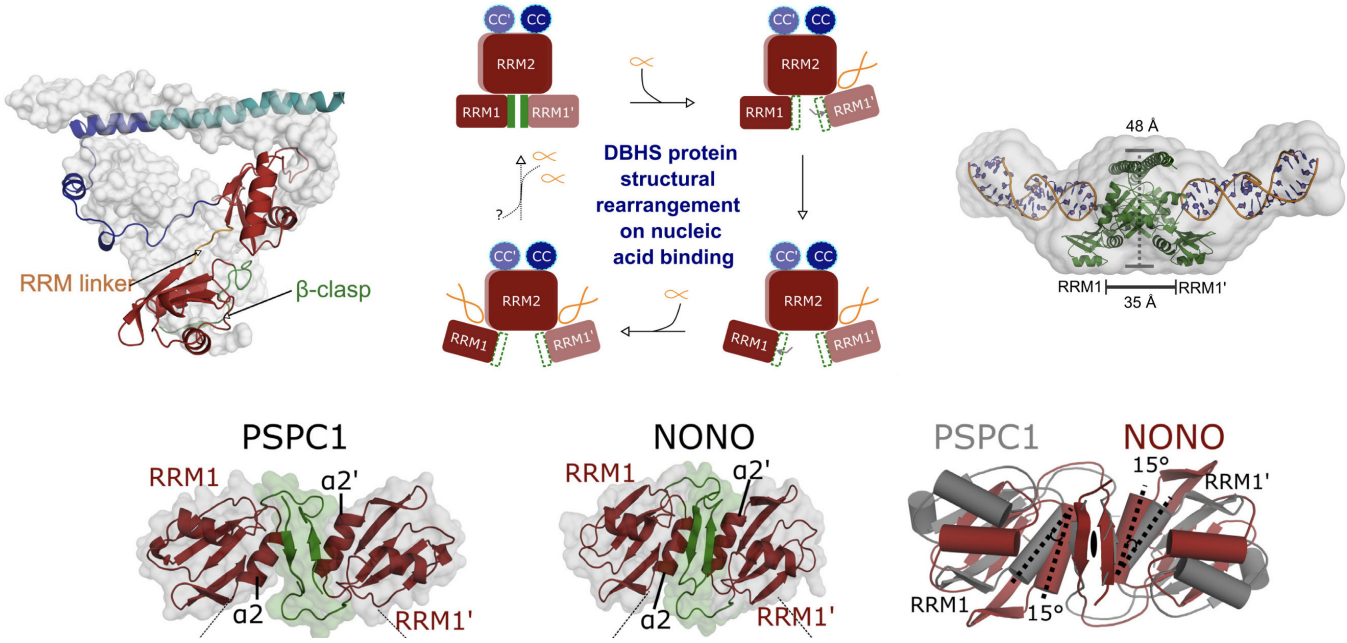
A previous contribution to Publications with Impact drew comparisons with Homer's Odyssey. For this paper, the analogy of the Nordic Saga seems more appropriate! Looking back at when the first publishable results were achieved, and the ultimate publication date, can be a bit of a shock. Eleven years in this case. Gulp!

This kind of situation can happen when you explore complex proteins with wide-reaching functions and specificities. The mammalian DBHS protein paralogs (NONO, PSPC1 and SFPQ) are the topic of this paper. Despite being quite ubiquitous in transcriptional and DNA repair processes in our cells, markers for subnuclear paraspeckles and 'frequent flyers' in mass spectrometry interaction studies, the details of how they act at the molecular level have remained hard to determine. Perhaps their relevance to rapidly changing fields of endeavour doesn't help (the various New Worlds of long non-coding RNA biology, functional aggregation, liquid–liquid phase separation), but the fact that they represent a few percent of our nuclear protein alone, and are good candidates for drug targeting, suggests they are worth understanding.

Ultimately, this work is part of a larger collaborative project between the Bond and Fox labs to understand interactions in paraspeckle proteins: exactly which molecules the DBHS proteins interact with, exactly how, and why mammals need three paralogs. These are broad questions which have also been addressed in other ways in other papers with many of the same authors. This paper includes three 'generations' of DBHS PhD students (Daniel Passon, Gavin Knott, Yee Seng Chong) and two generations of DBHS postdocs (Mihwa Lee, Andrew Marshall), and our epic collaborators, all of whom have helped piece together how tweaks of amino acid sequence result in proteins like NONO and PSPC1 preferring to heterodimerise rather than homodimerise, and how they interact with nucleic acids.

This paper contains the following key results:

1. Crystal structures of NONO and PSPC1 homodimers, and comparison with the heterodimer structure, reveal structural plasticity in the dimer interface and key amino acids that specify partner choice. The homodimer structures surprisingly also reveal additional inter-subunit secondary structures which were not observed in the heterodimer.



The structures of dimers of NONO and PSPC1, and a complex with an antisense oligonucleotide, reveal that movement of the RRM1 is essential for RNA binding even though the RRM1 domains are tethered by a small beta clasp which does not occur in the heterodimer. The homodimer structure is convoluted, each monomer wrapping a full 360 degrees around the other, yet NONO and PSPC1 preferentially heterodimerise, governed by a few amino acid residues at the dimer interface.

2. Nucleic acid binding studies, using microscale thermophoresis, indicate a preference for binding G- and U-rich ribopolymers. The first RRM domain of the DBHS is shown to be necessary, but not sufficient for optimal nucleic acid binding.
3. Colleagues from IONIS had published that certain therapeutic antisense oligonucleotides (ASOs) with specific backbone chemistries (especially phosphorothioate linked gapmers) displaced DBHS proteins from their usual home in paraspeckles to form intracellular aggregates and ultimately lead to their degradation. As these molecules are short (unlike the 23 kb lncRNA NEAT1!) and therefore potentially tractable, we approached Liang from IONIS to collaborate on the *in vitro* interactions of DBHS proteins with ASOs, demonstrating nanomolar binding via MST, and an explicit preference for binding NONO and not PSPC1 – quite remarkable considering their high sequence similarity. Finally, we could produce a sample of the NONO-ASO complex suitable for analysis by SAXS, which clearly indicated that the ASO interacts at the junction of RRM1 and main body of the DBHS protein, in agreement with our mutant studies.

While we now have opened a window into the specifics of how DBHS proteins bind nucleic acids, there is so much more to find out. Indeed, the reviewers helpfully suggested that we identify which parts of the lncRNA NEAT1 that the proteins bind to and study them instead. Of course, when studying relatively small proteins that phase separate into micron-sized bodies and interact with a 23 kb lncRNA, the gap between cell biology, super-resolution microscopy and whole-genome studies on the one hand, and classic proximal biophysical interaction analysis on the other, seems very wide. We are making progress but would love to hear from you if you have great ideas about how to sail across that divide.

Charlie Bond
School of Molecular Sciences
University of Western Australia

First two and last two authors (from left): Gavin Knott, Yee Seng Chong, Archa Fox and Charlie Bond.

Self-organising Cell–collagen Interactions Guide Epithelial Tube Elongation

Katsuno-Kambe H, Teo JL, Ju RJ, Hudson J, Stehbens SJ, Yap AS*. Collagen polarization promotes epithelial elongation by stimulating locoregional cell proliferation. *eLife* 2021; 10:e67915.
***Corresponding author: a.yap@uq.edu.au**

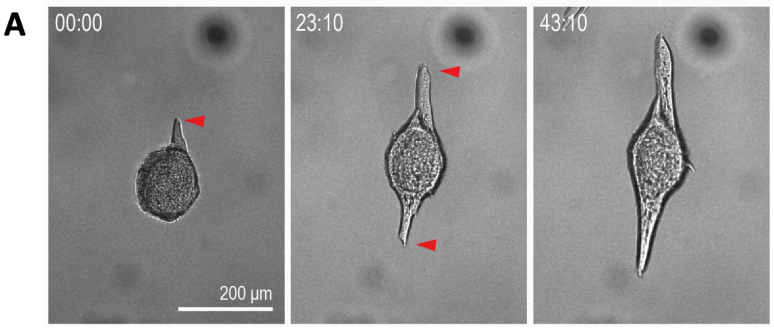
Epithelial tissues are commonly found as multicellular tubes, a mode of organisation that is closely linked to their physiological function, typically established during development, and often re-established during post-embryonic life. It is now evident that tubular morphogenesis is a complex process, where multiple cellular processes are combined in different ways in different tissues. One such strategy involves the extension of anisotropic tubules from anlage, which comprise masses of precursor cells that appear essentially isotropic. In the studies outlined here, we sought to understand the mechanisms that allow anlage to break symmetry and extend to form tubules. We found that it involves self-organising feedback interactions between epithelial cells and their surrounding extracellular matrix.

Epithelial tissues, such as the lung and mammary gland, are organised in networks of branching tubules. This architecture is physiologically important; among other things, it allows large surface areas to be generated for absorption and secretion within relatively circumscribed organs. We now appreciate that multiple cellular processes contribute to these morphogenetic events. Minimally, the generation of epithelial tubes requires cell adhesion for cohesion; tight junctions to seal the epithelium; lumena within the tubes for exchange with the environment; and apical-basal polarisation to ensure the appropriate distribution of membrane components and cytoskeletal organisation for effective transport. Moreover, epithelia take different strategies to generate these tubules. In some organs, such as the trachea, lumena appear early and accompany the growth of the tubular network. Other cases, as seen in the breast and salivary gland, begin with non-polarised, cellular aggregates (namely, the anlage) that elongate as solid cords of cells, before forming lumena. At first blush, the growth of tubules from anlage raises some interesting questions. What induces isotropic analage to break symmetry in the first place? How do they know where to go as they extend?

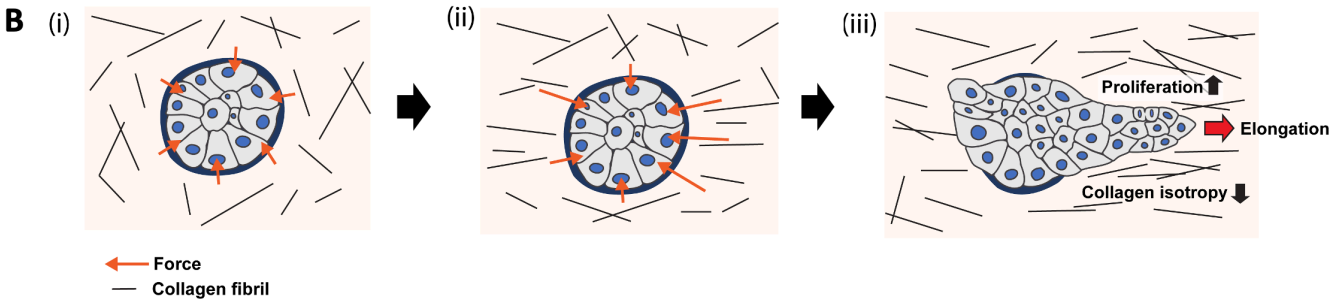
We sought to explore these questions by growing mammary MCF10A cells in 3-dimensional cultures embedded in extracellular matrix (ECM) gels. This is an adaptation of a long-standing technique, that allows

Publications with Impact

Symmetry breaking and elongation from epithelial anlage.
***A.** Time lapse images of MCF10A aggregates after transfer into collagen gels. Red arrowheads: elongation from aggregates.*



***B. (i)** At the onset, cell aggregates generates isotropic forces and collagen fibers are also isotropic. **(ii)** Anisotropic forces strain collagen fibrils through integrins and polarise ECM. **(iii)** The polarised collagen matrix provide a structural memory, that promotes regional cell proliferation to direct further elongation of the aggregate. Reproduced from Katsuno-Kambe* et al., eLife *2021;10:e67915.*



multicellular structures to be generated from what are initially single cells. Thus, it permits us to interrogate the cellular mechanisms that might support different multicellular architectures. We were struck to find that the structures produced depended very much on the type of ECM in which they were grown. As had been well-documented before, cells grown in Matrigel™, often used as a proxy for basement membrane, eventually form soccer ball-like cysts: they first grow as solid balls of cells, then polarise and form lumena. However, they don't elongate. In contrast, cells grown in Type 1 collagen (collagen 1) gels formed elongated cords of cells. This suggested that some property of collagen 1 might guide elongation.

To pursue this, we modified the system to examine how elongation might occur from multicellular anlage, rather than single cells. We first grew cells in Matrigel™, till they had proliferated to form isotropic aggregates, but not yet polarised. We used these as anlage, extracting them from the Matrigel™ and re-embedding them in collagen 1. Then we used live-cell imaging to see what they did next. Indeed, they broke symmetry and began to elongate (**Fig. 1A**). Elongation was driven by increased cell proliferation in the regions of the aggregates that had broken symmetry. These cells were also migratory, but not more so than in regions of the aggregates that had not broken symmetry. This implied that a regional stimulation of cell proliferation might be a key factor for elongation.

But what might guide elongation from anlage? Here, we were struck to find that the collagen 1 matrix also rearranged when anlage broke symmetry. Collagen fibrils were isotropically distributed when aggregates were first incorporated, but the gel condensed and became oriented with the long axis of elongation when the anlage broke symmetry. Collagen reorganisation was most pronounced around the regions of elongation themselves, suggesting that it might be responding to some cellular change that was happening nearby. Indeed, we found that collagen did not reorganise if we blocked cell proliferation. One possibility is that the division of proliferating cells might have generated local variation in force applied to the collagen gels. Cytokinesis is a mechanically-active process, distinguished by increased cell contractility. Significantly, collagen reorganisation was blocked by inhibitors of non-muscle Myosin II, which is necessary for contractility.

However, reorganisation of the collagen gel persisted beyond the initial phase of symmetry-breaking, continuing as aggregates became more elongated. Characteristically, this reorganised gel formed bundles that originated at, but extended away from, the aggregates, as if they were forming a girdle that became more aligned with the aggregates as they extended. We wondered if this co-alignment might allow the organisation of the collagen to provide feedback and influence the elongation process.

To test this, we applied external uni-axial stretch to the gels, which allowed us to reorganise and polarise the gel independent of the action of the cells. We embedded isotropic anlage into gels and immediate applied stretch to reorganise the collagen before the cells had the opportunity to spontaneously break symmetry. We found that this accelerated the onset, and increased

the extent, of elongation, compared with spontaneous symmetry-breaking. Therefore, reorganisation of the collagen 1 ECM could guide the elongation process. Importantly, this occurred via cell proliferation, which was stimulated when stretch was applied, and needed for the aggregates to elongate.

This leads us to the following model (**Fig. 1B**). Local variations in cell proliferation initiate elongation in otherwise unpolarised anlage. Regions that proliferate to a greater extent tend to begin to elongate; this may reflect stochastic variations in proliferation or result from instructive signaling events. In doing so, proliferating cells exert mechanical forces to reorganise the collagen ECM. Importantly, collagen reorganisation provides feedback to support further elongation by further stimulating regional cell proliferation. This occurs through integrin cell-ECM adhesion receptors that signal to ERK. Thus, the elongation process can be visualised as a self-organising feedback loop between cell proliferation and collagen reorganisation.

