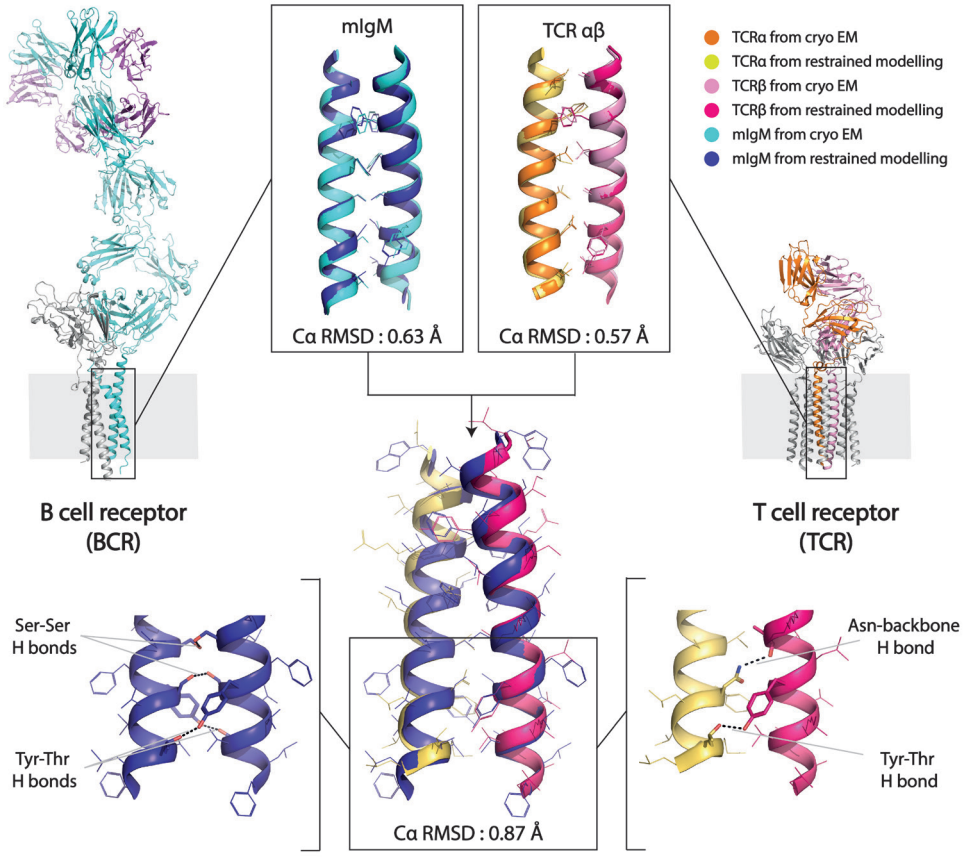
Australian Biochemist

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

April 2023, Volume 54, Number 1



ISSN 1443-0193

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Cryo-EM structures of the BCR (PDB ID: 7XQ8) and TCR (PDB ID: 6JXR). Image courtesy of Samyuktha Ramesh, Melissa Call and Matthew Call, Walter and Eliza Hall Institute of Medical Research and University of Melbourne.

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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 tatiana.soaresdacosta@adelaide.edu.au

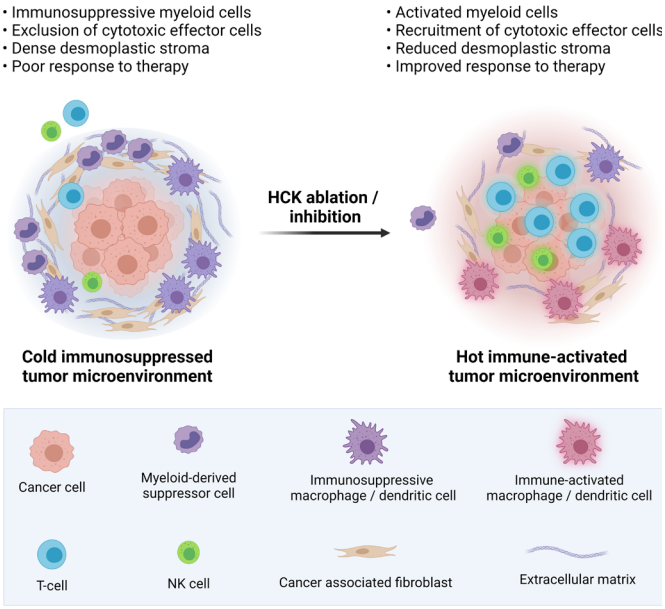
Reprogramming Myeloid Cells to Improve the Response of Pancreatic Cancer to Therapy

Poh AR, O'Brien M, Chisanga D, He H, Baloyan D, Traichel J, Dijkstra C, Chopin M, Nutt S, Whitehead L, Boon L, Parkin A, Lowell C, Pajic M, Shi W, Nikfarjam M, Ernst M*. Inhibition of HCK in myeloid cells restricts pancreatic tumor growth and metastasis. *Cell Rep* 2022;41(2):111479.
***Corresponding author: matthias.ernst@onjcri.org.au**

Pancreatic cancer is an aggressive disease with a five-year survival rate of less than 10%. One of the biggest clinical challenges of treating pancreatic cancer is the poor response to therapy. This is largely due to a highly immunosuppressive and desmoplastic tumour microenvironment characterised by an abundance of cancer-associated fibroblasts, myeloid-derived suppressor cells and tumour-associated macrophages. Together, these cells promote the inactivation and exclusion of cytotoxic effector cells. Thus, therapies that can simultaneously activate tumour immunity and reduce immune suppression represent promising adjuvant strategies to control pancreatic cancer development and metastasis.

Elevated expression of the myeloid-specific hematopoietic cell kinase (HCK) is observed in pancreatic cancer, and correlates with poor prognosis. Our previous work identified that HCK signalling in myeloid cells of stomach and colon cancers promotes an immunosuppressive tumour microenvironment. We therefore sought to investigate the benefit of targeting HCK in pancreatic cancer to reduce immune suppression, impair the desmoplastic response and reinvigorate adaptive anti-tumour responses.

To determine whether aberrant HCK signalling in myeloid cells is involved in pancreatic tumour growth and metastasis, we established orthotopic and intrasplenic tumours in wildtype and HCK knockout mice. We observed that ablation of the *Hck* gene suppressed pancreatic tumour development and metastasis by reprogramming tumour-associated macrophages and dendritic cells toward an inflammatory endotype. Likewise, the absence of *Hck* expression impaired the infiltration of myeloid-derived suppressor cells and cancer-associated fibroblasts. Collectively, this reduced the desmoplastic microenvironment, and enhanced the recruitment and activation of cytotoxic CD8 T-cells and NK cells into tumours. Importantly, we extended these findings to a therapeutic setting and observed reduced tumour burden and metastasis in wildtype mice treated with an HCK-specific small molecule inhibitor.



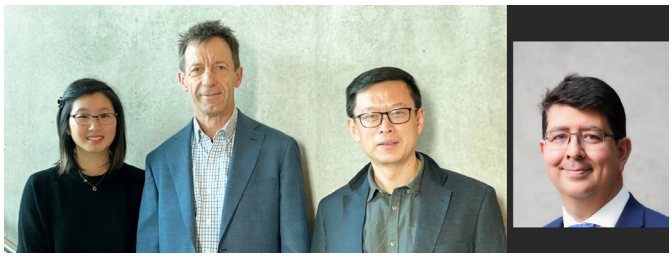
Pancreatic tumours have a cold or immunosuppressed microenvironment characterised by an abundance of immunosuppressive myeloid cells and cancer-associated fibroblasts, which prevent the recruitment of cytotoxic effector cells and reduces response to therapy. Genetic ablation or therapeutic inhibition of HCK reprograms the tumour microenvironment of pancreatic cancer by activating myeloid cells and reducing the desmoplastic stroma, which in turn promotes the recruitment of cytotoxic effector cells and improves response to chemo- and immunotherapy.

We translated these observations to clinically relevant therapies, and showed that either genetic ablation or therapeutic inhibition of HCK enhanced the activity of Gemcitabine chemotherapy, and sensitised treatment-refractory pancreatic tumours to anti-PD1, anti-CTLA4 or anti-CD40 immunotherapies. Collectively, our findings provide strong rationale for HCK inhibitors to be developed as adjuvant therapies for a broad range of solid malignancies, including pancreatic cancer. The highly restricted expression pattern of HCK, the

favorable phenotypic consequence of its long-term deficiency in mice, and the track record of tyrosine kinases as anticancer drug targets provides a novel pathway to improve and expand patient response to chemo- and immunotherapy.

The team gratefully acknowledges the generous support from Cancer Australia, Tour De Cure and PanKind for our research.

Ashleigh Poh and Matthias Ernst
Olivia Newton-John Cancer Research Institute



From left: Ashleigh Poh, Matthias Ernst, Wei Shi and Mehrdad Nikfarjam.