There are a number of interesting implications of these findings. First, this mode of self-organisation provides a system that can perpetuate tubular elongation without necessarily requiring ongoing directional signals. Feedback between proliferation and collagen reorganisation could represent a motor to drive elongation, which could then be modified or redirected by other instructive signals. Second, it emphasises the challenge of dissecting self-organising systems. Once feedback gets established, especially over long time periods (such as the days required for our experiments), it is difficult to be certain exactly where conventional experimental maneuvers may act. For example, in our system integrin adhesion is likely to transmit cellular forces to reorganise collagen 1 and also allow reorganised collagen to stimulate cell proliferation. New tools, such as optogenetics, will be important to provide greater temporal and spatial control to dissect feedback systems.

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Institute for Molecular Bioscience
University of Queensland

From left: John Brooks, Ivar Noordstra, Bageshri Nanavati, Kinga Duszyc, Hiroko Katsuno-Kambe, Alpha Yap and Kaijie Tang.

An Analysis of the SH2 Domain of the Lymphocyte Adaptor Protein, LNK

Morris R, Zhang Y, Ellyard JI, Vinuesa CG, Murphy JM, Laktyushin A, Kershaw NJ*, Babon JJ*.
Structural and functional analysis of target recognition by the lymphocyte adaptor protein LNK.
***Nat Commun* 2021;12(1):6110.**
***Corresponding authors: kershaw@wehi.edu.au, babon@wehi.edu.au**

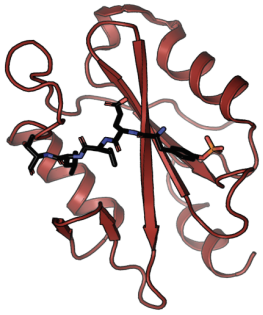
The Babon laboratory has a strong focus on studying cytokine signalling via the JAK-STAT signalling pathway. One of our main interests in this area is examining the proteins involved in regulating cytokine signalling cascades, particularly those with domains that bind phosphotyrosine motifs, such as SH2 domains.

LNK is an SH2 domain containing adaptor protein that binds and regulates proteins involved in haematopoiesis. LNK has been most intensively studied in its role as a negative regulator of erythropoietin and thrombopoietin signalling pathways, which control platelet, megakaryocyte, erythrocyte and haematopoietic stem cell numbers. LNK comprises three structural domains; an N-terminal dimerisation domain that forms protein–protein interactions; a central plekstrin homology domain that interacts with lipids in the cell membrane; and a C-terminal SH2 domain, which recognises and binds phosphorylated target proteins (**Fig. 1a**). Prior to our study, no structure of any part of LNK had been published. We were able to solve structures of the LNK SH2 domain in complex with phosphotyrosine-containing peptides corresponding known LNK-binding sites in JAK2 and the erythropoietin receptor (EPOR) (**Fig. 1b**). In addition to these residues, we surveyed binding to approximately 20 phosphopeptides and confirmed SH2 binding to a phosphotyrosine in JAK3 and identified moderate-affinity motifs in EPOR, FLT3 and c-KIT (**Fig. 1c**). These results, alongside mutagenesis of the JAK2 target phosphotyrosine sequence, allowed us to gain insight into how the LNK SH2 domain interacts with its binding partners and enabled us to identify key determinants of binding specificity.

In addition to our binding studies of the LNK SH2 domain, we investigated three mutations within the

Publications with Impact

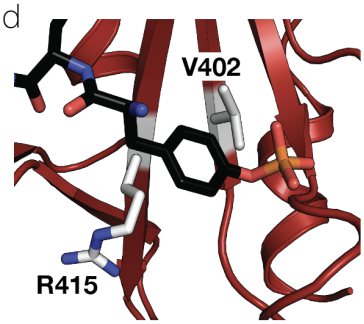
b mLNK SH2 + JAK2 pY813



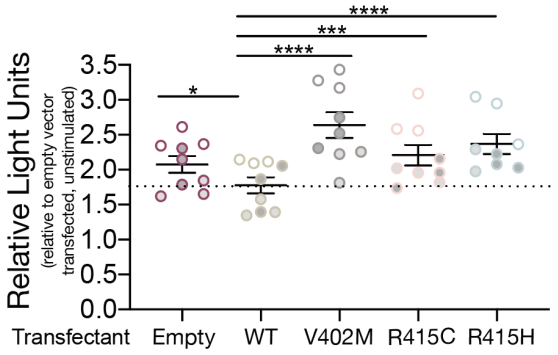
c

	-1	pY	+1	+2	+3	+4	+5	IC50 nM
JAK2 pY813	D	pY	E	L	L	T	E	138
JAK3 pY785	D	pY	E	L	L	S	D	305
EPOR pY454	K	pY	L	Y	L	V	V	661
EPOR pY368	T	pY	L	V	L	D	K	1121
FLT3 pY591	F	pY	V	D	F	R	E	1250
EPOR pY426	E	pY	T	I	L	D	K	1557
FLT3 pY919	I	pY	I	I	M	Q	S	1550
C-KIT pY568	N	pY	V	Y	V	I	D	1935

d



e



1a. *Domain architecture of full length LNK.*

1b. *Structures of the* M. musculus *LNK SH2 domain with phosphopeptide from JAK2 bound (PDB ID: 7R8W).*

1c. *Peptides identified as LNK SH2 domain binders with residues indicated as + or – relative to target phosphotyrosine. Highlighted in blue are the three high affinity and in yellow the moderative affinity phosphotyrosine residues.*

1d. *R415 and V402 residues highlighted on the LNK SH2 domain. Both residues cluster around the phosphotyrosine binding site.*

1e. *GAS-Firefly luciferase activity of WT, V402M, R415C or R415H full-length human LNK mutants treated with rhIFN-γ.*

Data are displayed as mean ± SEM from n = 3 independent experiments.
*Significance is indicated with asterisks: *p < 0.05, ***p < 0.001, ****p < 0.0001.*

LNK SH2 domain that had previously been identified in patients with myeloproliferative neoplasms, a type of blood cancer. Although LNK mutations are rarely driver mutations in these diseases, the frequency of LNK mutations increases in patients whose disease transform to leukemia, suggesting a role for LNK in disease progression. The three mutations we focused on (V402M, R415C and R415H) are clustered around the phosphotyrosine binding pocket of the SH2 domain (**Fig. 1d**), and so we hypothesised they would interfere with phosphotyrosine binding and thus the ability of LNK to regulate signalling. Thermostability experiments revealed that all three mutant proteins were less thermostable than the wildtype LNK SH2 domain. Further, we found in binding experiments that the V402M mutant was unable to bind phosphotyrosine, while both the R415C and R415H mutations displayed a loss of affinity due to a compromised on-rate. By expressing the LNK SH2 domain mutants as full-length proteins in HEK293 cells and investigating their ability to negatively regulate cytokine signalling, we showed that all three mutants had a reduced capacity to regulate signalling, with the V402M mutant being the most compromised (**Fig. 1d**). Collectively, these results provided us with a more detailed view of the interaction of the LNK SH2 domain with binding partners. Future studies will enable identification of additional binding partners of LNK, hopefully providing a more comprehensive picture of how defects in LNK contribute to haematological diseases.

Rhiannon Morris, Nadia Kershaw and Jeff Babon
Walter and Eliza Hall Institute of Medical Research Institute

From left: Rhiannon Morris, Nadia Kershaw and Jeff Babon.

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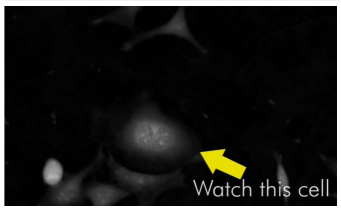

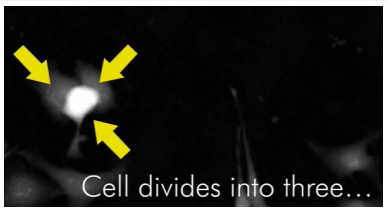

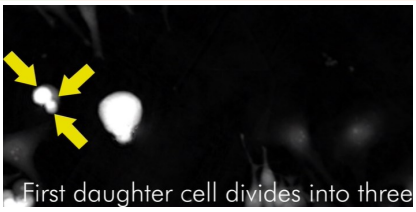

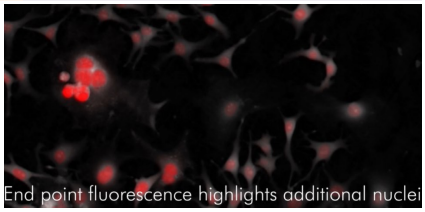

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Avoid a Collision with Collusion: an Academic Integrity Module Embedded in a First-year Cell Biology Subject

Ann Parkinson[1], Eva Hatje[1,2], Mary Kynn[3] and Nicole Reinke[1]

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[2]School of Biomedical Science, Faculty of Health, Queensland University of Technology

[3]Institute of Applied Health Sciences, University of Aberdeen, UK

Many students commence university lacking knowledge and skills in academic integrity or carrying with them practices that do not align with the rigour and quality expected at a university level. This can contribute to them unwittingly engaging in behaviours deemed as dishonest. Academic integrity is important, not just in the university setting but beyond, as students graduate and move into their professional careers.

After collusion was uncovered in a second-year Physiology course at University of the Sunshine Coast in 2017, a need was recognised to teach students about academic integrity at the start of their program. At this time, our university did not have any formal academic integrity education available for students, so we decided to develop our own modules and implement them in a first year, first semester subject, Cell Biology, in 2018. With these modules we aimed to improve students' understanding of academic integrity and to empower them to make appropriate decisions.

The three sequential academic integrity modules included examples of academic dishonesty students might encounter when completing the subject's assessment. Modules consisted of multiple-choice style questions, specific to the assessment in Cell Biology. Students received feedback (in-class discussions or narrated video) on each module before submitting their assessment. This feedback also included links to real world examples of professional dishonesty, which highlighted the importance of acting with integrity now and in their future careers.

We found that whilst students could clearly identify examples of cheating, fraud and contract cheating, many did not understand what constituted collusion. In particular, a large proportion of students could not recognise collusion when presented with scenarios involving friends or family. Whilst the development of both individual and collaboration skills is important in science, we still need to be certain that a student's grade on an individual assessment task reflects their own work. Therefore, for students to avoid a collision with collusion, it is our role as academics to provide clear guidelines about what is legitimate collaboration and what is collusion for each assessment task. As part of this strategy, we developed a Statement of Legitimate Collaboration, to help students identify which behaviours are acceptable (and which are not).

At the end of semester, students also completed an anonymous survey about their experiences with the academic integrity modules. Most students stated they felt confident that they could apply their newly acquired knowledge of academic integrity in their future studies and professions (1).

> *"The examples in real life were very helpful as well."*
> *"I think it provided clarity with certain scenarios – who was at fault."*
> *"I liked the 'post degree' application of the modules."*
>
> *First year Cell Biology students, 2018*

Moving forward, our revised goal is to offer multiple opportunities for students to engage in discussion around academic integrity as they progress through their studies. Based on student feedback, we refined the modules created in 2018 and deployed them in Cell Biology in 2019 and 2020. In 2021, the scenario-based questions were updated to reflect changes to the assessment in the subject. In addition, the module was adapted for assessment tasks in a second-year Physiology subject. Separate modules were created

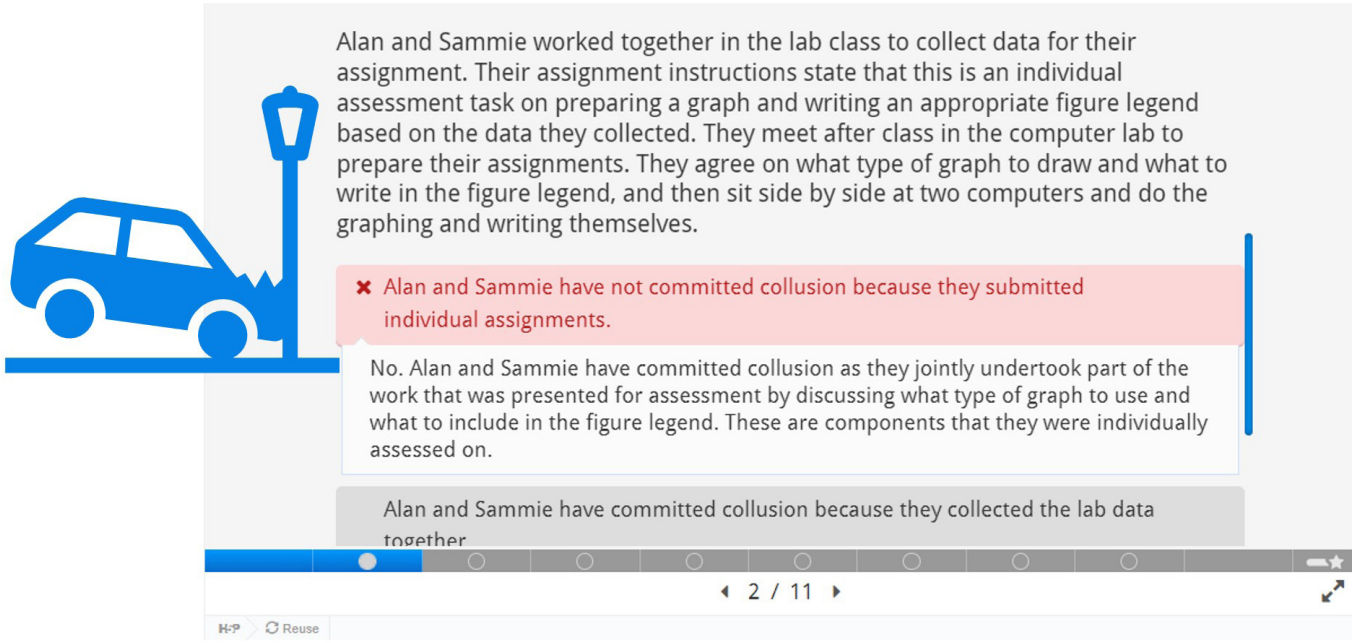

Fig. 1. *Example of the Academic integrity module in the H5P platform, showing a scenario-based question with incorrect response and feedback.*

using H5P interactive software, see **Fig. 1**.

Academic integrity is important for us all, and our experiences have shown that students need explicit guidelines around legitimate collaboration for each assessment task to avoid a collision with collusion. In addition, students need support to understand the importance of academic integrity in their studies and future careers. They also need to engage in multiple discussions and have opportunities to seek clarification.

Reference

1. Parkinson AL, Hatje E, Kynn M, Kuballa A, Donkin R, Reinke NB. *Assess Eval High Educ* 2022; In print. DOI: 10.1080/02602938.2022.2040947

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Clockwise from top left: Ann Parkinson, Eva Hatje, Mary Kynn and Nicole Reinke.