Watching Molecular Chaperones Refold Proteins One Molecule at a Time

Marzano NR, Paudel BP, van Oijen AM*, Ecroyd H*. Real-time single-molecule observation of chaperone-assisted protein folding. *Sci Adv* 2022;8(50):eadd0922.
Corresponding authors: heathe@uow.edu.au, vanoijen@uow.edu.au

The Ecroyd lab has long had an interest in understanding how molecular chaperone proteins act to fold, refold and prevent the aggregation of proteins. Typically, the interactions these chaperones have with themselves and their client proteins are extremely dynamic and heterogeneous, which makes it difficult to elucidate the precise molecular mechanism of their function using ensemble-averaged approaches. With the van Oijen lab's expertise in single-molecule imaging, we established a close collaboration with the main aim of developing novel single-molecule tools to study molecular chaperone function.

In this study, we investigated the mechanism by which the Hsp70 chaperone system refolds misfolded proteins, a process critical in maintaining the integrity of the proteome. Using the bacterial Hsp70 system, which is comprised of a single Hsp70 (DnaK), Hsp40 co-chaperone (DnaJ) and a nucleotide-exchange factor (GrpE), we sought to 'watch' as the chaperones refolded a protein back into its native state. To do so, we chose to work with the model chaperone client protein, firefly luciferase (Fluc) and develop it into a 'protein folding-sensor' that we could use to monitor the conformation of individual proteins in real time using a combination of single-molecule fluorescence resonance energy transfer (smFRET) and total internal reflection fluorescence (TIRF) microscopy. One notable advantage of this TIRF-based approach over previous single-molecule methods used to study protein (re)folding was that we could specifically immobilise our FRET-competent Fluc to a coverslip surface (via biotin/streptavidin interactions) and monitor the conformation of individual client proteins for several minutes (much longer than the ~1 millisecond that had previously been observed using confocal approaches).

We first characterised the ability of the Fluc folding-sensor to report on changes in conformation by changes in FRET efficiency. Using microfluidics, we incubated Fluc with increasing concentrations of guanidinium hydrochloride and observed a progressive decrease in FRET efficiency as it unfolded. Notably, refolding of Fluc upon dilution out of denaturant resulted in the formation of a misfolded state that possessed a significantly higher FRET state compared to that of the native protein. Using luminescence assays, we confirmed that the complete Hsp70 system could efficiently resolve these misfolded states of Fluc and refold it to an enzymatically active state.

With this protein-folding sensor in hand, we next interrogated the effect of increasing the concentration of various components of the Hsp70 system on the conformation of Fluc during refolding. By doing so we found that the Hsp40, DnaJ, preferentially binds to stochastically unfolded conformations of Fluc, which in turn stabilises expanded states (likely a mechanism by which DnaJ prevents aggregation). By fitting FRET traces from individual protein molecules to a Hidden Markov Model (HMM) in order to identify discrete FRET states, we determined that DnaJ does not induce conformational changes in the client and thus binds via a conformational selection mechanism.

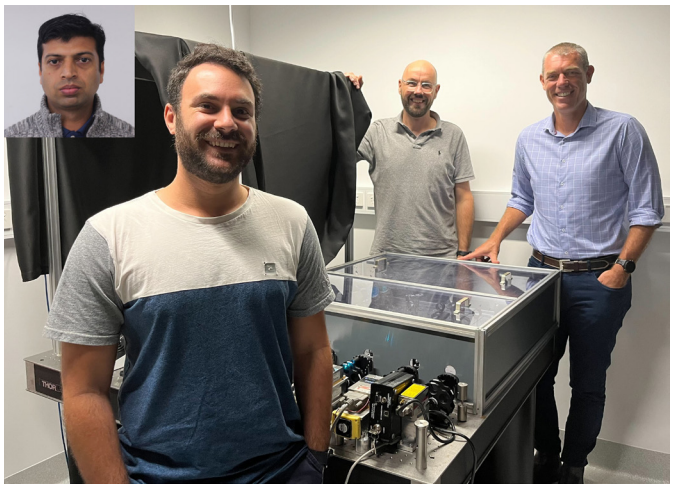
DnaJ is critical in accelerating DnaK-mediated ATP hydrolysis, which promotes the binding of DnaK to its clients. Indeed, in the presence of a low concentration of DnaJ, we observed a substantial decrease to ultra-low FRET states when Fluc is incubated with increasing concentrations of DnaK. This indicates that the binding of DnaK causes a dramatic conformational expansion of the client. Notably, many transitions of Fluc to the DnaK-bound state originated from high-FRET states typical

of misfolded protein, providing direct evidence of the mechanism by which DnaK (and indeed Hsp70 isoforms more broadly) resolves misfolded states. By further interrogating the data from individual molecules, we observed that the rate of DnaK dissociation decreases as a function of DnaK concentration (typically a dissociation rate is concentration-independent). These data are consistent with a model whereby multiple DnaK species bind to a single client protein and induce its unfolding in a mechanism described as 'entropic pulling'.

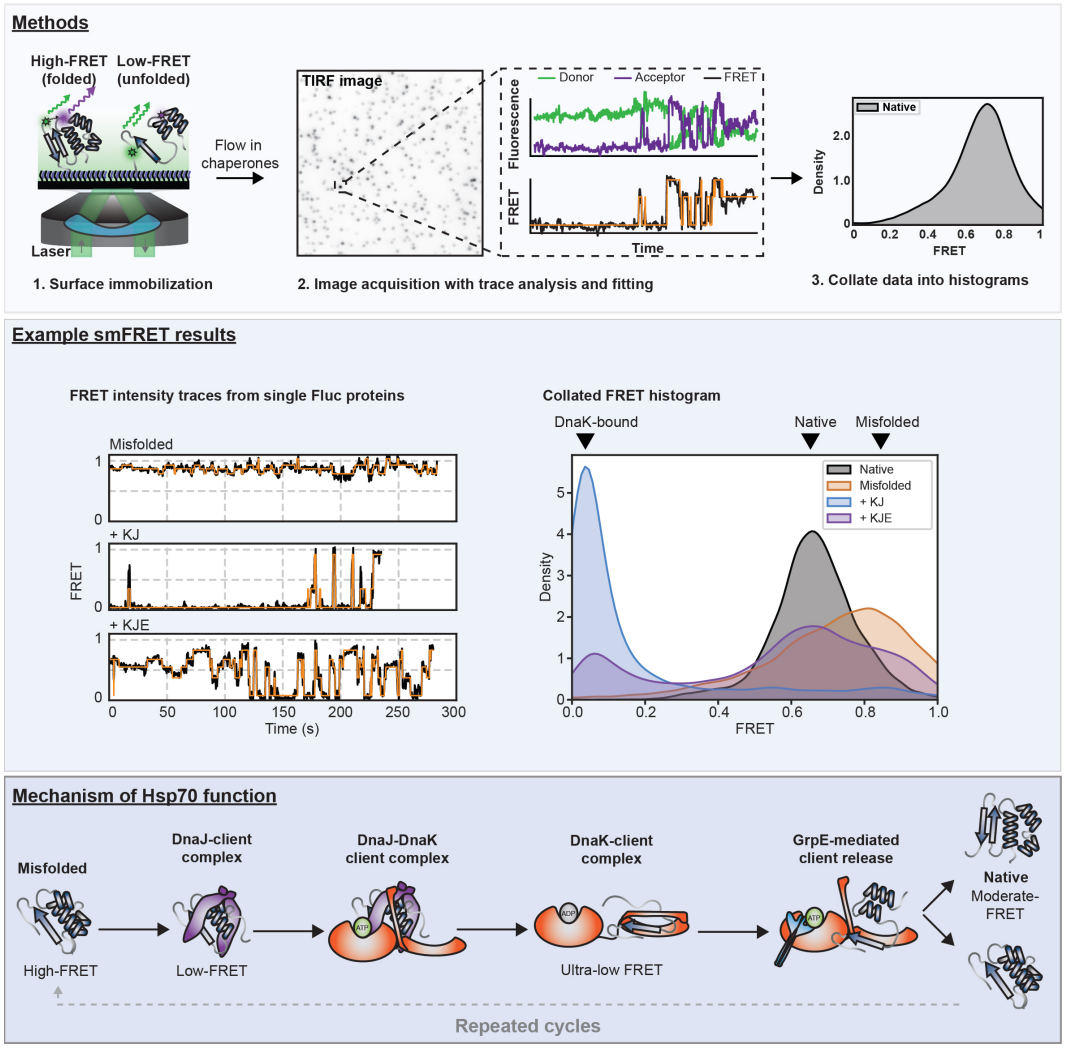
Finally, we performed single-molecule refolding experiments in the presence of all three components of the Hsp70 chaperone system. We found that the success of Fluc refolding is exquisitely sensitive to the amount of GrpE present since this regulates the rate of DnaK dissociation to the client. For the first time, we observed multiple cycles of DnaK binding-and-release to an individual client protein, and determined that higher rates correlate with improved refolding yield.

Collectively, through this work we were able to observe the complete reaction cycle involved in Hsp70-mediated refolding of a client protein. The work has provided novel insights into how molecular chaperones reshape the conformational landscape of their clients during productive folding.

Nicholas Marzano, Heath Ecroyd and Antoine van Oijen
Molecular Horizons and School of Chemistry and Molecular Bioscience, University of Wollongong



From left: Nicholas Marzano, Antoine van Oijen and Heath Ecroyd. Top left inset: Bishnu Paudel.



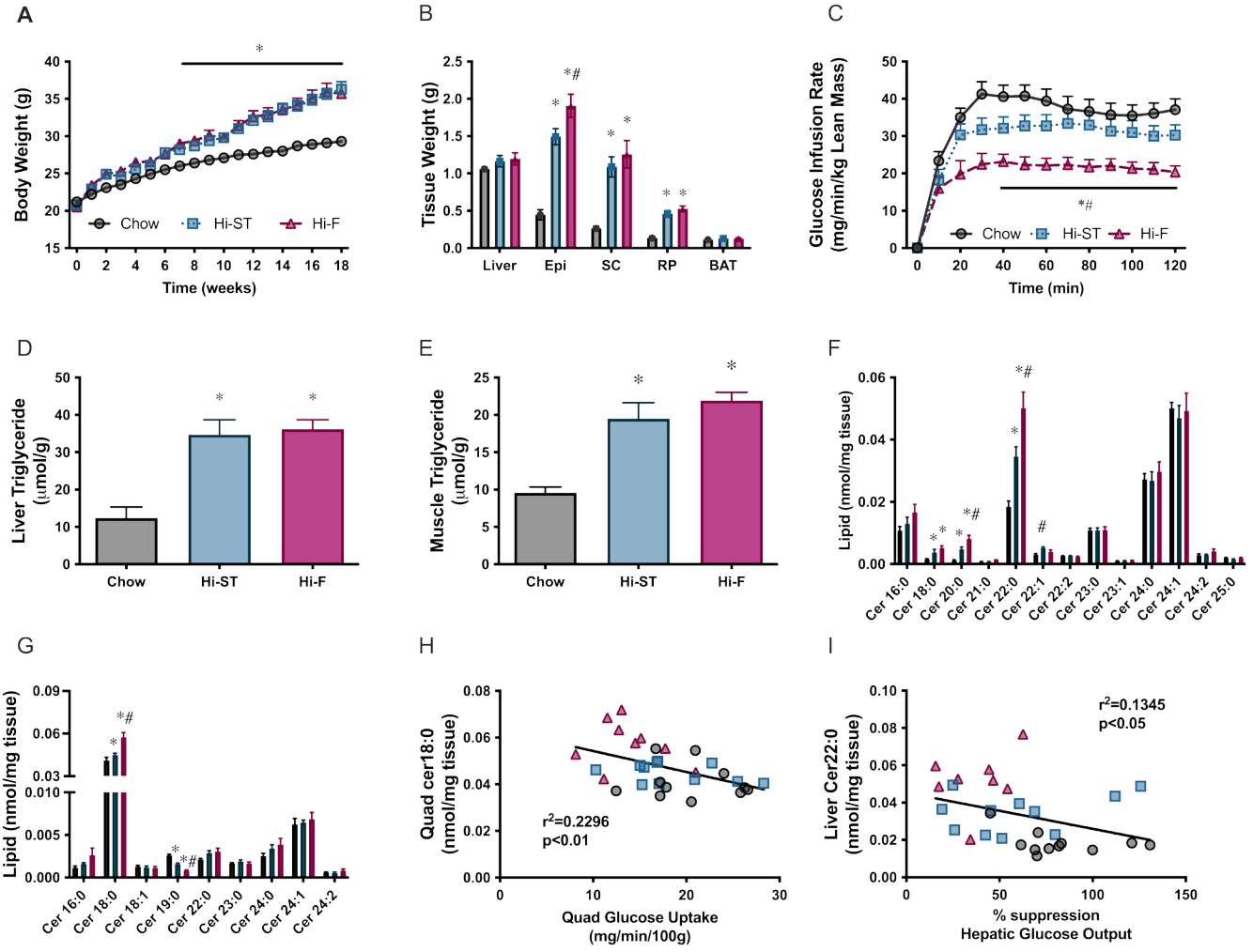
A schematic diagram showing (top) the single-molecule FRET approach and data analysis workflow used in this work, (middle) the FRET intensity traces from individual molecules through time that were used to generate FRET efficiency histograms, and (bottom) the proposed mechanism of action of the Hsp70-chaperone system based on the findings of this work.

What You Eat May Impact Metabolic Health as Much as Obesity

Brandon AE#*, Small L#, Nguyen TV, Suryana E, Gong H, Yassmin C, Hancock SE, Pulpitel T, Stonehouse S, Prescott L, Kebede MA, Yau B, Quek LE, Kowalski GM, Bruce CR, Turner N, Cooney GJ. Insulin sensitivity is preserved in mice made obese by feeding a high starch diet. *Elife* 2022;11:e79250.
#Contributed equally to this work
***Corresponding author: amanda.brandon@sydney.edu.au**

Our lab is interested in the link between increased fat mass and insulin resistance since being insulin resistant is a common feature of overweight and obese people and both are major risk factors for the development type 2 diabetes. Interestingly, there is a population of obese people that do not show the common features of metabolic dysfunction, a population termed 'metabolic healthy obese'. These individuals have been shown to have similar fat mass to metabolically unhealthy obese individuals, but the metabolic profile to that of a healthy lean individual. Although there are a few strains of mice that have this MHO phenotype (e.g. Balbc mouse) when fed a high fat diet, less is known about the impact of macronutrient composition and total fat mass in the regulation of insulin action at the whole body and tissue level.

In this study, we generated a dietary mouse model that allows us to determine what factors, other than obesity itself, can be associated with insulin resistance, and why some people can remain insulin sensitive despite their obesity. We fed mice either a high fat diet (60% fat) or a diet high in carbohydrates (60%



Graphs from our manuscript summarising the key findings.

carbohydrates, mainly starch) where both groups overconsumed calories and got similarly obese (**Fig. A,B**). Consistent with the literature, high fat fed animals became glucose intolerant (measured via oral glucose tolerance test) and insulin resistant (measured by the gold standard euglycaemic-hyperinsulinaemic clamp; **Fig. C**). However, despite their similar obesity levels, the high starch group remained glucose tolerant and insulin sensitive and showed very similar profiles to chow fed controls, who were lean and sensitive. While we investigated the pancreas and the adipose tissues of these animals, they didn't show differences between the groups, so we investigated the role of the liver and muscle.

Interestingly, the preservation of whole body and tissue insulin sensitivity was also in the face of high triglyceride levels in both liver and muscle (**Fig 1. D,E**), a feature commonly seen in insulin resistant tissues. Because triglycerides are thought to be relatively benign, we undertook targeted lipidomic analysis to investigate the bioactive lipid species that have been previously associated with resistant states. The results showed that while diacylglycerol (DAG) levels were similarly increased in both groups, ceramide species differed in both tissues (**Fig. F,G**). In the muscle, C18:0 levels were high in the insulin resistant, fat fed mice, while high starch and chow fed mice had similar levels. Muscle C18:0 levels were also negatively correlated with muscle insulin stimulated glucose uptake (a measure of muscle insulin sensitivity; **Fig. H**). Similarly in the liver, C22:0 was negatively correlated with hepatic glucose output (a measure of hepatic insulin sensitivity (**Fig. I**). Taken together, this data suggests that dietary manipulation can influence insulin action independently of the level of adiposity and that the presence of specific ceramide species correlates with these differences.

This study was the result of a great collaboration of people and institutes within Australia with amazing expertise. The Turner Lab for the lipidomic analysis, the Kebede lab for the isolated islet experiments, the Bruce lab for analysis of the stable isotope given during the GTT and the Quek lab for metabolomics analysis.