On the Fly: a Rubric Balancing the Need for Speed and Provision of Feedback – the Oral Presentation

Alyssa Van Dreumel and Peter Arthur

School of Molecular Sciences, University of Western Australia

Creating a well-constructed assessment rubric as a scoring guide is time consuming, conceptually difficult and an iterative process of redevelopment (1). A rubric is used to assess communication skills in a second-year undergraduate biochemistry unit, BIOC2001 – Biochemistry and Molecular Biology of the Cell, with approximately 100 students each year. The laboratory component of this unit follows the Prepare–Do–Review model (2). The 'review' component is focused on a post-laboratory discussion session in which students give short oral presentations (up to five minutes) to develop their skills in data interpretation and analysis, and communication of scientific information.

One drawback of the pre-existing scoring guide, by definition a rating scale, was a lack of performance level descriptions, leading to open interpretation between assessors and marking variation. Further, this rating scale did not provide students concrete information on how to achieve the highest level of performance, or feedback on performance against assessed criteria. We reconstructed the rating scale into an analytic, student-centred rubric (**Fig. 1**). This rubric was refocused to align with the learning outcomes, divided into two main criteria with expanded subcriteria: 1) presentation skills: audience engagement and delivery, and 2) content: addressing the laboratory question, organisation, visual aid design, and ability to respond to audience questions. The rubric was designed to feedforward summative judgements about student work via clear criteria and carefully constructed descriptions at four levels of achievement (3). This redeveloped rubric was shared on the learning management system to provide students instruction and feedback on their performance to support student learning (1). The use of a rubric provides students a better understanding of what is being assessed, on what criteria grades are based, and what standards are expected.

Balancing the learner-centred approach with

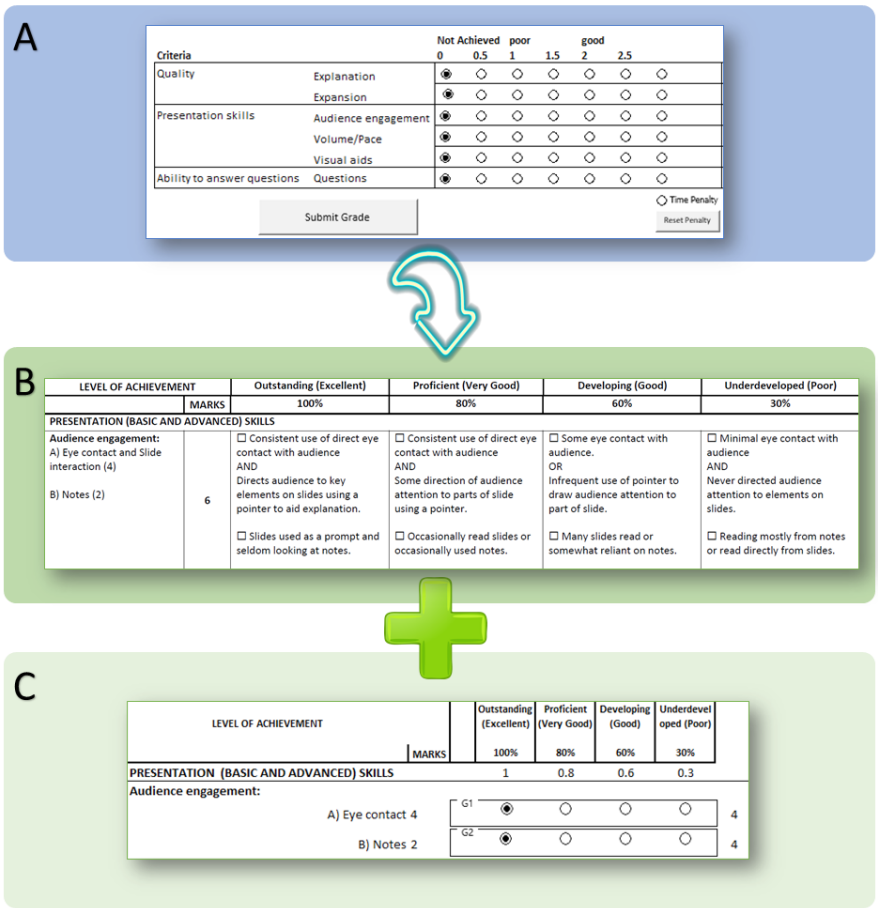

Fig. 1. *Reconstruction of a pre-existing scoring guide, a rating scale* ***(A)*** *to an analytic, student-centred rubric* (**B**) with a tick-box version* ***(C)*** *for quick assessment of a time-restrained oral presentation.*
**Rubric not shown in full.*

functionality, the design included an easy-to-use 'on the fly' measure, achieved by categorised criteria, use of concise performance descriptions and limiting multifactor subcriteria or descriptions. Simplified descriptors were used to improve interpretation and distinction of achievement and so enhance marking consistency between academics. It was marked using a tick box system to increase grading process efficiency, optimise academic time and minimise marking workload for a time-restrained assessment.

Marks of the 2019 cohort (114 students) assessed using the former rating scale and the 2021 cohort (68 students) using the redeveloped rubric were analysed using the Mann-Whitney U test to evaluate the difference in mark distribution spread. The 2021 data were less skewed, more symmetrical and had a wider spread than the 2019 data, however the median scores were not statistically significantly different. Note that the 2020 data were omitted from analysis due to modified delivery and assessment of oral presentations given online. The rubric also proved reliable, with consistency between assessors indicated by lower standard deviation within the marks awarded in 2021 than in 2019.

The design employed did enable easy use 'on the fly' and optimised academic time, once familiarised with the criteria and performance descriptions. Reflecting on use of the rubric to assess student performance, the authors and colleagues reviewed the students' quality of work: the majority of students performed highly on this assessment task. Nevertheless, there is still room for improvement and the rubric is being improved iteratively (4). For example, there were still minor interpretive issues of a few descriptors between assessors in scoring student work and, as a result, those descriptors have been rephrased to enhance clarity. Further, it was unclear if students in the 2021 cohort reviewed or engaged with the rubric in either a feedforward or feedback manner via the LMS. To enhance student learning the revised rubric will be formally introduced to students, with provision of instruction on how to utilise feedback, provided and delivered in a timely manner, to adjust their performance for future assessment tasks (3).

The authors may be contacted for a copy of the full rubric and would appreciate any feedback.

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Student and Staff Perspectives on Online Proctored and Open-book Exams

Matthew Clemson and Alice Huang

School of Life and Environmental Sciences, University of Sydney

The adoption of online exams at most universities has transformed the final exam experience for both students and staff. The constraints of running exams remotely, without face-to-face invigilation, has prompted many coordinators to question the practicability of exams as a method of assessment as we adapt to changes caused by the pandemic.

The emergency response to remote learning in 2020 required a rapid transition to online exams, wherein most exams were conducted without invigilation. This style of exam challenged course coordinators to strive for higher Bloom's level testing, composing exam papers that required students to apply knowledge, extrapolate data and formulate conclusions with justifiable logic. Googleable recall-style questions became pointless, and testing was arguably more authentic for students.

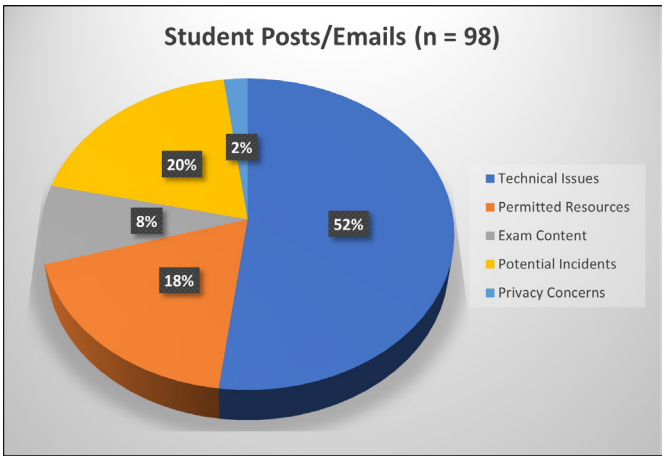

Fig. 1. *Summary of student queries about online proctored exams.*

Academic integrity was managed primarily by imposing limits on the weighting, exam duration, randomisation of questions and options, development of question banks, presenting questions one at a time and using text-matching software for written responses. However, composing and managing unique open-book exams each semester generated an overwhelming workload for academics, and the residual risks to academic integrity were apparent.

In 2021, two-thirds of all exams within the Faculty of Science at the University of Sydney were remotely invigilated using ProctorU Review⁺ software that utilises artificial intelligence to identify potential academic integrity breaches during the test. Potential breaches are reviewed centrally, and further action is taken if necessary. In our large second-year Biochemistry and Molecular Biology course (n = 800 students), we utilised this system to run exams in both closed-book (mid-semester test) and open-book, closed-web (final exam) formats.

For course coordinators, the Review⁺ software provided confidence in the identity of the test takers and assurance that the exam was conducted independently, under appropriate exam conditions, and with access only to permitted resources. It also provided some protection over the exam paper itself being copied and shared online.

For students, the concept of being monitored by AI whilst completing their exam took some getting used to. From the 98 emails and online discussion boards that related to the exams, surprisingly few students (n = 2) highlighted issues with privacy concerns (**Fig. 1**). However, we expect many harboured concerns that were not openly shared. Many posts related to technical issues with setting up ProctorU software along with their computer, webcam and microphone in preparation for the exam (n = 51). Students frequently sought clarification of the exam rules and permitted materials during the test (n = 18). Many students were concerned that they would be perceived as cheating because of incidents that occurred whilst the exam was in progress (n = 19). These included bathroom breaks, mobile phones ringing, email notifications, pop ups and people speaking in the background or entering their room during the exam. So, whilst there were no human invigilators in the exam, students remained acutely aware that they were being watched, and they felt this pressure during the exam.

Anecdotally, students that had previously experienced Live⁺ (human) invigilation said that they greatly preferred the Review⁺ AI-driven proctoring system, and they preferred open-book exams for obvious reasons. The number of questions and concerns raised was also greatly reduced for their second exam, as students became familiar with the online exam software and procedures.

Aside from some technical issues, most online exams ran smoothly: within Biochemistry and Molecular Biology, from 1,600 total exams conducted, there were only two recorded incidents of academic integrity breaches. However, to achieve this, there was a substantial academic and professional staff workload behind the scenes. We continue to carefully consider the challenges, limitations and successes of online exams as we plan our assessment for 2022.

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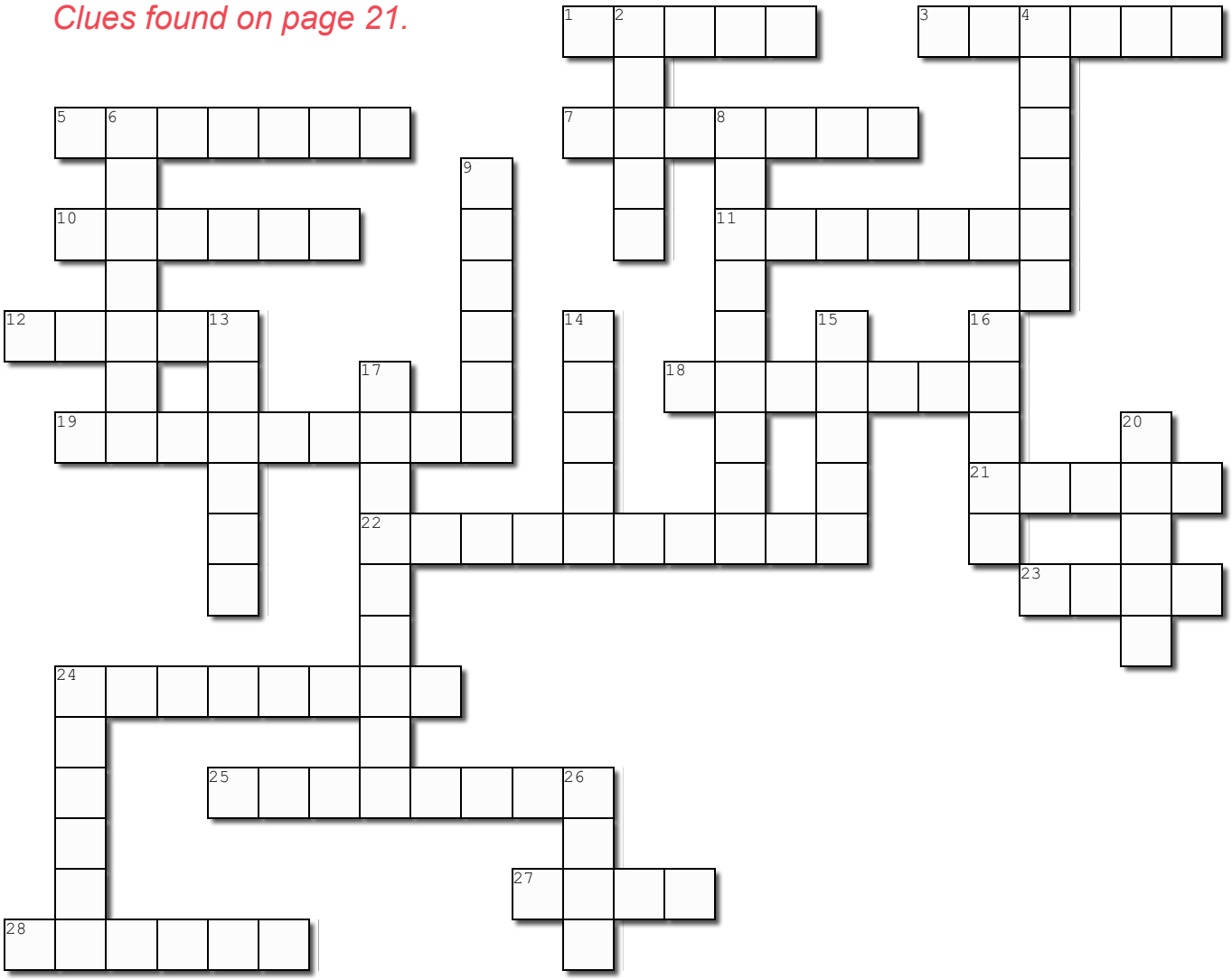
Competition: Cryptic Crossword

Presenting the latest competition for the members of ASBMB. All correct entries received by the Editor (editor@asbmb.org.au) by 25 April 2022 will enter the draw to receive a voucher. With thanks to Joe Kaczmarski.

Clues found on page 21.



'The Missing Intermediates' Result

The winner of the December competition is Gareth Denyer, School of Life and Environmental Sciences, University of Sydney. Congratulations to Gareth, who will receive a gift voucher.