Amanda Brandon
School of Life and Environmental Sciences
University of Sydney

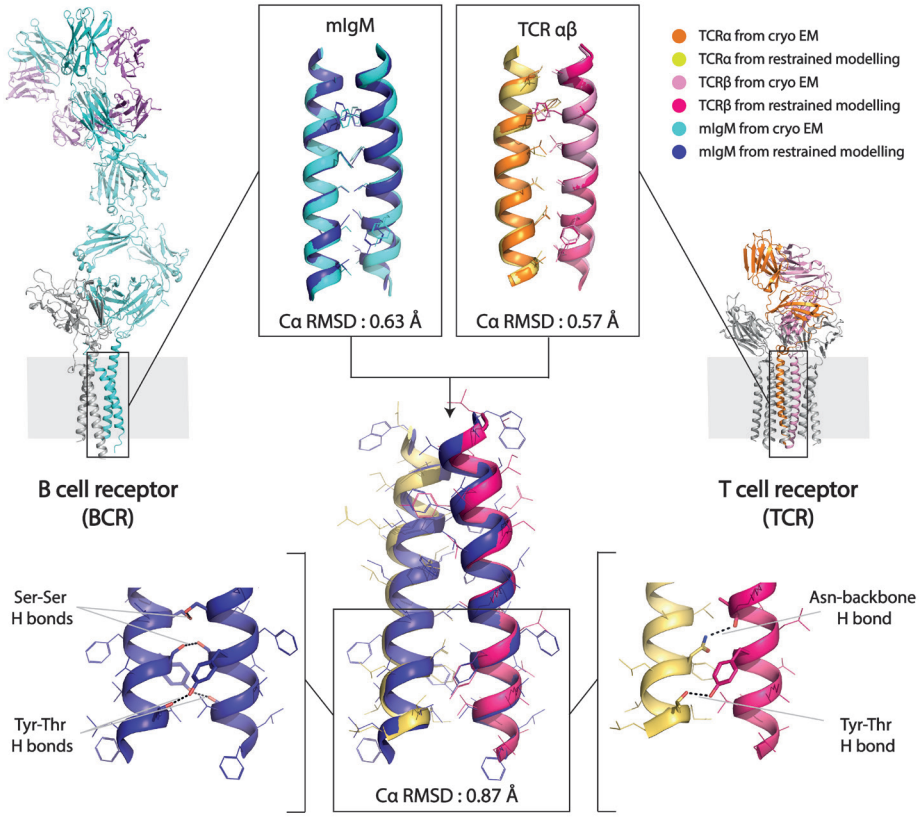
From top left: Amanda Brandon, Lewin Small, Sarah Hancock, Melkam Kebede, Belinda Yu, Lake-Ee Qeck, Greg Kowalski, Clinton Bruce, Nigel Turner and Gregory Cooney.

A Conserved Structural Element at the Core of T Cell and B Cell Antigen Receptors

Ramesh S, Park S, Im W, Call MJ#*, Call ME#*. T cell and B cell antigen receptors share a conserved core transmembrane structure. *Proc Natl Acad Sci USA* 2022;119(48):e2208058119.
#These authors contributed equally to this work
***Corresponding authors: mjcall@wehi.edu.au, mecall@wehi.edu.au**

T cell receptors (TCRs) and B cell receptors (BCRs), found on the surface of T cells and B cells, respectively, scan the body for foreign or abnormal features to elicit adaptive immune responses. They do so with their antigen-recognising subunits, TCR's αβ or BCR's membrane-Ig (mIg), which bind ligands outside the cell and pass this information across the cell membrane through dedicated signalling subunits (see figure). While these receptors were discovered decades ago, their intact, membrane-embedded structures remained elusive due to the challenges posed by their hydrophobic transmembrane (TM) domains to traditional methods of structure determination. Removal of these TM domains for structural study is also not an option, as they harbour key interactions that hold these modular receptors together. To circumvent this issue, a previous study from our lab employed a combination of cysteine crosslinking and computational modelling, and identified that TCR αβ forms a structured TM core around which its three signalling modules assemble. The accuracy of this TCR αβ model was confirmed in the later published TCR cryogenic electron microscopy (cryo-EM) structure (see figure), and this prompted us to extend our approach to the BCR's mIg TM domains,

Publications with Impact



Cryo-EM structures of the BCR (PDB ID: 7XQ8) and TCR (PDB ID: 6JXR) complexes are shown, with their antigen-binding subunits highlighted in colour and their signalling subunits in grey. The transmembrane domains of the antigen-binding subunits are overlayed with our models generated by experimentally-guided MD simulations, and their close alignment indicated by the Cα RMSD. BCR mIg and TCR αβ TM domains are overlayed to demonstrate the extremely similar structures they form, and the hydrogen bonding networks at both interfaces shown.

for which no structural information existed.

We performed cysteine crosslinking in mouse IgM BCRs that were *in vitro* translated and assembled in purified endoplasmic reticulum (ER) microsomes to recapitulate native membrane protein biosynthesis. Crosslinks that were captured in the context of fully assembled, membrane-embedded BCR complexes were used as distance restrains for replica exchange molecular dynamics (REMD) simulations to develop a model of the antigen-binding module TM domains in the membrane environment. The resultant model was then allowed to relax in unrestrained simulations in fully atomistic 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC) bilayers.

Our model revealed the BCR's ligand-binding module, mIg, has an ordered and tightly packed TM interface strikingly similar to its analogue in the TCR, αβ (see figure). This interface is built around multiple inter-helical hydrogen bonds, which are particularly strong in the membrane environment and include a familiar Y-T structural motif we and others have identified in other immune proteins. Additional simulations revealed that all five BCR isotypes (IgM, IgD, IgA, IgE and IgG) are compatible with a similar structure, and our complementary biochemical analyses demonstrate that disrupting the key interactions at the interface causes severe BCR assembly defects. Again, our model derived from native ER membranes aligns closely with the recently published detergent-embedded cryo-EM structures of the BCR (see figure).

This work highlights an unexpected similarity in the architecture of the two lymphocyte antigen receptors despite their differences in subunit stoichiometry and mode of antigen engagement. It furthers our understanding of the evolution of antigen receptor structures and the interactions underpinning BCR complex stability.

Samyuktha Ramesh, Melissa Call and Matthew Call
Structural Biology Division,
Walter and Eliza Hall Institute of Medical Research
Department of Medical Biology,
University of Melbourne

From left: Samyuktha Ramesh, Matthew Call and Melissa Call.

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The ASBMB Education Feature is coordinated by Tracey Kuit (tracey_kuit@uow.edu.au) and Amber Willems-Jones (amber.willems@unimelb.edu.au).

Development of a Metacognitive Mindset to Improve Student Learning in Biochemistry

Kathryn Jones, University of Auckland, New Zealand

Metacognition is the ability to plan, monitor and assess one's understanding and performance; it is a driver of success in university-level study (1). The COVID-19 pivot online led to widespread changes in teaching and assessment, resulting in students having to quickly adapt to learning in a digital environment. The University of Auckland biology curriculum historically included little metacognitive teaching. Therefore, we decided to promote metacognitive thinking across the upper level curriculum, starting with the 400-student second year biochemistry course.

Since 2020, reflective questions designed to encourage metacognitive thinking were added to existing formative, fortnightly module quizzes worth 1%. A written reflective question was added to an H5P module containing ten interactive biochemistry questions. These reflective questions encouraged students to consider their current methods of **learning** (e.g. *what strategies are you using to study for the test?*), **monitoring** (e.g. *did your strategies allow you to achieve your goals?*), **planning** (e.g. *what's one thing you can start doing today to better manage your time?*), **performance** (e.g. *what could you do differently to better prepare for the exam?*) and **motivation** (e.g. *what is motivating you to learn?*). Questions were key word automarked, thereby reducing marking time for staff. By linking questions to existing weighted content-based module quizzes, completion rates averaged 94% and students understood their reflections were important and valued.

How did we introduce such questions?

To set the scene, we used a Slido poll on Day 1 to ask students to reflect on what they could do to improve their **learning**, based on their experiences in previous semesters. Student answers were populated ***live*** into a word cloud (see **Fig. 1**), with themes such as time management consistently appearing as a challenge for students. With large classes this is a fun, eye-opening, but potentially risky activity as you must trust your students to keep responses appropriate. Before this initial poll, I was unaware of how many students played video games well into the night!

In Week 2, the **monitoring** quiz followed up on the reflection by asking students what they will do to action what they wrote on Day 1. Anonymised quiz feedback was collected and themes discussed in class. This student-led approach proved to be a great tool for discovering new approaches students use (e.g., apps for time management and productivity, flash cards). Sharing feedback across the class allowed all to benefit. In Week 4, students were asked about their **planning** and study strategies for the upcoming test. Once grades were released, the Week 6 **performance**-themed quiz enabled students to reflect on the success of their strategies. High-achieving student strategies were anonymously shared with the class through Canvas to promote thought. Interestingly, almost all students suggested clear ways to improve their study, irrespective of their test grade. Reflecting on **motivation** to study in Week 8 aimed to refocus students on their own reasons to continue 'showing up' and meet their goals.

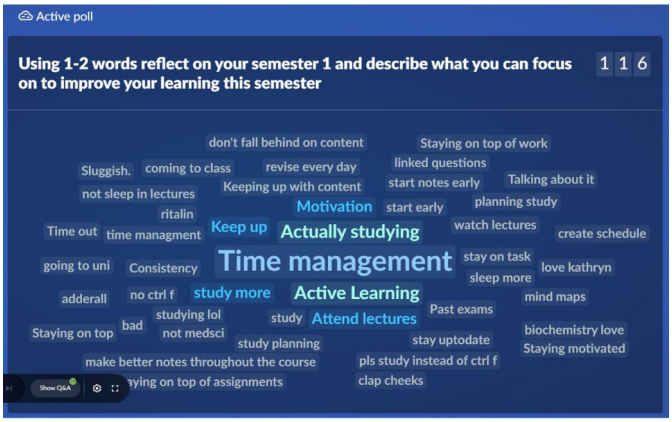

Fig. 1. *Word cloud generated in Slido showing student responses for how they can improve their learning. Larger words represent more common responses.*

What did students learn from their reflections?