Solution: METABOLIC MAP

Competition: Cryptic Crossword

ACROSS

1. An organic compound derived from ammonia is found within a mineral!
3. An object that has both a magnitude and a direction can cause disease?
5. To find the solution with Northern Territory leaders, use a liquid that dissolves stuff.
7. No heavy side chain found within the ugly cinema.
10. Elle gets stuck into Kevin about the temperature.
11. Part of Alan in England is an amino acid.
12. No sex? Mixed up sections of coding DNA.
18. Tends to make a turn or kink within the professional line.
19. A small Egyptian cobra described in Caspar, Tate *et al*.
21. Either missing Israeli leader or pleasant-smelling liquid.
22. A measure of pressure at sea-level ATM.
23. The bottom part that reacts with acid.
24. Breaks down macromolecules found within the Uniprot easement.
25. Radium leader and mixed amongst a measure of interatomic distances.
27. The rate of flow has Fred's head combined with one lumen per square metre.
28. Positive subatomic particle is an expert unit to measure heavy thing.

DOWN

2. Concentration on the back tooth of mammal's mouth.
4. A disease state found amongst the star signs.
6. Sets of linked genes a short operation with reverse sleeping noise.
8. Helps to fold a person who accompanies a group.
9. Enzyme that pops on a phosphate found amongst kin as expected.
13. A short street joins curved structure to yield a common carbohydrate.
14. An infectious agent needs host to survive, else it's the end of Aaryavir and us.
15. Latin one hundred joins lone thing that is genetically identical.
16. Units of heredity or pair of pants?
17. Speed up a feline with A-plus cell rupture.
20. Common lab organism joins elementary 39 east.
24. A short introductory course is used to amplify DNA.
26. Burrowing animal is used to measure amount of a chemical substance.

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SDS Page: Short Discussions for Students Page

Taking Care of Your Mental Health During a PhD

Joshua Hardy and Stephanie Nguyen,
Walter and Eliza Hall Institute of Medical Research

There is no one-size-fits-all approach to taking care of your mental health during a PhD. Along the way, there will be botched experiments, time-costly mistakes and demoralising failures. On the other hand, there will also be moments of quiet triumph and celebrations of scientific breakthroughs. If you are in the midst of your PhD or have recently completed, you will know that there are never-ending ups and downs. So how do we even begin to take care of our mental health? As people who have recently lived through it, we would like to offer two different perspectives on what worked for us in our PhDs in the hope that some of it will be helpful for you.

The centrality of personal relationships

Josh – Relationships were the most important contributors to my mental health during my PhD. Successfully completing my PhD depended on a handful of close friends in my life who would celebrate the small wins and hold my head up when I failed. A good friend or partner is worth their weight in papers. On the other hand, a bad relationship can really mess you up and it's important to seek help. Many PhD students I know had a rough time due to interpersonal clashes with people in their lab and because they did not know how to resolve the conflict. Speak to your supervisor or someone you trust to get advice on how to approach this before it gets too hard to handle.

Steph – It might seem like your PhD is a solo journey but it really doesn't have to be. Don't be afraid to lean into your relationships with your family, friends outside of the lab and other PhD students who know all too well what you're going through. I feel like building the ultimate support system is an essential part of enjoying your PhD. I spent a huge part of my time sharing laughs, tears and snacks with my lab mates and that was easily the best part of doing my PhD. On the opposite end of the spectrum, terrible relationships with friends or colleagues can make your PhD unbearable. Don't be afraid to speak out and remove toxic people from your life for the sake of your own mental health.

Enjoying the extracurriculars

Steph – This is going to sound clichéd because every discussion of mental health includes the 'eat right and exercise everyday' mantra, but in all honesty, the best thing that I have ever done for my mental health was signing up for a gym membership. Six months into my PhD, I was already burnt out and that did not bode well for the remaining three or so years of my candidature. I was introduced to powerlifting and let me tell you, I became obsessed. Seeing improvements in my physical strength helped me develop a stronger sense of mental fortitude and, in turn, this eased my anxiety and stress. It became a morning ritual that I considered to be a non-negotiable feature of my day-to-day life. No matter what hobby you decide to pursue, I think the key is to find things outside of science that you feel just as passionately about and make them priorities in your life. It always feels like there is a never-ending list of things to do in the lab but try to make time for yourself too.

Josh – A PhD can be all-consuming if you want it to be. There is no end to repeating experiments, re-analysing data, and reading papers. Some people can achieve full immersion in research, but I found I always was drawn to activities outside of my PhD. While initially video games soaked up the hours, I became interested in role-playing games. Not only were these more social, they tapped into my creative side, which led me to discovering new hobbies and interests along the way. At a university, there are many niche clubs and societies that you can join and it is a great way to make new friends and pursue new avenues for recreation. Like Steph, I did some exercise, but it was always with friends, and going for a run by myself was never something that worked for me, although many of my peers found it therapeutic.

Maintaining a healthy work–life balance

Josh – I was fortunate enough to complete my PhD a few months before the COVID pandemic started. For many students now, working from home has been mandatory. Early in my PhD, I was in the habit of bringing work home too – partly due to my inexperience and things taking longer than expected – but also because of study habits formed in undergrad. Unlike undergrad, however, a biochemistry PhD is full-time, and this is an easy path to burnout. I learned that I needed to compartmentalise work from home. It was often better to stay late at work and finish it there, rather than bring it home. I wrote my thesis almost entirely at the uni library, away from the lab and home.

Steph – I was in a slightly more precarious situation compared to Josh. I had just started full-time work at WEHI and was spending my nights and weekends

SDS Page: Short Discussions for Students Page

writing my thesis. During this time, I needed to work hard on maintaining some semblance of a healthy work–life balance. To get through it, I had to set clear boundaries with myself. Everything that I considered to be a non-negotiable in my life had to remain untouched, so I made time for a daily workout, a home-cooked meal and eight hours of sleep. If that meant that progress on my thesis stalled for a few days or a few weeks, so be it. In the end, I did manage to get it done, probably a bit more slowly than I anticipated, but with most of my sanity intact.

Seeking professional help

Steph – Early on in my PhD, I felt overwhelmed to a point where I needed to acknowledge that something was wrong. After some debating, I decided to visit my GP. Speaking to her about my worries, she was both sympathetic and tough on me. She told me that as hard as it felt now, this was not going to be the last time I would experience something difficult in my life so I needed to learn how to cope. Although it was helpful to work through my worries and learn ways to ground myself with a professional counsellor, I felt the best thing for my mental health was to prioritise my own wellbeing and putting that into practice.

Josh – I sought professional counselling a few times during my PhD, mostly due to personal problems that had begun to overflow into other areas of my life. My first counsellor was actually not very helpful; they made me feel as if my problems were trivial. Although this put me off professional counselling for a couple of years, when I went back, I met a new counsellor who was fantastic and helped me navigate a messy relationship breakup. I definitely recommend seeking this out if you need help – you just might need to try a couple of counsellors before you find the right fit.

What would you do differently?

Josh – Procrastination is the mind-killer. While it provides temporary relief to put off things, that task sitting on the top of your to-do list becomes bigger each day. Even trivial things can feel huge when they are unfinished. For me, this is an indication that I need help – I either don't know how to get started or I just feel unequipped. Talking to a friend or colleague about breaking it into sub-tasks was really helpful in getting me started. Try starting with the easiest aspect, and I think you'll find the rest will flow on from there.

Steph – Learn how to say "No" – this is the single most important thing I wish I learned earlier. Sometimes as a PhD student, you might feel obligated to say yes to every side-project, request or favour that comes your way thinking, "Yeah, I have time for that," knowing full well that you don't. I think it's great to branch out and expand beyond your main PhD project, but you can afford to be picky. Feel free to say "Yes" to things that interest you and are worth your time and energy, but learn to say "No" to things that add too much stress and pressure to your already busy schedule.

Dr Josh Hardy is a postdoctoral researcher in the Lucet and Babon laboratories at the Walter and Eliza Hall Institute of Medical Research. Josh completed his PhD at Monash University in 2019, in which he used cryo-electron microscopy to study the architecture of viruses. He was recently awarded an NHMRC EL1 Investigator Grant to study the structure and regulation of microtubule networks in cancer and neurogenesis.

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Dr Stephanie Nguyen is a postdoctoral researcher in the Lucet laboratory at the Walter and Eliza Hall Institute of Medical Research. Steph completed her PhD at the University of Adelaide in 2021, which focussed on the structural and biochemical characterisation of several antifungal drug targets. She is currently involved in a drug discovery project as part of a collaboration between WEHI and Boehringer Ingelheim.

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Science meets Parliament 2022

Laura Osellame and Gavin Knott report on SmP2022.

STA CEO Misha Schubert (left) in conversation with Professor Peter Doherty AC.

Science meets Parliament (SmP) is an annual showcase event organised by Science & Technology Australia (STA). This event is a powerful vehicle for connecting and fostering engagement of those working in the STEM sector and for policy makers. Due to the uncertainties surrounding COVID-19, SmP was again held online this year, from Monday 28 February to Friday 4 March. Dr Laura Osellame, La Trobe University and the Olivia Newton-John Cancer Research Institute, and Dr Gavin Knott, Monash University, attended SmP2022 on behalf of the ASBMB.

Over five days, we heard from a stellar lineup of scientists, parliamentarians and advocates representing the full breadth and diversity of Australia's STEM sector. Day One began with social media superstar and national treasure, Professor Peter Doherty AC. He delivered an insightful and passionate commentary on the state of Australian Science, interspersed with anecdotes from his career. Professor Doherty stated that while there were negatives to emerge from the COVID pandemic, a definite positive was the trust that many Australians put into science. In true Professor Doherty fashion, he further implored the public to "listen to scientists and not snake oil salesmen." The first workshop session was an introduction to Canberra and how to make your pitch memorable when meeting a politician. For all of us new to SmP, this session outlined how public service and advocacy groups can shape and respond to policy, and detailed how science and technology can work in this space. In preparation for meeting an MP, we were treated to a wonderful panel of science communicators and former SmP delegates who shared tips and tricks on how to 'hone your pitch'. Panellists highlighted that as scientists, we are adept at explaining our work in minute detail to our colleagues, but how do you get your message across to an MP with limited time and a diverse portfolio or electorate? Make it personable and relatable, and don't ask for money (at least not immediately!)

This flowed nicely to the 'Advocacy with Impact' session on Day Two. Tanya Hosch (Executive General Manager for Inclusion and Social Policy, Australian Football League), Feyi Akindoyeni (Partner and Melbourne Office Head, SEC Newgate Australia) and Kate Cole (Director, Cole Heath), outlined "the why, the what and the how" of a successful briefing. Being strategic is essential but it's also important to remember that "you're not going to get married on the first date." Forming a relationship with the person you are attempting to influence is crucial, but in playing the policy game "it takes a long time to be an overnight success." Often policy change can begin with submissions to a Senate inquiry. With the upcoming Senate inquiry into political interference into ARC grants, this session was particularly topical. Discussing key skills for science advocates, former Cooperative Research Council CEO, Dr Tony Peacock (now Wintermute Biomedical) urged advocates to remain "brief and concise." Often less is more with these documents and tone and context are vital. Fascinating stories from previous delegates on their meeting with Parliamentarians were highlights of the 'Preparing to Meet a Parliamentarian' session. Professor Brian Schmidt (Vice-Chancellor, Australian National University) regaled us with his experience in meeting a particularly colourful MP from Queensland when he first attended SmP. His message to us was that our political values may not align with the MP we would be meeting, so no matter how difficult it is, we should try to make our point personal to them; they are more likely to remember you and your issues if it links with concerns in their electorate.

Day Two ended with an evening with Professor Brian Cox and science communicator and astrophysicist Kristen Banks. Professor Cox is no stranger to Australian television screens, distilling down complex science in a way that is accessible to the average viewer. The theme of making science appreciated by all was expressed throughout SmP, with one advocate suggesting that the points you are trying to make must be understood by a "really smart 12 year old!" Professor Cox and Kristian Banks shared their journey into science communication, urging us to always remain curious.

Clockwise from top left: Kate Cole, Feyi Akindoyeni, Tanya Hosch and Dr Kathy Nicholson (Chair) in the Advocacy with Impact session.

Science meets Parliament 2022

Science & Technology AUSTRALIA

On Day Three, STA President, Professor Mark Hutchinson, gave the National Press Club address. He commented that science and journalism are similar in many aspects, and likened science to a scoop in journalism – "the thrill of the pursuit, it's why a career in science, despite all its challenges, is one of the most exciting, awe inspiring, mind blowing, world changing callings anyone could choose to pursue." Surely this encapsulates perfectly what it is to be a scientist: most of our experiments may fail – but that one amazing result, that one piece that completes the puzzle, is the fuel that continues the fire. Professor Hutchinson further expounded on how to take great Australian science from the bench to the boardroom.

Kristen Banks (left) and Professor Brian Cox.

Science is as much about diverse and great people as it is about great and diverse ideas. This idea was on display throughout Day Four, with keynote speaker the Hon Arthur Sinodinos AO (Australia's Ambassador to the USA), who urged Australian scientists to seize opportunities to engage globally for collaborations and impact. Armed with great ideas, it's critical that we communicate them clearly and effectively. Misha Schubert (CEO, Science & Technology Australia) delivered a great workshop on how to 'Marie Kondo Your Writing'. Unfortunately, it doesn't involve throwing manuscripts or grant applications into a pile and asking, "Does it spark joy?" She urged us to declutter our writing so that we can be more persuasive with simple tricks like avoiding jargon, weasel words and cluttered phrases.

On Day Four, we had the opportunity to hear from our elected representatives, with an emphasis on how to be heard by politicians. Dr Katie Allen MP (Liberal Member for Higgins) urged scientists to be respectfully persistent, which was echoed by both Greens Senator Dorinda Cox and Dr Mike Freelander MP (Labor Member for Macarthur) who said, "The wheels of policy turn slowly." Indigenous STEM leaders spoke powerfully on traditional knowledge that has "always been shared and which is practical and not theoretical." Experts outlined how Australian Indigenous culture has vast depths of knowledge in subjects such as astronomy, fire management and marine science, spanning thousands of years, and how traditional concepts are being reapplyied to the modern world and society. The importance of diversity and inclusion was also echoed in the 'Meet the Chiefs' session by Dr Amanda Caples (Victoria's Lead Scientist), Dr Daniel Walker (ACIAR Chief Scientist), Jane MacMaster (Engineers Australia Chief Engineer) and CSIRO Chief Scientist Bronwyn Fox who put it clearly – "We need to have gender and international diversity around the table."

The concluding sessions on Day Five brought SmP full circle with speakers reiterating messages from Professor Doherty's opening address. Stories of social trust and local leadership underpinned how important community is for public health advice uptake, particularly in support of the COVID-19 vaccine rollout. SmP2022 concluded with a commercialisation masterclass from Dr Cathy Foley (Chief Scientist of Australia).

The week following SmP, Laura met with her local member, Ged Kearney MP (Labor Member for Cooper, a diverse and progressive electorate in the inner north of Melbourne). Also present in the meeting were Dr Marguerite Evans-Galea AM (Executive Director, Industry Mentoring Network in STEM with the Australian Academy of Technology and Engineering, and CEO of Women in STEMM Australia) and Grace Lethlean (Chief Product Officer, ANDHealth), two amazing women doing impressive work in Science and Technology. The discussion ran well over the allocated 30 minutes and ranged from women in STEM, commercialisation of research and medical devices in Australia, to new STEM and industry initiatives. Ms Kearney was well researched and her breadth of knowledge on topics of issues facing the STEM sector and the Australian Labor Party's plans to aid in these areas was particularly insightful.