Through these processes, students learnt the differences between high and low power study strategies (e.g., mind mapping and testing themselves versus re-reading highlighted notes). Many students realised that deeper conceptual understanding was more valuable than rote memorisation, and for some students, this coincided with a change in revision strategies to include concept mapping. The emerging themes students identified included the need for increased self-regulation (and their struggle to achieve this), the realisation that learning is a social activity (which was lost online), the desire to find new online tools to facilitate social learning, plus a shift from paper to digital, text-based revision notes.

The students also provided thoughtful advice for future

cohorts, with selected comments recorded as audio messages for the following year's students, like a kind of 'message in a bottle'.

Through this work, we have shown that developing metacognitive thinking can enable students to be better learners who can monitor their learning in ways other than grades.

Reference

1. Tanner KD (2012) *CBE Life Sci Educ* 11(2):113–120.

Dr Kathryn Jones is an education-focused academic in the School of Biological Sciences, University of Auckland, New Zealand.
ks.jones@auckland.ac.nz

Refreshing a Biochemistry Curriculum: A Pinch of Problem-Based Learning, a Dash of Peer-Mentoring, Blended Together with Online Interactive Modules

James Tsatsaronis, Katrina Binger, Julian Pakay, Lakshmi Wijeyewickrema, Fiona Durand, Fiona Carroll and Noni Frankenberg, La Trobe University

Biochemistry curricula are influenced by the landscape of higher education in Australia, which includes an increasing shift towards online and blended learning. In 2019, in response to student feedback received from subject feedback surveys, we instigated a complete revision of the biochemistry curriculum. The major goals of this revision were to improve scaffolding of subject content and optimise the blended mode of delivery to improve student experience and learning outcomes.

At La Trobe University in Victoria, second-year biochemistry is taught across two subjects, BCH2IBM (Introductory Biochemistry) and BCH2MBC (Metabolic Biochemistry). Both subjects are taught across three onshore campuses, as well as online through partnerships with Open Universities Australia (OUA), and transnationally at the PSB Academy in Singapore. Both subjects are core for more than ten courses taught across the university, including Biomedicine, Animal and Veterinary Biosciences, Agriculture and Human Nutrition.

Redevelopment through thematic analysis

To identify frequently expressed student concerns, we analysed subject surveys from previous years through thematic analysis of qualitative student feedback data using NVivo. We identified concerns across four main themes: class format, delivery mode, assessments and content quality. Using these data alongside application of the ASBMB (USA) biochemistry threshold concepts (1), we formed a framework for the redevelopment of BCH2IBM and BCH2MBC. As shown in **Fig. 1**, we designed a transformed biochemistry curriculum that scaffolds lecture, workshop and practical content across both subjects.

The redeveloped subject content incrementally builds student mastery of the biochemistry discipline through online delivery of lecture material in the form of short lecture snippets (5–7 minute), designed to deconstruct complex biochemistry concepts and to ease excessive cognitive burden. Using Moodle Lesson modules, short lecture snippets are embedded alongside formative quiz questions and interactive H5P activities. Subject content is grouped into six two-week modules, covering the flow of genetic information through the central dogma, protein structure, enzyme kinetics, metabolism and cell biology. Each module is assessed in a problem-based learning (PBL) class that requires students to apply online lecture material to authentic biochemistry research and industry scenarios. Led by students, the PBL classes are run in small group workshops with academic facilitators rather than didactic teachers, supported by near-peer mentors – high-achieving students from previous cohorts who have volunteered as helpers during PBL workshops. Assessment of student performance in the PBL class is conducted using participation scoring, whereby individual communication and contribution to PBLs are assessed by both peers and academics in each session. This approach was taken in order to foster teamwork, communication, critical thinking and information processing skills.

Redevelopment yields improvement

Following delivery of the redeveloped curriculum in 2020, numerical scores of overall student satisfaction in both subjects has improved overall from ~3.5 to >4 on a 5-point scale. Student qualitative feedback specifically identifies online lesson modules as being effective. Blended learning, identified through student comments,

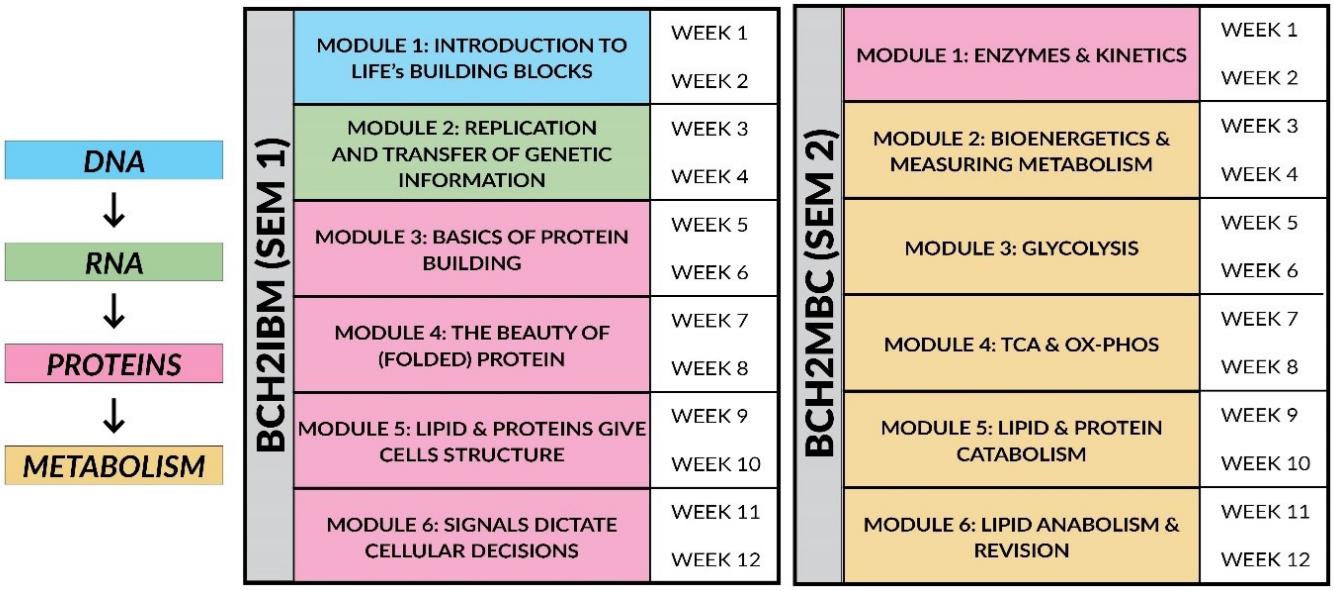

Fig. 1. *A blended transformed biochemistry curriculum.*

is now overwhelmingly framed as one of the 'best aspects' of the subject rather than an area for improvement. A separate survey of student satisfaction with PBL classes found that >80% of students agreed that the workshops helped them to apply concepts covered in lectures, and >85% agreed that they had enjoyed group-work with their peers. The involvement of student near-peer mentors in PBLs has not yet been formally evaluated, however anecdotally we believe this has benefits for helping address chemistry and maths 'anxieties' in biochemistry students. Furthermore, the opportunity to participate as a peer mentor provides our former high achieving students a chance to both foster and improve their communication and leadership skills.

We plan to iteratively continue to improve these subjects through implementation of new technologies, such as 3D printing and VR-led protein structure tutorials into the two-week module plus PBL framework.

Reference

1. Loertscher J, Green D, Lewis JE, Lin S, Minderhout V (2014). *CBE Life Sci Educ* 13(3):516–528.

Dr Katrina Binger is a Senior Lecturer in the Department of Biochemistry and Chemistry, La Trobe University. k.binger@latrobe.edu.au

Dr Julian Pakay is a Senior Lecturer in the Department of Biochemistry and Chemistry, La Trobe University. j.pakay@latrobe.edu.au

Dr Lakshmi Wijeyewickrema is a Senior Lecturer in the Department of Biochemistry and Chemistry, La Trobe University. l.wijeyewickrema@latrobe.edu.au

Dr James Tsatsaronis is a Senior Lecturer in the Department of Biochemistry and Chemistry, La Trobe University. j.tsatsaronis@latrobe.edu.au

Dr Fiona Durand is a Lecturer in the Department of Biochemistry and Chemistry, La Trobe University. f.durand@latrobe.edu.au

Dr Fiona Carroll is a Lecturer in the Department of Biochemistry and Chemistry, La Trobe University. f.carroll@latrobe.edu.au

Dr Noni Frankenberg is an Academic Coordinator for the PSB Partnership in the Department of Biochemistry and Chemistry, La Trobe University. n.frankenberg@latrobe.edu.au

Student Partners: Strengthening Staff–Student Connections Beyond the Pandemic

Anne Galea, Kristin Turnbull and Collins Fleischner, University of New South Wales

Positioning and preparing students to work in collaboration with staff to design, implement and evaluate programs and initiatives can facilitate beneficial impacts on learning and significantly improve both student and staff experiences (1). By inviting students to be active participants and co-creators in their course, students can have a more engaging and rewarding learning journey. This approach nurtures the potential of students as 'change agents' who can contribute valuable skills, perspectives and experiences to enhance their higher education and benefit the broader university learning community. Here, we describe a simple model for embedding student–staff partnerships in undergraduate courses and the development of a framework for delivering this initiative more broadly across an institution.

Throughout the COVID pandemic, large second year biochemistry and molecular biology courses at the University of New South Wales (UNSW) enlisted 'Student Course Ambassadors' to enhance engagement, collaboration and communication between students and staff. The framework saw students self-nominate into an ambassador role at the start of term for regular meetings/communications with staff to identify strengths and weaknesses of different aspects of course content, assessment and delivery. To acknowledge service and contribution, Student Course Ambassadors were presented with a digital certificate at the completion of their role.

Initially introduced to better facilitate real-time responses to feedback on courses, the Student Course Ambassador Program quickly broadened its scope to provide students with leadership and professional development opportunities, as well as avenues for creative and strategic input into the development of course resources and new directions. Examples of Student Course Ambassador contributions and achievements are detailed in **Fig. 1**.

The success of the Student Course Ambassador Program has been measured through consistent positive student feedback with high course satisfaction ratings. Furthermore, the Ambassador Program was a contributing factor in the design and development of an institution-wide Student Partner Program pilot run by the

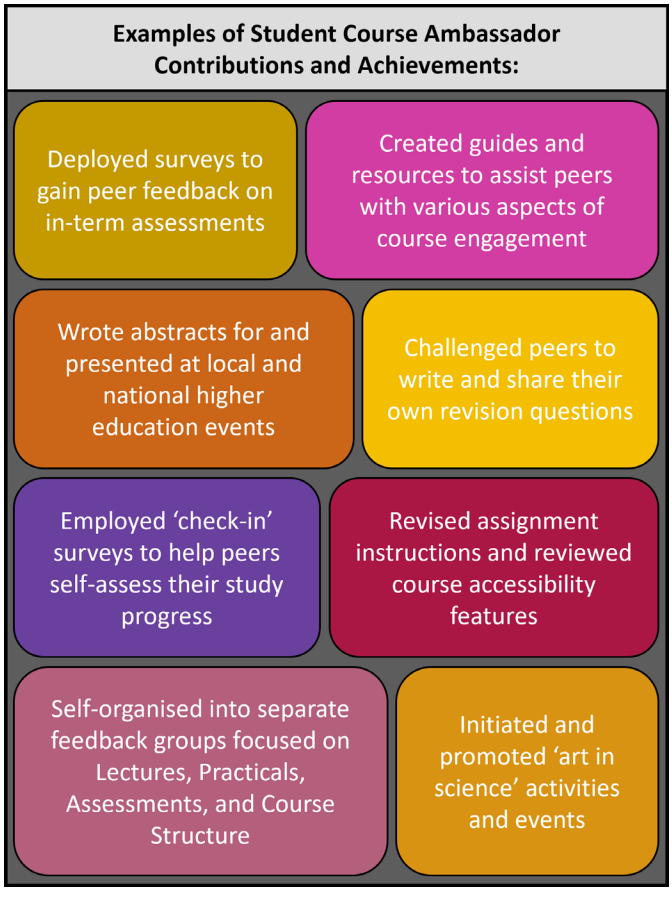

***Fig. 1.** Examples of Student Course Ambassador Contributions and Achievements.*

Academic and Education Focussed Development team within the Pro Vice-Chancellor Education and Student Experience Portfolio at UNSW. Centrally supported and available to all UNSW course convenors, the university-wide program includes a general introduction to student partnerships in higher education and provides regular workshops and support for course staff as they design and implement their own student partnerships.

In 2022, the Student Partner Program pilot involved 22 cross-Faculty convenors and 175 students. The diversity of courses and participants in the Student Partner Program pilot led to a range of student–staff meeting patterns, from weekly to 'on-demand' and fully flexible online communications. Evaluation of the pilot program was guided by the SPELT (Small Project Evaluation in Learning and Teaching) framework (2) and involved end of term surveys, focus groups and interviews with students and staff. An end of term survey completed by 54 of the students who participated in the pilot provided insights into the impacts of the program on both the student partners and other students in their course. Some of the most common responses from the student participants indicated that the program: (a) helped build better connections within and between staff and peer communities, (b) increased confidence in learning and communicating at university and (c) was successful in facilitating timely adjustments (such as changes to assessment timing, improvements to content delivery and development of supportive course resources and revision materials). When surveyed, most staff participants similarly indicated that they saw improved connections with students and developed a greater understanding of their needs within a timeframe where changes could still be executed. Staff and students in the program occasionally acknowledged tension points relating to effective and inclusive communication strategies, as well as the need for careful consideration and planning relating to workloads for staff and students alike.

As described, the collective outcomes and feedback from the Student Partner Program pilot offered valuable insights into the scope of student partnerships across different disciplines and courses. Armed with these insights, the program coordinators also worked alongside student partners from the Term 1 pilot to further develop Student Partner Program support guides, training workshops, drop-in sessions and a resource-sharing site for both students and staff in the next iterations of the program. Future goals include increasing our suite of student partnership opportunities and engaging with national and international 'Students as Partners' initiatives and events.

References

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Dr Anne Galea is a Senior Education-Focussed Lecturer in the School of Biotechnology and Biomolecular Sciences, University of New South Wales, Sydney.
a.galea@unsw.edu.au

Kristin Turnbull (SFHEA) is the Manager of Academic Program Development, University of New South Wales, Sydney.
k.turnbull@unsw.edu.au

Collins Fleischner is the Lead for Academic and Education Focussed Development, University of New South Wales, Sydney.
c.fleischner@unsw.edu.au

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
Michael Ryan

Mike Ryan heads the Mitochondrial Biology and Disease Laboratory in the Monash Biomedicine Discovery Institute. His research seeks to understand mitochondrial disease pathogenesis and to investigate and characterise the gene products involved in mitochondrial signalling and dynamics.

After completing his PhD on molecular chaperones in 1997 (supervised by Peter Høj and Nick Hoogenraad), Mike was awarded a Humboldt Research Fellowship to work in the lab of Klaus Pfanner laboratory (Freiburg, Germany), where he dissected the mitochondrial protein import machinery and protein transport pathways.

In 2000, Mike was appointed as a Lecturer in the Department of Biochemistry at La Trobe University, where he investigated how membrane protein complexes assemble. He pioneered research into mitochondrial complex I biogenesis, seeking to understand how the 38 nuclear-encoded complex I subunits assemble with the seven mtDNA encoded subunits and how defects in this process cause disease. He was responsible for discovering/co-discovering most of the known complex I assembly factors, which led to the identification of several novel pathogenic mutations that cause mitochondrial disease. He was an early adopter of gene editing techniques, and coupled with quantitative proteomic analysis, he published a ground-breaking study demonstrating the important of non-enzymatic subunits of complex I (Stroud *et al.*, 2016 *Nature*).

Mike has also led research that has contributed to fundamental discoveries into the dynamics of mitochondria in health and disease. This includes the identification of receptors for mitochondrial fission and the importance of a sole dynamin-like protein to execute mitochondrial fission. His long-standing work in this area recently led to the publication of an invited review on mitochondrial fission and disease in *Nature*.

Mike's significant contributions include President of ASBMB (2015–2016), Head of Program Committee for OzBio2010, and member and Chair of the International Human Frontier Science Program grants panel. He a Director of the Mito Foundation and Deputy Chair of its Scientific and Medical Advisory Panel. He has undertaken academic and university leadership, including Head of the Department of Biochemistry (La Trobe; 2011–2013) and Deputy Dean of Research and Research Infrastructure (Faculty of Medicine, Monash; 2018–2020). In 2021, Mike was appointed Pro Vice-Chancellor (Research) at Monash University.

Mike considers his greatest legacy to be his mentoring of students and staff that have moved through his lab and have undertaken successful careers in academia, research and/or industry.

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
Stephanie Gras

Professor Stephanie Gras is an NHMRC Senior Research Fellow and heads the laboratory of Viral and Structural Immunology at the La Trobe Institute for Molecular Science (LIMS).

Stephanie's PhD research focused on using X-ray crystallography to determine the 3D atomic structure of proteins. Her PhD consisted of two distinct projects: one focussed on studying a new GTPase from *Archaea* bacteria, and the other on investigating a human T cell receptor that recognises virus-derived peptides. Stephanie's passion for medical and multidisciplinary research was evident throughout her academic journey. She pursued two years of medical study, followed by a Master's degree in Biochemistry, and completed Honours and a PhD in X-ray crystallography.

After completing her PhD in France, she visited Australia for her honeymoon and had a job interview at the same time (as you do). She moved to Australia in 2007 to start her postdoctoral position within Professor Jamie Rossjohn's laboratory at Monash University, and to collaborate with viral immunologists in Melbourne to expand her knowledge in immunology from her PhD. In 2012, Stephanie received an ARC Future Fellowship and established her own independent research group.