SmP was a fantastic week. It will be great to return to a face-to-face format in the future. We would like to thank the ASBMB for giving us the opportunity to attend.

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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.

The Bright Side of the Dark Side

Natalie Gunn, Data and AI Software Sales Representative, IBM Australia/New Zealand Technology

I am a sales representative selling software into the public sector. In my previous role, in the same company, I was a research manager in an industrial research lab. I remember joking with my fellow PhD students about joining "the dark side" – some mythical commercial organisation that would eat your soul for breakfast. I did indeed join a commercial organisation and have found it to be exactly where I want to be.

I have always been drawn to science. My love of science started in school and developed through undergraduate studies, Honours and a PhD. I completed my PhD at the University of Melbourne in the Biochemistry Department. I loved working in the newly opened Bio21 Institute. Our labs were filled with natural light (unlike the cliché of dank laboratory basements), pristine facilities, state of the art equipment, and students and staff passionate about what they were working on. I also did experiments at the Australian Synchrotron. I thought it extraordinary that the whole building housing the synchrotron was a scientific instrument to which I had access.

At the end of my PhD, I was ready to move into the workforce and say goodbye to my student life. I knew I did not want to be a postdoctoral researcher. To me, research had become undertaking mundane tasks, rather than those things being paths to new discoveries. My plan was to get my foot in the door somewhere and explore opportunities that would arise.

The best piece of advice I received was that I should tell my colleagues I was looking for a job. People cannot help you if they do not know what you want. One day while finishing an experiment a postdoctoral researcher told me about her friend who was looking to fill a role at another research institute. I was introduced and several meetings later was welcomed onboard at the newly formed IBM Research Australia Laboratory. Here was a role that needed my biochemistry skills. I was now in a large global organisation, and there would be many opportunities to explore once I had established myself.

The IBM Research Australia Laboratory was occupied by my fellow researchers whose experiments were computer-based in an office rather than the biochemistry laboratory I was used to. I would work in the laboratories of our collaborators to produce materials and I was part of the IBM team starting up a new project. I was pleased to be able to reinforce my technical skills, but at the back of my mind was the desire to move on from lab-based work. I did my experiments, published papers, and filed patents. I also took colleagues for coffee, presented at internal seminars and attended IBM marketing events. Over several years, I built a body of work and fostered a reputation for reliability, professionalism and critical thinking.

Natalie Gunn.

After three years, I was offered the opportunity to become a manager. I jumped at the chance. Here was my opportunity to walk through the door I had hoped would open. I was nervous because I did not have the same background as anyone else in my team. Imposter syndrome occupied prime real estate in my head. Now I am better equipped with experience and skills to manage this negative mental chatter, but it took a lot of mentoring and coaching to get to this point. I was no longer in a biochemistry lab, but I did have skills and experience that ultimately helped me succeed in my first managerial role. The resilience we need when experiments fail is the same as when projects are no longer funded. Resolving conflict when you have double booked the centrifuge is a similar process to resolving conflict between you and a project manager who has decided your project is not progressing fast enough.

After three years of experience as a manager, I applied to be a senior manager at IBM Research Australia. This role has been my favourite role so far. It gave me new territory to explore. I had a larger portfolio to manage

Off the Beaten Track

and was accountable for obtaining visibility for our team globally and securing external funding. At this level, I needed to be able to understand more about business initiatives so we could align our work to them. I performed the same tasks as I did when I first joined IBM, only this time I was building a global network. I scheduled virtual catchups with international researchers, attended international workshops and conferences, and stayed on extra days to meet with my global colleagues. I had a wonderful time in this role, and I am proud of what we achieved as a team.

Not long ago, I felt that I needed to put myself out of my comfort zone once again. As researchers, we do a lot of selling, whether for grants, or project proposals, or even ourselves. I was frustrated that researchers would be paraded out at events, but afterwards piled back into our labs until the next event. I felt one way to overcome this was to join the commercial organisation. I wanted to work with people who sell as a profession. I have joined IBM's sales organisation as a sales representative. I have a quota, a territory and a product set. This is a very different structure compared to my research roles, but I am finding the same fundamental skills are crucial for success in the role. My strong analytical and communication skills help me build a common understanding of what the customer needs and values. One of the best things from IBM Research was that I became great friends with our marketing team! They have the best events and, importantly, are helping me to expand my network and exposure in my new role. I am finding this new adventure a refreshing challenge, and a huge opportunity to build my skillset that will be important for future leadership roles. I have truly joined the dark side and have found it is quite bright out here after all!

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When Self-disclosure Inadvertently Leads to Patent Self-sabotage

In this issue, Sheila Barbero and Sarah Hennebry from FPA Patent Attorneys discuss some self-disclosure issues that could potentially block success in obtaining a granted patent, and tips on how to avoid these.

Sheila Barbero (top) and Sarah Hennebry.

Regular readers of our IP articles will know that to obtain a granted patent, the invention claimed in the patent must be novel (new) and inventive over the 'prior art'. Broadly speaking, prior art includes any information that has been made publicly available. This may include written or oral descriptions or an actual use, before a patent application is filed. The information may be disclosed by anyone, including self-disclosures by the inventors themselves.

When it comes to self-disclosures, the types of disclosure that immediately come to mind for inventors are their own published journal articles. Many readers will be aware that if patent protection for an invention is desirable, a patent application should ideally be filed before any journal article describing that invention is published, in order to prevent the article from becoming prior art.

However, there are other types of self-disclosures that are sometimes overlooked. It is important to be aware of these, particularly because if you disclose too much information, there is a risk that you can block yourself from obtaining patent protection for your invention.

In this article, we discuss some less obvious examples of self-disclosures and provide tips on ways to avoid such self-disclosures from precluding later opportunities to obtain patent protection.

Preprints

Article preprints – manuscripts that are published before peer review – are becoming increasingly popular as a means to share research and obtain early feedback before submitting the manuscript to a journal. There are several preprint platforms available across a variety of disciplines that allow researchers to upload preprints, including bioRxiv, chemRxiv, F1000 Research and Preprints.org.

Even though they have not yet been peer reviewed, preprints can be cited as prior art because the information is publicly accessible. Therefore, where there may be interest to obtain patent protection for the research, a patent application should ideally be filed before submitting a preprint.

Tip: *If there is potential interest to patent the research, consider whether submitting a preprint is appropriate in light of IP strategy.*

Accepted author manuscripts

The publication of accepted author manuscripts (AAMs) is also increasing. AAMs, also called postprints (and sometimes called preprints), are peer-reviewed manuscripts that have been accepted for publication, but have not yet been typeset and formatted by the journal.

Postprints can result in 'early' publication of an article, so it is good practice to check whether the target journal publishes postprints before the final publisher's version. If it is not possible to delay publication, check with the commercialisation/technology transfer office of your university/institute whether a patent application should be filed before your manuscript is submitted for review.

Tip: *Before submitting your paper to a journal, check whether that journal publishes AAMs and, if so, whether publication can be delayed.*

Thesis publications

Work described in student theses can often become the basis for subsequent journal articles – and patent applications. Student theses are increasingly becoming available online, making them easier to locate in a search.

If there is an interest to patent research described in a thesis, it is usually possible to request an embargo of the thesis to prevent access. A thesis embargo will typically last for a set period of time (e.g., two to three years), though it is often possible to extend the embargo if required. It is good practice to monitor the embargo period to ensure that a patent application is filed before the embargo expires.

Tip: *If there is potential interest to patent work described in a thesis, request embargo of the thesis and make sure a patent application is filed before the embargo period expires.*

Oral and poster presentations

Oral and poster presentations given at conferences and seminars are non-confidential disclosures that can become prior art.

Typically, abstracts for presentations are cited as prior art because they are often readily accessible. However, the presentations themselves are now becoming increasingly

When Self-disclosure Inadvertently Leads to Patent Self-sabotage

available online, especially with many seminars and conferences transitioning to online platforms over the last couple of years due to the current pandemic. For example, the social media platform, Twitter, is becoming popular for hosting virtual poster sessions, with presenters providing copies of their posters and links to short video presentations of their posters.

In view of this, to avoid a potentially damaging self-disclosure, it would be best to avoid including in your abstract and presentation the key features of the invention that are to be claimed. Another option could be to de-identify the key features of the invention in your presentation. If you are uncertain whether or not you are disclosing any key features, make sure to run your abstract and presentation by your university or institute commercialisation/technology transfer office first.

Tip: *Avoid disclosing key features of the invention in presentations and abstracts. Make sure to consult with your commercialisation/technology transfer office prior to making any disclosures relating to your innovations.*

Advertisements and flyers

A type of self-disclosure that is often overlooked includes public advertisements, in particular those that describe a research project. These advertisements may be used, for example, to recruit new students and researchers to your laboratory or may be directed to prospective commercial partners and investors.

Advertisements and flyers that describe key aspects of a research program can potentially be damaging self-disclosures. These key aspects could include, for example, specific details about the hypothesis and expected outcomes of the research. Therefore, it may be best to only include high-level information and avoid specific details in these advertisements.

Tip: *Avoid disclosing key details of research projects in publicly accessible advertisements.*

Clinical trials

In some situations, a clinical trial may be registered before a patent application is filed. As some readers may know, in Australia, clinical trials must be registered in a publicly accessible database before the first participant is recruited. The two main registries are Australian New Zealand Clinical Trials Registry (ANZCTR) and ClinicalTrials.gov. The registries record details of a trial's objectives, design and treatments under investigation, meaning that key details of a planned clinical trial are made public before the trial even starts.

Last year, an Australian court found that claims relating to new medical uses for a known drug were not novel and not inventive, in view of an earlier published clinical trial protocol by the patent applicant – *even though the clinical trial hypothesis was unproven at the time*. This example highlights the potentially damaging impact a published clinical trial registration can have on a later filed patent application.

The impact of clinical trial registrations can be minimised by disclosing only the minimum requirements for registration, and avoiding the disclosure of key features of the invention.

On patient recruitment, it is also important to note that information provided to trial participants is not confidential as a matter of course and therefore can be public disclosures. It is often possible to arrange for trial participants to sign a confidentiality or non-disclosure agreement. Bear in mind that such agreements can be breached and therefore are not guaranteed to prevent a public disclosure being made. Therefore, it would be ideal to have a patent application filed before starting patient recruitment.

Tip: *Where it is not possible to file a patent application before a clinical trial, keep clinical trial registrations to minimum requirements and avoid disclosing key features of the invention. Also, consider putting confidentiality/non-disclosure agreements in place as early as possible.*

What if I have already made a self-disclosure before filing a patent application?

In an ideal situation, the above self-disclosures would be avoided until a patent application is filed. Sometimes self-disclosures can be made unintentionally or without knowing the consequences. In some cases, it may just not be practical to avoid the disclosure due to competing interests.

If you happen to have self-disclosed, this does not necessarily mean you will be prevented from obtaining a granted patent. Whether or not a self-disclosure is likely to be damaging will typically depend on the nature and extent of what has actually been disclosed, and so is usually assessed on a case-by-case basis. If you are unsure whether a disclosure you have made (or are planning to make) will be problematic, make sure to consult your university/institute commercialisation/technology transfer office before making the disclosure.

Where a potentially damaging self-disclosure has been made, you may able to get around the disclosure by relying on the so-called 'grace period'. This involves filing a patent application within a fixed period from the disclosure (the grace period – usually six or 12 months), which will remove the self-disclosure from being considered as prior art. It is important to note that, although more countries are now starting to adopt a grace period, not all countries allow for a grace period. Also, the requirements for a patent application to comply with the grace period are different for each country. It is best not to rely on this option, although it can be a helpful fallback in the case of an earlier problematic self-disclosure.

When Self-disclosure Inadvertently Leads to Patent Self-sabotage

Take home messages

- To avoid a self-disclosure blocking you from obtaining a granted patent, best practice is to ensure a patent application is filed before any details of your invention are publicly disclosed. If this is not possible, consider some of the tips above to potentially minimise the impact of the public disclosures.
- If you are uncertain whether a self-disclosure is likely to jeopardise a future patent application, make sure to consult with the commercialisation/technology transfer office of your university/institute.
- Where a problematic self-disclosure has been made, it may be possible for the disclosure to be disregarded as prior art if a patent application is filed within the "grace period" in certain countries.

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Australia Day Honour for ASBMB Member

Professor Leslie Burnett was awarded a Member of the Order of Australia (AM) for significant service to pathology, to medical research, and to professional societies.

Leslie is a clinical pathologist in both genetic pathology and clinical chemistry. He has been an ASBMB member for 45 years.

He commenced his studies as a medical student at the University of Sydney but was repeatedly drawn into exploring questions of basic research in molecular biology and genetics. He completed his first research degree studying under Professor Gerry Wake (bacterial genetics), pursued further research in his final medical undergraduate year as a Fellow under Nobel laureate Paul Berg (SV40 genetics) and, concurrently with his Pathology specialisation, he completed his PhD in computational biology under supervisors Professor Tony Basten and the late Professor Bill Hensley. Much of Leslie's subsequent career has been as a Director of various clinical pathology services, initially in Clinical Chemistry, and later (when the discipline emerged) in Genetic Pathology.

Leslie is currently Principal Medical Geneticist and Medical Director in Clinical Genomics at the Garvan Institute of Medical Research, consultant Pathologist and Clinical Laboratory Director at Invitae Australia, and supports the Clinical Immunology Research Consortium of Australasia (CIRCA) as a Genetic Pathologist. He holds honorary positions as Conjoint Professor at the School of Clinical Medicine, UNSW Sydney; and Honorary Professor in Pathology and Genomic Medicine in the Northern Clinical School, Faculty of Medicine and Health, University of Sydney.

Leslie pioneered many pathology and genetics initiatives, which are today mainstream clinical services. These include founding Australia's first genetic carrier screening program (the 'Tay-Sachs disease program'), establishing Australasia's first clinically accredited whole genome sequencing laboratory, developing the world's first pre- and post-analytical quality assurance programs in pathology, and founding Australia's national peak body for public pathology (now Public Pathology Australia). He has served as Ministerial appointee, Chairman, or President of a number of National and International bodies in pathology and genetics.

He is a passionate teacher and communicator about genetics and the genomics revolution.

ASBMB Medallist and Awardee Profiles

The Lemberg Medal is awarded to a distinguished Australian biochemist or molecular biologist who will present the Lemberg Lecture at the annual ASBMB conference. The Medal is presented in memory of Emeritus Professor MR Lemberg, who was the Society's first President and Honorary Member. Nominees must have been members of the Society for at least five years before the year in which the Medal nomination is to be considered. An honorarium is provided by the ASBMB.