In 2018, Stephanie was awarded both a CDF2 NHMRC Fellowship (declined) and an SRFA NHMRC Fellowship. She established her laboratory at Monash University, where she continued to conduct innovative research in the field of immunology. In 2021, Stephanie was appointed as a Professor at La Trobe University, where she moved her laboratory to LIMS and became the Deputy Director in 2022. Throughout her successful career, Stephanie has received invitations to present her work and has received numerous awards for her contributions to biomedical science (Monash Dean's Award for Excellence in Research, Georgina Sweet Award for Women in Biomedical Science, Lorne Sparrow Award, Australian and New Zealand Society for Immunology Gordon Ada Senior Award, Society of Crystallographers in Australia and New Zealand Sandy Mathieson Medal). Stephanie has published over 120 manuscripts in journals such as *Science, Nature, Immunity, Nature Immunology, Science Immunology* and *Nature Communications*.

Stephanie's research is instrumental in providing a better understanding of the first key event in T cell-mediated immunity towards pathogens: the antigen recognition mechanism. By combining her expertise in biochemistry, structural biology and cellular immunology, Stephanie aims to understand the mechanism of antigen recognition by T cells at the atomic level, which could lead to the development of more targetted and effective immunotherapies for a range of diseases. Her work on identifying T cell epitopes in viruses such as SARS-CoV-2 is particularly relevant in the context of the ongoing COVID-19 pandemic.

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
Maurizio Costabile

A Year 7 experiment measuring the time taken for a balloon at varying levels of inflation moving between two chairs ignited my enthusiasm for science. While I didn't obtain any accurate results, it didn't matter; I was hooked and looked forward to science classes above other subjects. From that day, I wanted to be a scientist, but what kind? After completing my science degree, I narrowed the fields to Biochemistry or Immunology. I ended up completing Honours investigating the biochemistry of slime molds, followed by a PhD in Immunology. While completing my thesis, I was fortunate to be offered a Level A lecturing position at the University of South Australia (UniSA).

While employed to teach immunology, I began co-teaching biochemistry within a year, and my two passions were again united. I maintained my research links with the Women's and Children's Hospital while juggling my teaching load. Without formal teaching qualifications, settling into a good rhythm took me a little time. While I enjoyed my research, I began to identify a passion for teaching students. It was (and is) a joy to teach content that I find fascinating, fundamental to our lives, and interconnected to many other disciplines.

In time, through a combination of self-reflection and student feedback, my teaching became more refined. I enjoyed the challenge of identifying issues with student learning and devising ways to remedy these areas. Each year, I challenge myself to develop an innovation to improve my teaching and the student experience. I have been fortunate to have my teaching and innovations acknowledged through several local, national and international awards. I have received tremendous support from colleagues in this journey and now give back at every opportunity.

With the introduction of teaching-focussed academic roles at UniSA, I moved to this classification in 2019. Since then, I have been promoted to Associate Professor; only the second staff member to be promoted to this rank as a full teaching academic. This has brought additional leadership roles within the university, including two secondments to a Dean of Research role. I now focus on keeping my teaching excellence and disseminating my finding at conferences (e.g., ASBMB) and journal articles. It is always a pleasure to witness that lightbulb moment from our students and renew that science spark within ourselves.

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
Pirooz Zareie

Dr Pirooz Zareie completed his PhD in 2018 at the Victoria University of Wellington in New Zealand. Dr Zareie made significant contributions to understanding methods to modulate inflammation in the central nervous system using an animal model of multiple sclerosis. Throughout the course of his PhD, Dr Zareie published two journal articles as co-author and one first-author publication in the *Journal of Neuroinflammation*. In 2018, Dr Zareie was recruited to the Monash Biomedicine Discovery Institute as a postdoc in Professor Nicole La Gruta's laboratory, where he shifted his focus towards understanding cytotoxic T cell mediated immunity. Dr Zareie developed considerable expertise across a wide range of different state-of-the-art technologies and has used these techniques to make seminal discoveries published as first-author publications in *Science* (2021) and *Nature Communications* (2022). Dr Zareie has contributed as co-author to work in high impact journals such as *Nature Cancer* (2022), *Science Immunology* (2021) and *Journal of Immunology* (2020).

It has long been thought that the strength by which T cell receptors binds with its ligand is a key determinant of the T cell response, however, Dr Zareie's recent research revealed additional determinants of immune cell activation and function that occurs independently of binding strength, overturning the current dogma in the field. His recent *Science* publication has attracted significant positive media attention and was the topic of a Perspectives article published in *Science*, 'A LoCK at the T cell dock'. Dr Zareie is also a co-inventor on a patent application based on his recent N*ature Communications* article, a testament to the impact potential of his research program.

Dr Zareie has an emerging international profile, as evidenced by invitations to speak at national and international conferences and prestigious institutions. His research excellence has been recognised by many prominent awards, including the Robert Porter ECR publication prize (Monash University; 2022), MCR Shining Star Immunity Program Award (Monash University; 2022) and the Monash Biomedicine Discovery Institute Director's Highly Commended Publication Award (Monash University; 2021). Recently, Dr Zareie was awarded an ARC DECRA (2023–2025) to support his research program continuing to understand the precise mechanisms by which T cell antigen recognition drives T cell activation and development.

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.

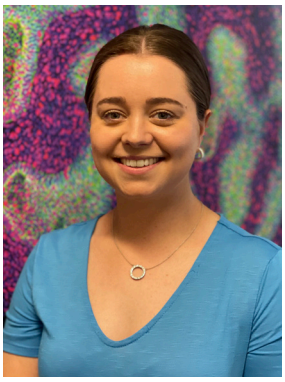
The Collins family kindly established the Fred Collins Award to honour the role that Fred Collins played in the establishment of the Australian Biochemical Society.

Lauren Jones – recipient of the Fred Collins Award for the most outstanding ASBMB Fellowship applicant

Lauren completed her Bachelor of Medical Science at Flinders University, attaining First Class Honours in the lab of Associate Professor Mary-Louise Rogers studying a novel antibody-directed treatment for motor neuron disease. Lauren then received an Australian Government RTP Scholarship and SA Government PhD Top-Up Stipend to undertake a PhD under the supervision of Professor Damien Keating at Flinders University. Lauren's PhD focussed on understanding the molecular mechanisms that facilitate the mechanosensory function of sensory cells (enterochromaffin (EC) cells), which line the gut wall. Lauren demonstrated the role of the mechanically activated ion channel Piezo2 as a key functional channel in human EC cell mechanobiology. Lauren's PhD led to seven publications, including three in the top-ranking journals *Gastroenterology* and *Gut*, and a first author invited review on serotonin in the *International Journal of Biochemistry & Cell Biology*. Lauren has been recognised as the fifth world leading expert in EC cell biology and is ranked in the Top 1% of researchers worldwide on serotonin as evaluated by Expertscape. In 2022, Lauren was selected as one of 30 early career researchers worldwide to present at the highly prestigious biennial young investigator meeting, Little Brain Big Brain, in Germany, and was selected for an oral presentation at the Australasian Neurogastroenterology and Motility Conference, in Melbourne, for which she won the Best Oral Presentation prize.

This ASBMB Fellowship will give Lauren the opportunity to learn advanced research techniques from international specialists at the Mayo Clinic, USA. This will allow Lauren to perform novel experiments to better understand how EC cells mediate different responses to differing stimuli.

Sarah Garnish



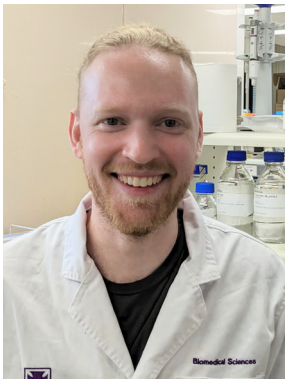
Dr Sarah Garnish completed a Bachelor of Science in Biochemistry and Molecular Biology in 2017 at the University of Melbourne. She continued her studies at the Walter and Eliza Hall Institute (WEHI), completing her Honours in 2018 under Professor John Silke and Dr Joanne Hildebrand. During this time, Sarah investigated a naturally occurring polymorphism in the necroptotic executioner protein, mixed lineage kinase domain-like (MLKL). Sarah was the recipient of the 2018 Colman Speed Honours award at WEHI, recognising the top Honours student. In 2019, Sarah joined the laboratory of Professor James Murphy (WEHI) to begin her PhD studies. Co-supervised by Dr Joanne Hildebrand, Sarah's current research investigates the underlying molecular mechanisms that govern MLKL activation, and how these are dysregulated in human disease. During her PhD, Sarah made three major discoveries: 1. human MLKL is maintained by RIPK3 in an inactive conformation prior to necroptosis activation, 2. a high frequency missense mutation in MLKL results in gain-of-function and impairs the return to homeostasis after systemic challenge and 3. MLKL deficiency protects against age-related sterile inflammation. Her research has made significant impact in the field of necroptosis, reflected by 16 publications, including first-author papers in *Nature Communications* and *Cell Death & Differentiation*. Sarah's PhD thesis was awarded the *Biomolecules* 2022 PhD Thesis Award and her

ASBMB Fellowship Profiles

PhD Oration was recognised with the WEHI 2022 Best Seminar Prize. Sarah's research has also been recognised with international and national conference presentations, and several awards and scholarships, including the 2022 Cell Death Gordon Research Conference Best Poster Prize.