The Lemberg Medal
Leann Tilley

Professor Leann Tilley studied at the University of Melbourne (BSc, Hons) and Sydney University (PhD), and undertook postdoctoral fellowships at Utrecht University, The Netherlands, College de France, Paris and the University of Melbourne, before beginning her independent career at La Trobe University 1989. She was promoted to Professor in 2004. In 2011, she returned to the University of Melbourne and is now Professor Emeritus of Biochemistry and Pharmacology, at the Bio21 Institute, University of Melbourne.

Leann's laboratory embraces a large range of technologies, such as structural cryoEM, X-ray crystallography, novel imaging technologies, molecular cell biology and chemical biology, to identify vulnerabilities in the malaria parasite and other pathogens. She is interested in the action of, and resistance to, anti-infective drugs; and is working with industry partners to design pathogen-specific compound that hijack adenylate forming enzymes. She believes that answering the major medical and biotechnology questions of the 21st century will require convergence of the life and physical sciences, with particular reliance on advanced imaging techniques and biocomputational approaches. She also believes that the development of drugs for diseases that affect patients who can't afford expensive treatments, requires radical new approaches involving academic/private/public partnerships. She would like to be part of the exciting developments in these areas.

Leann is passionate about encouraging the next generation of scientists, particularly about enhancing the roles of women in science. She believes that answering important questions requires teams of gender and culturally diverse, passionate people who provide different ideas, perspectives and backgrounds – building a collective intelligence.

Leann served as Director and Deputy Director of the ARC Centre of Excellence for Coherent X-ray Science (CXS). This Centre received international acclaim for its cross-disciplinary and cross-institutional work and its contributions to the development of novel imaging techniques.

In 2015, Leann was awarded the Georgina Sweet Australian Laureate Fellowship from the Australian Research Council, to measure and model malaria parasites. She has played a leadership role in promoting women in science; this includes her establishing and implementing the Georgina Sweet Awards for Women in Quantitative Biomedical Science. She was honoured with the title of Redmond Barry Distinguished Professor, by the University of Melbourne in 2016.

ASBMB Medallist and Awardee Profiles

The Shimadzu Research Medal is awarded to an outstanding Australian biochemist or molecular biologist with less than 15 years postdoctoral experience. The successful candidate will present the Shimadzu Medal Lecture at the ASBMB annual conference. Nominees must have been members of the Society for at least two years before the year in which the Medal nomination is to be considered. An honorarium is provided through the courtesy of Shimadzu.

The Shimadzu Research Medal
Michael Lazarou

Associate Professor Michael Lazarou heads a laboratory focused on autophagy and mitochondrial quality control within the Ubiquitin Signalling Division at the Walter and Eliza Hall Institute of Medical Research (WEHI), and is co-affiliated with the Biomedicine Discovery Institute at Monash University.

Michael's graduate studies with Professor Mike Ryan focused on the assembly of mitochondrial protein complexes and how they break down in energy generation disorders. He developed assembly models for complex I of the oxidative phosphorylation machinery and untangled the basis of complex I assembly defects in mitochondrial disease patients. He undertook his postdoctoral studies in 2010 with Professor Richard Youle at the National Institutes of Health, USA, with the support of an NIH/NINDS postdoctoral fellowship. Here, he focused on the Parkinson's disease proteins PINK1 and Parkin and their role in maintaining mitochondrial health through mitophagy, a degradative pathway which culls damaged mitochondria. Michael's work solved how the kinase PINK1 senses mitochondrial damage, and identified PINK1's mitophagy-activating substrate, ubiquitin, while also providing critical insights into the mechanisms of Parkin's enzymatic activity.

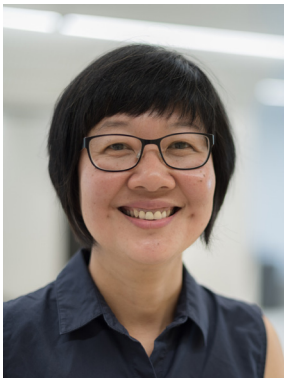
Michael was recruited to the Biomedicine Discovery Institute at Monash University in June 2014, where he established his laboratory, before moving to WEHI as a lab head in 2022. Michael's lab uses multiple imaging modalities, including AI-directed volumetric electron microscopy, combined with gene editing and biochemistry to understand the intricate mechanisms of mitophagy and mitochondrial quality control. Michael's research highlights include: solving how PINK1/Parkin mitophagy is initiated and understanding the downstream mechanisms of mitophagy involving the capture of damaged mitochondria within double membrane vesicles termed autophagosomes. His work has revealed "new paradigms for understanding the complicated mechanism that orchestrates autophagosome biogenesis" (*Autophagy*, 2021). He has published in *Molecular and Cellular Biology, Developmental Cell, Molecular Cell*, *Journal of Cell Biology, Nature, Science* and *Nature Cell Biology.*

Michael's research has been supported by the NHMRC and ARC. He was the recipient of the 2013 ASBMB Boomerang Award and he held a 2017–2020 ARC Future Fellowship. He is a Council member and affiliate member of the NIH-funded Autophagy Inflammation and Metabolism Center (USA) and serves on the Editorial Board for *Journal of Cell Biology* 2022–2024. Michael supports the Parkinson's disease community through philanthropic and community events.

ASBMB Medallist and Awardee Profiles

The SDR Scientific Education Award rewards outstanding achievement in education in biochemistry or molecular biology, especially innovation and creativity in education, with a view to fostering leadership in this important area of the Society's objectives. The Award will enable the recipient to participate in an international conference with a significant focus on education, or to spend a period of time at another institution (in Australia or overseas) for the purposes of undertaking developments in education in biochemistry and molecular biology. The recipient will present a lecture within the Education Symposium at the ASBMB annual conference. Applicants must have been members of the Society for at least two years before the year in which the Award application is to be considered. The contribution to travel expenses is provided through the courtesy of SDR Scientific.

SDR Scientific Education Award
Saw Hoon Lim



Teaching brings me such joy, it simply re-energizes me – although I couldn't explain it for a very long time! I come out from a class more content than when I entered. If I could, I would whistle a happy tune.

Right after my BSc, I was offered a job at a multinational company in Malaysia as a systems analyst employing completely different skills from my degree in genetics. A year in, the offer of a scholarship for a PhD at the University of Cambridge came in the mail (yes, it was that long ago). It was one of the most agonising decisions that I had to make. Leave a decent paying job for another three years of study? But when I looked to the future, I knew that I needed to carve out a path that included being an educator. After all, since Year 1, being a teacher has always been my ambition.

Three years later and after many rounds of punting on the River Cam, I graduated with a PhD in Plant Molecular Biology. I was offered a lecturing position at the National University of Singapore, teaching molecular biology and doing research on transferring genes into orchids. As beautiful as orchids were, I found the scholarship of teaching and learning even more captivating. There, I was also part of the pioneering team to form the University Scholars Program, bringing a multidisciplinary curriculum to undergraduate students.

Eight years on, we moved back as a family to Malaysia where I secured a position as a management consultant, a world away from teaching. But again, the lure of teaching beckoned so I went back to being an academic at the Malaysia University of Science and Technology, a (then) postgraduate university, modelled after the Massachusetts Institute of Technology.

Another eight years later, we moved to Australia. My 'wondering' years were over. I knew then that teaching was what I really wanted to do. I restarted my career again as a tutor, and then as a lecturer at Monash University. I settled at the University of Melbourne as a senior lecturer in the Department of Biochemistry and Pharmacology, teaching biochemistry and incorporating biochemistry concepts into interdisciplinary subjects.

I finally solved the mystery of why teaching brings me such joy – it's the relationship and the connection with students and with my other colleagues that I thrive on. I feel gratified building knowledge with students as partners and incorporating interdisciplinary perspectives in my teaching. No more eight-year itches, no more hopping into other careers, I have found my answer.

ASBMB Medallist and Awardee Profiles

The Eppendorf Edman ECR Award is awarded to an ASBMB member with no more than seven years postdoctoral experience (or equivalent taking any career disruption into account), in recognition of their outstanding research work. The Award provides funds to assist the recipient to attend an overseas conference in a field associated with biochemistry or molecular biology or to visit briefly a research laboratory in Australia or elsewhere to access specialised equipment or to learn new research techniques. The recipient will present a lecture within a symposium at the ASBMB annual conference. Applicants must have been members of the Society for at least two years before the year in which the application is to be considered, or must have taken out a three year membership in the year of the application. The contribution to travel expenses is provided through the courtesy of Eppendorf South Pacific.

Eppendorf Edman ECR Award
Wael Awad

Dr Wael Awad completed BSc and MSc studies at Cairo University, Egypt, resulting in two publications in the fields of molecular biophysics. With the support of an Erasmus Mundus Scholarship, Wael then moved to Sweden and completed a PhD under the supervision of Professor Derek Logan at Lund University. Wael's PhD research was focused on the structural and functional characterisation of glycoproteins integral to cellular communication and signalling. His outstanding PhD dissertation led to five publications (four as first author and one review) and received the Best PhD Thesis Award from the MAX-IV Synchrotron (2015, Sweden). Wael then pursued his scientific career as a Research Fellow at Monash University (November 2015), under the mentorship of Professor Jamie Rossjohn. At Monash, he has brought a wealth of technical expertise in biochemistry and protein crystallography to markedly advance our understanding of the molecular correlates of metabolite-mediated T cell immunity.

Wael has demonstrated an ability to drive high-calibre research, and establish strong and fruitful collaborations as evidenced by his authorship of 19 original publications (nine as the first author and three reviews) in top-tier journals including *Science, Nature Immunology, Science Immunology and Proceedings of the National Academy of Sciences USA*. Of note, his seminal research on the molecular basis underpinning T cell recognition of microbial-derivatives was showcased on the cover of the April 2020 issue of *Nature Immunology*. This research paves the way for the development of innovative therapeutics based on selective modulation of T cell immunity. In addition, he has determined 28 protein crystal structures, the data for which have been deposited into the Protein Data Bank open access repository.

Wael has now established an international profile in the field of structural immunology as evidenced by his high impact publications and his selection to present at more than 30 national and international conferences. He has been recognised with more than 16 awards for research excellence including the prestigious International Union of Crystallography Young Scientist Award (New Zealand, 2018), the Robert Porter ECR Publication Prize 2021 for Laboratory-based Sciences (Monash University) and the Robin Anders Young Investigator Award 2021 (Lorne Proteins). He has recently been awarded an Australian ARC DECRA Fellowship (2022–2024) to support the development of his research program in the field of metabolite-mediated T cell immunity.

ASBMB Fellowship Profiles

The ASBMB Fellowships are awarded annually to biochemists or molecular biologists, in their early career and normally resident in Australia, in recognition of their outstanding work in an area of biochemistry and molecular biology. The Fellowships provide funds to assist the recipient to attend an overseas conference in a field associated with biochemistry or molecular biology or to briefly visit a research laboratory in Australia or elsewhere to access specialised equipment or to learn new research techniques. Applicants must be at least in the second year of PhD training and not more than two years subsequent to the award of their PhD degree. Applicants must have been members of the Society for at least one year immediately prior to application or must have taken out a three year membership in the year of the application.

The Collins family kindly established the Fred Collins Award to honour the role that Fred Collins played in the establishment of the Australian Biochemical Society.

Yanxiang Meng – recipient of the Fred Collins Award for the most outstanding ASBMB Fellowship applicant

Yanxiang Meng completed a Bachelor of Science in Biochemistry in 2017 at the University of Canterbury, New Zealand. He continued his studies in Christchurch at the University of Canterbury, completing his Honours in 2018 under Professor Renwick Dobson and Professor Mark Hampton (University of Otago, Christchurch). During this time, Meng investigated the structure and function of alkylhydroperoxidase D from *Streptococcus pneumoniae*, discovering an unexpected active site architecture, and published these results in *Journal of Biological Chemistry*. In late 2019, Meng joined the laboratory of Professor James Murphy at the Walter and Eliza Hall Institute of Medical Research. Co-supervised by Associate Professor Peter Czabotar and Dr Jarrod Sandow for PhD studies, Meng's current research investigates the structural basis of RIPK3-mediated necroptosis signalling and cell death in human cells. During this time, he discovered that human MLKL is maintained by RIPK3 in an inactive conformation prior to necroptosis activation; he also uncovered the structural basis of the conformational switching mechanism of MLKL pseudokinase domain. His research made significant impact in the field of necroptosis, reflected in two first-author papers in *Nature Communications* and one in *Cell Death & Differentiation*. Meng's achievements have been recognised through his receipt of several awards and scholarships, including AINSE Postgraduate Research Award (2020), Melbourne Research Scholarship (2019) and AINSE Honours Scholarship (2018).

Meng is scheduled to present his recent findings at the 88th Harden Conference of the Biochemical Society (Beyond Catalysis – Kinases and Pseudokinases) to be held in Warwickshire, UK.

Jacinta Conroy

Jacinta Conroy completed a Bachelor of Biomedical Science with First Class Honours at the University of Queensland, in 2016. Following, she worked as a research assistant in the School of Biomedical Sciences at the University of Queensland, testing treatments for Parkinson's disease and motor neurone disease *in vitro* and *in vivo*. In 2018, Jacinta received an Australian Government Research Training Program Scholarship and full Tuition Fee Offset Scholarship to undertake a PhD under the supervision of Professor Elizabeth Coulson at the University of Queensland. Since commencing, Jacinta has worked to understand the contribution of neurotrophic signalling to cholinergic neuron death or survival outcomes in Alzheimer's disease, as well as the role of neurotrophin receptors in normal function of these neurons. She is also interested in how manipulation of neurotrophin receptors could protect cholinergic neurons, and plans to investigate this further in the final stages of her postgraduate study. During her candidature, Jacinta has published an invited first author spotlight article in *Neuron* and a review in the *Journal of Biological Chemistry*, closely related her thesis work. She is also on track to publish three first author and two co-author articles before thesis submission, with two currently under review and another in preparation.

This ASBMB Fellowship will give Jacinta an opportunity to attend the 3rd UK Workshop on Membrane Proteins: Solubilisation and Biophysical Characterisation in Birmingham, UK, and thereafter travel to meet potential collaborators and employers based in Europe to further develop her research and career progression.

ASBMB Fellowship Profiles

Chris Horne

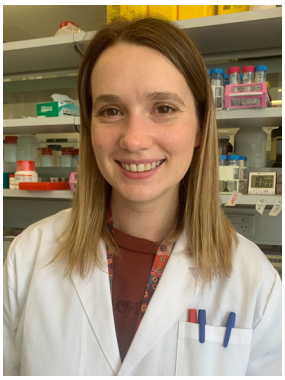
Dr Chris Horne completed his PhD in 2019 working in the laboratory of Professor Ren Dobson at the University of Canterbury, New Zealand. During his PhD studies, Chris unravelled the molecular details of gene regulation for sialic acid metabolism in bacteria. Through this program, he developed expertise in the areas of structural biology and protein biophysics, which notably led to a first author publication in *Nature Communications*.

In 2020, Chris moved to Melbourne and began working as a postdoctoral research fellow at the Walter and Eliza Hall Institute of Medical Research (WEHI) in the laboratory of Professor James Murphy. His research now focuses on models, mechanisms and molecular interactions of kinase and pseudokinase signalling proteins, including those that govern the necroptosis cell death pathway.

Chris has generated over 19 peer-reviewed publications, which include those focussing on his own work, and his contributions to collaborative projects. This research has been recognised by opportunities to present at local and international conferences, write reviews for prominent journals and through awards from various organisations, including the Biochemical Society.

This ASBMB Fellowship will enable Chris to share his latest work at the 88th Harden Conference of the Biochemical Society (Beyond Catalysis – Kinases and Pseudokinases) to be held in Warwickshire, UK.

Tess Malcolm



Dr Tess Malcolm completed her Bachelor of Biotechnology (Medical) at Monash University in 2015, followed by Honours under the supervision of Associate Professor Sheena McGowan within the Department of Microbiology. Her research project involved the screening of compounds against two essential aminopeptidases from *Plasmodium falciparum* and *P. vivax*, which are targets for the design of novel antimalarials.

In 2017, Tess was awarded a Research Training Program scholarship to undertake a PhD in Associate Professor McGowan's laboratory. During her PhD, Tess continued to investigate and characterise the antimalarial drug targets studied during her Honours year. Following her passion for structural biology, Tess integrated the use of X-ray crystallography in combination with cryo-electron microscopy and several biophysical techniques to investigate how to effectively inhibit aminopeptidase activity with small compounds.

Throughout her PhD, Tess' research has been recognised with several national and international awards including the SCANZ Rising Star Award (2020), the Tilley Prize for a Promising Young Protein Scientist (2019) and the Poster Prize of the Czech Society for Biochemistry and Molecular Biology at the International Proteolysis Society General Meeting (2019). Tess was also involved in student advocacy during her PhD, as the president of the Monash University Microbiology Postgraduate Society and as a member of the Monash BDI Graduate Student Committee.

In 2020, Tess joined the laboratory of Associate Professor Megan Maher within the School of Chemistry at University of Melbourne as a Postdoctoral Research Fellow. Tess currently researches the manganese importer from *Streptococcus pneumoniae*, and she continues to use complementary structural biology techniques to understand protein structure and function.

This ASBMB Fellowship will allow Tess to travel to Jeju Island, South Korea, to present her research at the Asian Crystallographic Association (AsCA) 2022 Meeting.

Australian Society for Biochemistry and Molecular Biology Inc
PUBLICATION SCHEDULE FOR *AUSTRALIAN BIOCHEMIST*, volume 53, 2022

Issue	ASBMB Content	Copy Deadline	Issue Date
April 2022 53(1)	Profiles of medal, award and fellowship winners Nominations for Executive/Council	Monday 7 February	Monday 4 April
August 2022 53(2)	Nominations for medals, awards and fellowships Notice of AGM/proposed constitutional changes	Monday 6 June	Monday 1 August
December 2022 53(3)	Annual reports ComBio2022 report	Monday 3 October	Monday 5 December

Perth Protein Group: an ASBMB Special Interest Group

The Perth Protein Group (PPG) is one of ASBMB's more recently established Special Interest Groups. PPG is now in its third year, having been launched in mid-2019.

The Executive Committee for PPG in 2021 was Josh Mylne (Chairperson and Webmaster), Abi Ghifari (Treasurer), Tahlia Bastholm (Secretary), Nicolas Taylor (ASBMB Liaison), Brady Johnston (Media Officer). There were also four Events Officers, Jeffreena Miranda, Aleshanee Paxman, Andrew Marshall and Farley Kwok van der Giezen.

While we all hoped 2021 would be a brighter one than 2020, last year certainly had its complications. WA had the good fortune to remain largely COVID-free in 2021, and in lieu of meetings interstate or overseas, we held our 2021 AGM in September down South (aka 'Douth' for us sandgropers).

Organisation of the PPG AGM 2021 was spearheaded by rising star Dr Pauline Zaenker of Edith Cowan University. We held our AGM at the Edith Cowan University campus in Bunbury. The City of Bunbury has a population of approximately 80,000 and is about 180 km south of Perth.

We stuck to the format of our first AGM, similar to the long-running and successful SPG/QPG East Coast Protein Meeting. Most delegates arrived on the Friday afternoon 10 September, and we opened proceedings with a keynote session by Dr Pauline Zaenker titled 'Autoantibodies as powerful cancer biomarkers – are we there yet?' This was followed by a session of three more talks, before drinks and then dinner.

Saturday was jam-packed with 15 talks, starting at 8:45am. The program included sessions entitled Biological Chemistry, Biochemistry and Chemical Biology. The day ended with a poster session and the conference social at the Rose Hotel in town.

Sunday 12 September opened with a keynote session by Professor Charlie Bond who gave an inspiring talk titled 'RNA-induced control of the structure and organisation of proteins'. One last session showcased four early- and mid-career research talks, and the day was closed out by awarding some prizes. There were four winners, each taking home a $150 prize:

- Zahra Abbas – Best Student Talk (sponsor: Proteomics International)
- Mark Agostino – Best EMCR Talk (sponsor: John Morris)
- Tahlia Bastholm – Best Student Poster (sponsor: John Morris)
- Indra Roux – Best EMCR Poster (sponsor: ASBMB)

Registration remained at the very low rate of $60 for the early birds. We plan to continue using remote university campuses that are ideal for small conferences, provide a getaway and are usually very affordable. The venue for

Delegates at the 2021 Perth Protein Group AGM at the Edith Cowan University campus in Bunbury, two hours south of Perth. Image credit: Josh Mylne.

Perth Protein Group: an ASBMB Special Interest Group

PPG 2022 is yet to be decided and it's Curtin University's turn. The Curtin Kalgoorlie campus seemed a bit too far, being a seven-hour drive away, but a campus in Geraldton, north of Perth might do, although the idea of Rottnest Island was mooted for 2022 too.

Our most recent event was a special presentation by Evelyne Deplazes titled 'An integrative approach to characterise membrane-altering peptides and proteins', held at Curtin University and streamed live on Friday 29 October 2021. Evelyne is currently based in Queensland, but was over in WA visiting. She is an alumna of both Curtin University and UWA. Evelyne emerged from quarantine to deliver her lecture and then everyone adjourned to a nearby rooftop for some yeasty Friday afternoon refreshments.

Our database contains 141 active members. To be added to our database and be made aware of what we are doing in WA, email perthproteins@gmail.com.

Josh Mylne
Chairperson, Perth Protein Group
Email perthproteins@gmail.com
Website http://perthproteins.org
Twitter @PerthProteins
Facebook https://www.facebook.com/Perth-Protein-Group-105895535020957

Election of Council 2023

Nominations are called for the following positions on the Council of the Australian Society for Biochemistry and Molecular Biology Inc for 2023: Secretary, Treasurer, Editor, Education Representative, FAOBMB Representative, Secretary for Sustaining Members and State Representatives.

The ASBMB Council for the period 1 January 2022 to 31 December 2022 is composed of the following members:

President	J Matthews
President Elect	R Hannan
Secretary	D Ng #
Treasurer	M Kvansakul §
Editor	T Soares da Costa #
Education Representative	N Samarawickrema §
FAOBMB Representative	T Piva §
Secretary for Sustaining Members	S Jay #

Representatives for:	
ACT	C Spry #
NSW	L Sharpe #
Vic	L Osellame #
Qld	M Landsberg #
SA	M Pitman §
Tas	I Azimi #
WA	A Van Dreumel #

Eligible for re-election
§ Position open

Nomination forms are available on the ASBMB website. Nominations for all vacant positions must be signed and seconded by members of the Society. The nominations must be signed by the nominee to indicate his/her willingness to stand. If more than one nomination is received for any position, a ballot will be held at the Annual General Meeting. All members will be notified of any elections and members not attending the Annual General Meeting may submit a proxy form available from the Secretary.

NOMINATIONS MUST REACH THE SECRETARY 14 DAYS PRIOR TO THE AGM TO BE HELD DURING COMBIO2022: 27–30 SEPTEMBER 2022.

Science Teachers' Association of Victoria – Science Talent Search

The Victorian branch of the ASBMB continued its Gold Sponsorship of the annual Science Talent Search in 2021. Once again, the event, presentations and awards were held online. The Science Talent Search, founded in 1952, is organised by the Science Teachers' Association of Victoria and is open to all Victorian primary and secondary school students. The aims of this program are:

- Encouraging independent self-motivated project work amongst students of science.
- Giving students the opportunity to communicate their achievements to a wider audience.
- According recognition of effort and achievement for their scientific enterprise.
- Promotion of the direct involvement of the students in the process of science and its communication.
- Providing the public at large an opportunity to see the quality of work being achieved in science, by both primary and secondary students.

Zain Chohan (Sirius College) extracting bull thistles.

The overriding theme of the 2021 Science Talent Search was 'Food: Different by Design'. Sixty-six schools participated, 551 student bursaries were awarded and 600–700 people attended the individual ceremony sessions on the presentation day.

The Victorian branch of the ASBMB was happy to again support the event with a $1,000 donation in the form of minor and major bursaries to students from the following schools: Melbourne Girls Grammar School, Serpell Primary School, Sirius College, St Leonard's College, and Templestowe Park Primary School. Project titles included: 'Enzymatic browning', 'The mould extravaganza', 'Under which conditions do carrots grow best?', 'Which commonly used surfaces contain the most bacteria?', 'The science of spherification of orange juice' and 'Bitter thistles: extracting an enzyme from bull thistles to produce large amounts of curds'.

ASBMB Victoria is proud to sponsor this event annually. The letters we receive from the students at the conclusion of their projects is a testament to the program, as many of students develop such a great love for science and experimentation that they return each year. Following the progression of many of the ASBMB-sponsored projects, highlights that often the new project is built upon knowledge and techniques and were gained in the previous year. This program gives the students a fantastic taste of science and hopefully inspires a future in STEM. 2021 was once again a very difficult year for face-to-face learning and students in general in Victoria; congratulations from ASBMB Victoria to all the students on completing your research projects.

Meagan Barrow (Melbourne Girls Grammar School) studies the spherification of orange juice.

Laura Osellame
ASBMB Victorian State Representative
www.sciencevictoria.com.au/sts

Australian Academy of Science Honours for ASBMB Members

Twenty researchers from around Australia have been recognised by the Australian Academy of Science in March 2022, receiving honorific awards for their contributions to the advancement of science. Three of the awardees are ASBMB members.

RUBY PAYNE-SCOTT MEDAL AND LECTURE
A Premier AAS Award
LIZ DENNIS, CSIRO

Dr Liz Dennis is a distinguished plant molecular biology researcher. She has addressed important basic questions in plant development, vernalisation-induced flowering and the increased yield of hybrid varieties. A feature of her research is that she has worked with *Arabidopsis*, a plant favoured in laboratory research, and then transferred her discoveries to crop plants. This has been a powerful strategy. Her analysis of the basis of hybrid vigour has been outstanding in *Arabidopsis* and subsequently in rice. The development of hybrid mimics in rice has removed the first-generation limit for hybrids and facilitates a continuity of high food grain production. The development of high yielding mimic varieties can be expected in many other crops.

FENNER MEDAL
An Early-career AAS Award
CHRIS GREENING, MONASH UNIVERSITY

Associate Professor Chris Greening's remarkable discovery that bacteria can live on air has redefined what constitutes life. When bacteria exhaust organic energy sources, they can survive indefinitely by scavenging the unlimited supply of hydrogen and carbon monoxide gas present in the atmosphere. This survival mechanism has broad-reaching consequences for global biodiversity, infectious disease, climate change and public health research. Chris has revealed it supports the biodiversity of life's soils and oceans, regulates greenhouse gases in the atmosphere and enhances agricultural productivity. He has also shown that these gas-eating bacteria provide a basis for life in continental Antarctica, where conditions are too extreme for plants to prosper. Yet similar survival mechanisms are also used by devastating human pathogens, including causative agents of tuberculosis and dysentery. By integrating his One Health microbiology laboratory with large-scale applied programs, Associate Professor Greening is translating these fundamental insights into applied interventions that improve environmental and human health.

GOTTSCHALK MEDAL
An Early-career AAS Award
ALISA GLUKHOVA, UNIVERSITY OF MELBOURNE

All cellular organisms exchange information with their environment in the form of chemical molecules or light, electrical or physical stimuli. G protein-coupled receptors (GPCRs) are primary information sensors at the cell surface and are major drug targets for a multitude of conditions. Dr Glukhova is using structural biology approaches to understand the biology of GPCRs and, specifically, how these receptors recognise chemical signals and how they transmit these signals inside the cell. Her research provided the first structural insights into the activation mechanism of the A1 adenosine receptor, a target for pain management and heart disease, opening possibilities for structure-based drug design. Her current work, in collaboration with researchers from Monash Institute of Pharmaceutical Sciences, aims to understand the biology of other members of adenosine receptor family and identify novel mechanisms for targeting them, either through unconventional binding sites or by altering their signalling path. The current research in her lab at the Walter and Eliza Hall Institute of Medical Research is focussed on understanding the structural basis of Wnt signalling that involves a different GPCR family that is a major target for cancer therapeutics.

In Memoriam

George Ernest Rogers AO FAA 1927–2021

In 1951, after completing his MSc in Biochemistry at the University of Melbourne, George Rogers joined the then recently-established Biochemistry Unit of the CSIRO Wool Research Laboratories in Parkville. In 1954 he was awarded a CSIRO scholarship to undertake a PhD at Trinity College Cambridge on the structure and biochemistry of the wool follicle. On his return to Australia in 1957, George worked as a Senior Research Officer in CSIRO's Division of Protein Chemistry. In 1963 he took up a Readership in Biochemistry at the University of Adelaide. He was appointed Professor from 1978–1992 and then Emeritus Professor. In 2005, George was also appointed a Professorial Fellow in the Department of Medicine, Faculty of Medicine at the University of Melbourne.

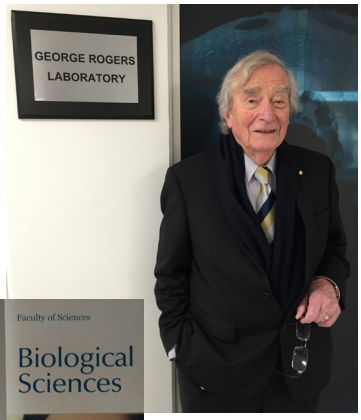
George was elected to the Australian Academy of Science in 1977 for his work on the molecular structure of keratins and the biochemistry of keratinisation. George was a pioneer in the application of electron microscopy to hair and wool ultrastructure and to that of the hair follicle. His work includes the discovery of the existence of citrulline in keratin proteins. In recognition of his work, George was awarded a DSc from the University of Adelaide (1976), the Australian Biochemical Society (ABS) Lemberg Medal (1976) and was made an Officer in the Order of Australia (2013).

After serving as Head of the Biochemistry Department from 1988–1992, George transitioned to Emeritus Professor. In 1995, he became program manager for the Premium Quality Wool Commonwealth Research Centre, a major research program aiming to use molecular and biochemical approaches to improve wool quality. He held this position for five years, running a large research group that introduced state of the art molecular technologies to the field. George continued to work at the lab bench himself in an honorary capacity well into the new century, publishing research supported by successful grant applications in the area of hair follicle development.

George Rogers. Image credit: Australian Academy of Science.

George was the ABS State Representative for South Australia from 1965–1967, and was a frequent participant in conferences held by ABS/ASBMB over the years.

George was an inspiration and role model to many and was renowned as being very humble. He was greatly admired by his former students, many of whom became brilliant scientists and close family friends. George's end of year events were attended by many of his former students and colleagues (including those



Below: George congratulating Timothy Allen, the inaugural recipient of the George Rogers postgraduate scholarship at the University of Adelaide.

Above: George visiting the George Rogers Laboratory at Adelaide Microscopy.

It is my fortune that in 1967, when I first joined the Department of Biochemistry at the University of Adelaide, as a 'green' senior lecturer, Bill Elliott tucked me under George Rogers' wing. Since that time, George was a constant and dependable source of sharing many academic tasks with enjoyment. He showed me by example the purpose of why we had accepted a university appointment, namely, to educate our students so that they could meaningfully participate in the future of our discipline. George was a perfect mentor for me, full of hard work, purpose, ethics, fun and with a great sense of the ridiculous. On many occasions we indulged our shared addiction to French onion soup, chardonnay and crêpes Suzette. The personnel of George's beloved Keratin Korner, and the multitude of their accomplishments, are a great testimonial to the leadership of George and his enduring impact. It has been a privilege and a pleasure to have known George Rogers and to have shared many good times.

Professor Barry Egan

In Memoriam

based interstate or overseas), with the last one held in November 2019.

George's gentle demeanor, endless curiosity and humorous quips enhanced his great popularity with young academics and graduate students as he nudged into his nineties. The respect for his contributions was formally recognised by dedicating a laboratory at Adelaide Microscopy to his name, and in 2019, by an anonymous donor orchestrating the perpetual Professor George Rogers postgraduate scholarship in the field of Molecular Bioscience. The grand gentleman of the bench will be painfully missed.

Our deepest condolences go to George's wife, Lynn, his daughters, Natasha and Nicole, their family, and George's friends and colleagues.

Professor John Shine AC PresAA FAHMS(Hon) FRS
President, Australian Academy of Science
Professor Murray Whitelaw and
Associate Professor Keith Shearwin
Molecular and Biomedical Science
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DELMIC METEOR Cryo-CLEM Imaging System Wins 2021 Microscopy Today Award

The DELMIC METEOR integrated Cryo-CLEM imaging system has recently been named one of ten 2021 Microscopy Today Innovation Award winners. These prestigious awards celebrate new instruments that provide better, faster, easier, or entirely new microscopy methods.

METEOR is an integrated top down system that optimises the cryo-ET workflow by reducing complicated transfer steps. Consisting of a fluorescence light microscope integrated into a FIB/SEM, it simplifies the production of cryo electron tomography (cryo-ET) samples by streamlining processing eliminating several steps where sample damage can occur.

Having the fluorescence microscope inside the FIB allows easy identification of molecules of interest which cannot be done using SEM. Once identified, these molecules can be sectioned out using your FIB without moving your sample. Conventional workflows identification external to the FIB and then re-located into it for subsequent milling with no way to ensure the ROI is correct, with devitrification or ice contamination becoming possibilities.

METEOR reduces the number of stages in cryo-EM sample prep down to 7, saving you time and boosting sample yields. It can be installed into your FIB using existing ports, requires no permanent alteration to your microscope and is ideal for studies in life science, virology, cell biology, neuroscience and microbiology.

www.axt.com.au

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Eppendorf – Proactive Sustainability

Eppendorf is a leading life science manufacturer of innovative products and workflow solutions for liquid-, sample-, and cell handling. Our aim is to provide reliable services and tools to support your applications and research goals as well as being committed to proactive sustainability.

Sustainability is a big concept – yet one that is often not taken seriously enough. As a well-established, traditional mid-sized company, Eppendorf intends to be just as concrete and consistent in the pursuit of sustainability as it has always has been with its products – just as our company slogan 'In Touch with Life' suggests.

For us, that means striving for the shortest distance, the most sparing consumption of resources, the solution that produces the least waste, and the sensible reuse and recycling of materials – but also the careful use of every form of energy, whether electrical power, oil, gas, or the human energy of our employees, customers and suppliers. All these things are the focus of the voluntary commitments we have made to ecological and corporate sustainability. This claim to sustainability is not one we awarded ourselves; we are pleased to announce that Eppendorf SE and its manufacturing competence centres have been certified according to ISO 14001.

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BioEcho are committed to encouraging global ecological responsibility. With the adaptation of DNA preparation protocols EchoLUTION provides no hazardous reagents, completely recyclable kits, and provides 70% less plastic due to the convenient single-step purification technology, in comparison to its Silica counterparts. Since EchoLUTION purified DNA is completely free of contaminants and enzyme inhibitors, it is highly suited for all downstream applications. Particularly in experiments, where sensitivity is of high importance such as qPCR with limited sample material.

For more information, please contact
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Livecyte 2 from Phasefocus is a complete imaging and analysis system optimised for long term, non-invasive monitoring of live cells, label-free! High contrast imaging, where pixel intensity is proportional to dry mass enables robust cell segmentation and tracking leading to accurate single-cell measurements of proliferation, motility and more. Dry mass quantification facilitates the distinction between cell proliferation and growth, not possible using other imaging techniques. Livecyte presents clear advantages to a researcher in the accuracy of measurements, plus saves a considerable amount of time and energy.

1. Nothing like it
A huge array of analysis possibilities allow you to ask questions that no other system can answer – Dr Mat Hardman, University of Hull

2. Disrupts common theory
Livecyte was used to disprove a long-held theory about how stable nevus melanocytes switch to cancerous melanoma cells – Dr Robert Judson-Torres, Huntsman Institute

3. Expect the unexpected
Livecyte has led to observations of unexpected cell behaviour when quantifying live-cell drug resistance – Dr Kurt Anderson and Dr Alix Le Marois, The Francis Crick Institute

4. See change as it happens
Used primary prostate cells to study new cancer treatment – Professor Norman Maitland, University of York

5. Simplifying not simpler
Livecyte removes barriers to entry for junior students – Greg Perry, St George's University of London

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Improved Expression of Virus Like Particles

Oxford Expression Technologies' *flash*BAC™ baculovirus expression kits provide superior recombinant protein yields in a shorter time when compared to other expression systems. The *flash*BAC™ is also highly flexible thanks to its compatibility with a wide variety of transfer vectors. There are four baculovirus expression kits based on the *flash*BAC technology: *flash*BAC, *flash*BAC GOLD, *flash*BAC ULTRA and *flash*BAC PRIME.

The latter, *flash*BAC PRIME, combines the simplicity of the *flash*BAC™ one step baculovirus expression system with increased recovery and yield of virus like particles (VLPs) and protein complexes. *flash*BAC PRIME is based on the original AcMNPV genome without any of the gene deletions characteristic of the other *flash*BAC™ range of vectors. Thus cells infected with *flash*BAC PRIME induce cell lysis in the late stages of infection which facilitates release and subsequent purification of VLPs (or other proteins) that form in the cytoplasm or nucleus of infected cells. For best results when expressing virus like particles, it is recommend to use the recombinant virus in Trichoplusia ni (Tni) derived cell lines.

Using the *flash*BAC™ system is easier and quicker than other baculovirus expression systems because there is no need to separate recombinant virus from parental virus by plaque-purification or any other means; only recombinant virus is produced after the co-transfection. Because the production of recombinant virus has been reduced to a single step procedure in insect cells, it is amenable to high throughput and automated production systems. However, it is also of benefit to the small research group requiring a low cost solution to producing one or a few recombinant baculoviruses prepared in individual dishes of cells.

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Sapphire Biomolecular Imager – Resolution Down to 10 µm

The new Sapphire Biomolecular Imager from Azure Biosystems is a next generation laser scanning system that provides you with exceptional data quality through extremely sensitive detection, ultra-high resolution and broad linear dynamic range. Applications include Blot Imaging eg Western blots and Southern Blots of 2D DNA gels, Gel Imaging, Tissue and Small Animal Imaging eg whole zebrafish and 96-Well Plate Imaging.

This system supports long and short wavelengths of near infrared fluorescence (NIR), red/green/blue (RGB) imaging, chemiluminescent imaging, phosphor imaging as well as optical densitometry (OD) of proteins in stained gels. It uses up to four solid state lasers (488, 520, 658 and 784 nm) offering ultimate excitation sensitivity and four colour detection of fluorescent westerns.

The Sapphire Biomolecular Imager offers a photomultiplier tube (PMT) for fluorescence and phosphor imaging, avalanche photodiodes (APD) for near-infrared imaging and a CCD sensor for chemiluminescent and visible imaging.

Chemiluminescent Western blotting takes advantage of the enzymatic reaction between horseradish peroxidase (HRP)-labeled secondary antibodies and an enhanced chemiluminescence (ECL) substrate to produce photons of light. The signal enhancement of the enzymatic reaction is useful for detecting small amounts of protein. The Sapphire can deliver chemiluminescent detection with the same sensitivity as film, but with a much broader dynamic range.

The same three detector technology that makes the Sapphire so great for imaging western blots is also flexible enough to image a wide range of gels, whether they are ethidium bromide (EtBr)-stained DNA agarose gels, coomassie-stained protein gels, or even ^{32}P-labeled DNA acrylamide gels and more.

Other key features include image resolution down to 10 microns for high quality image analysis and ultra-wide dynamic range for imaging and quantifying low and high abundance samples simultaneously. This system fully integrates with Sapphire Capture and AzureSpot software programs for perfect imaging and accurate analysis.

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PerkinElmer's Applied Genomics and Life Sciences portfolio offers a broad range of solutions. In this issue of the *Australian Biochemist*, we want to share with you some of our current hot products.

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TECAN.

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Hoechst 33342 (blue) – nuclei stain

Propidium iodide (red) – necrotic cell stain

Annexin V-FITC / Alexa Fluor® 488 (green) – binds to the early apoptosis marker phosphatidylserine

Using a proprietary algorithm, the software can uniquely identify three object classes:

- Blue objects – cell nuclei
- Blue/red objects – necrotic cells (for live: dead cell ratio)
- Blue/red/green objects – apoptotic cells (for apoptotic: necrotic cell ratio)

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A detailed description of the Worthington collagenase and contaminant assays can be found in the Worthington Enzyme Manual. Tissue specific references and detailed isolation conditions can be found in the Worthington Tissue Dissociation Guide. Go to Worthington-Biochem.com or TissueDissociation.com. Alternatively, contact ScimaR, your Worthington supplier, on 1800 639 364 or via email scimar@bigpond.net.au, and we would be happy to attend to your queries.

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BMG LABTECH

The Microplate Reader Company

The latest addition to the BMG LABTECH portfolio, the VANTAstar was created for ease-of-use and flexibility for a wide range of applications in basic research and life sciences.

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Visit www.bmglabtech.com to view detailed specifications.

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Monday 6 June 2022

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ComBio 2022 MELBOURNE

Melbourne Convention and Exhibition Centre

South Wharf, MELBOURNE 27 - 30 September 2022

We extend a warm invitation to you to be part of ComBio2022 to be held at the Melbourne Convention and Exhibition Centre (MCEC). After a long pause in our plans, we anticipate that this will be a vibrant return to face-to-face scientific exchange with our colleagues.* ComBio2022 will be held in a spectacular arm of MCEC that is adjacent to the Yarra River and walking distance from numerous restaurants and cafes serving the widest imaginable variety of food. Melbourne is home to many sporting and cultural events and world class museums and galleries plus an aquarium are in the immediate vicinity. There is also an abundance of budget priced accommodation within walking distance of MCEC. ComBio in Melbourne in the Spring of 2022 should be a 'must' for all. (*Covid-safe protocols will be in place as advised closer to the date)

We are pleased to announce that the Opening Keynote Plenary Lecturer is Nobel Laureate Jennifer Doudna and the ASBMB Grimwade Keynote Plenary Lecturer is Cynthia Kenyon.

Jennifer Doudna is an internationally renowned Professor of Chemistry and Molecular and Cell Biology at U.C. Berkeley. She and her colleagues rocked the research world in 2012 by describing a simple way of editing the DNA of any organism using an RNA-guided protein found in bacteria. This technology, called CRISPR-Cas9, has opened the floodgates of possibility for human and non-human applications of gene editing and was the basis for her co-award of the Nobel Prize in 2020. Jennifer is a Howard Hughes Medical Investigator, a member of the National Academy of Sciences, the National Academy of Medicine, the National Academy of Inventors and the American Academy of Arts and Sciences.

Cynthia Kenyon is Vice President, Aging Research, at Calico and expert on the genetics of aging. In 1993, Cynthia's discovery that a single-gene mutation could double the lifespan of the roundworm *C. elegans* has led to a new understanding of the genetics of aging. She has received many honors and awards for her findings. Cynthia is a member of the US National Academy of Sciences, the American Academy of Arts and Sciences, and the Institute of Medicine and she is a past president of the Genetics Society of America.

Plenary Speakers:

- **Siobhan Brady,** *University of California, Davis, CA, USA*
- **Jamie Cate,** *University of California, Berkeley, CA, USA*
- **Jennifer Doudna,** *University of California, Berkeley, CA, USA*
- **Niko Geldner,** *Université de Lausanne, Switzerland*
- **Wolfgang Haak,** *Max Planck Institute, Germany*
- **Tony Hunter,** *Salk Institute, CA, USA*
- **Cynthia Kenyon,** *Calico LLC, South San Francisco, CA, USA*
- **Cristina Lo Celso,** *Imperial College London, London, UK*
- **Jodi Nunnari,** *University of California, Davis, USA*
- **Roy Parker,** *University of Colorado, Boulder, USA*
- **Daniel St Johnston,** *Gurdon Institute, Cambridge, UK*
- **Emma Teeling,** *University College Dublin, Ireland*
- **Lisette Waits,** *University of Idaho, USA*

ASBMB Education Plenary

- **Martin Westwell, Chief Executive** *SACE Board of South Australia*

Conference Streams:

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

Photos courtesy of MCVB

Siglo Bar on Spring Street by Ben King

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KEY DATES:

Earlybird Registration Deadline:
Friday, 24 June 2022

Abstract Submission Deadline:
Friday, 24 June 2022

Guaranteed Hotel Reservation Deadline:
Friday, 5 August 2022

ComBio2022 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
- Genetics Society of AustralAsia
- New Zealand Society for Biochemistry and Molecular Biology

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