This ASBMB Fellowship will enable Sarah to present her recent findings at the 13th European Workshop on Cell Death to be held in Fiuggi, Italy.

Adam Hagg



Dr Adam Hagg was awarded his PhD from Monash University in 2021, supervised by Professor Paul Gregorevic and Associate Professor Craig Harrison. Adam conducted his research jointly across the Baker Heart and Diabetes Institute, the Department of Physiology at Monash University and the Center for Muscle Research at the University of Melbourne. Adam's PhD studies focused on identifying new mechanisms by which the Transforming Growth Factor β (TGF-β) superfamily controls skeletal muscle mass, particularly in the context of cancer associated muscle wasting. Adam's recent work, which involved extensive international collaboration, utilised adeno-associated viral vectors to demonstrate that dysregulated bone morphogenetic protein (growth factors that belong to the TGF-β family) signalling is associated with neuromuscular defects which contribute to muscle wasting caused by advanced cancer.

Following his PhD, Adam relocated to the School of Biomedical Sciences at the University of Queensland to work alongside Dr Kelly Walton. Dr Walton and Adam are currently investigating new roles for the TGF-β pathway in regulating whole-body homeostasis with a particular focus on metabolic, skeletal muscle and reproductive physiology.

Adam's research has been recognised through best speaker and publication awards from the Australian Physiological Society and Endocrine Society of Australia. In 2019, Adam was awarded the Novartis Junior Scientist award by the Endocrine Society of Australia. Adam has published 14 peer review manuscripts with over 600 citations.

The 2023 ASBMB Fellowship award will allow Adam to travel to Edinburgh, Scotland, to attend the 7th Cancer Cachexia Conference.

Chathura Suraweera

Dr Chathura Suraweera completed a Bachelor of Science (Honours) degree in 2013 at the University of Peradeniya in Sri Lanka and moved to Australia in 2014, where he completed a Master of Chemical Science degree in 2016 at La Trobe University. Dr Suraweera completed his PhD at La Trobe University under the supervision of Professor Marc Kvansakul and Associate Professor Mark Hinds, where he acquired extensive skills in structural biology (protein crystallography) and protein biochemistry. His PhD research investigated the structure–function relationships of large DNA virus apoptosis subversion molecules across divergent viral species and has made a significant impact across the fields of cell death and viral immune evasion. Specifically, he used X-ray crystallography and biophysical molecular interaction approaches to define the mechanism of action of Bcl-2 homologues from multiple pathogenic viruses. His PhD research resulted in 11 publications with 10 as a first or co-first author in highly recognised journals in the field including *Cell Death and Disease*, *Cell Death and Differentiation*, *FEBS Journal*, *Biochemical Journal* and *Viruses*.

Dr Suraweera's achievements have been recognised through several awards and scholarships, including the Rising Star award from both the Asian Crystallographic Association and the Society of Crystallographers Australia and New Zealand (SCANZ), ASBMB (USA) travel fellowship (2019), EMBL Australia travel award (2019), FAOBMB travel fellowship (2020), SCANZ Maslen travel award (2018 – national, 2019 – international). Dr Suraweera moved to Monash University in 2021 and currently working as a Research Fellow in Associate Professor Sheena McGowan's laboratory at the Department of Microbiology.

This ASBMB Fellowship will enable Dr Suraweera to attend and share his latest work at the 7th Viruses of Microbes meeting to be held in Tbilisi, Georgia.

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 November 2022. This was the 71st year of the competition with a welcome return to in person teaching and group experiments. The Science Talent Search, founded in 1952, is organised by the Science Teachers' Association of Victoria and is open to all primary and secondary school students in Victoria. 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.
- Promoting 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.

The main theme of the 2022 Science Talent Search was 'Glass: More Than Meets the Eye'. With the easing of COVID restrictions in Victoria and students returning to the classroom, the number of participants was exceptionally high, with 169 schools and 3,369 students entered. ASBMB Victoria was once again delighted to support the event with a $1,000 donation in the form of major and minor bursaries to the following primary and secondary schools: Melbourne Girls Grammar School, Doncaster Gardens Primary School, Hume Anglican Grammar, Auburn High School, Genazzano FCJ College, Waverley Christian College, Camberwell Girls Grammar School, Tintern Grammar, Presbyterian Ladies' College, Methodist Ladies' College and Parade College Bundoora. Project titles included: 'Invisible germs: where are they, how do they grow, and how can we kill them?', 'Impact of drought stress on seed germination and seedling growth of selected legumes', 'Investigating the placebo effect in food', 'Effective assessment on EGPA: cyclophosphamide and steroid', 'Which eight types of milk froth best?', 'Which fruit and vegetable waste produces more biofuel?', 'The microbes ate the glass', 'What is bioglass?', 'Innovative uses for glass' and 'Bioactive glass – glass saving lives'.

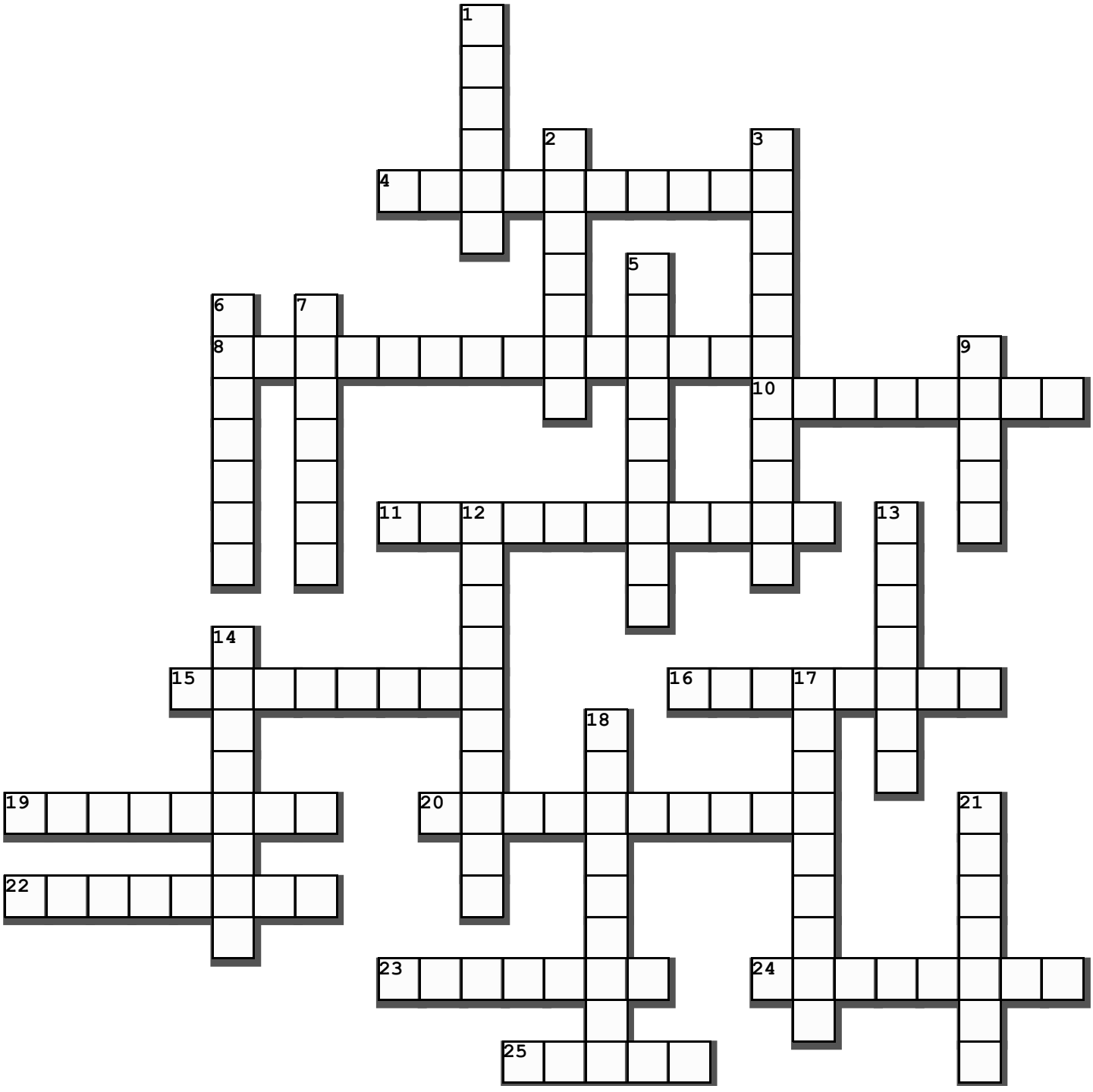
After a challenging few years in Victoria, it is wonderful to see the students interacting with their peers and discovering a love of STEM subjects in the classroom. Experimental research in Australia is in very good hands given primary school students are undertaking 'bench' research with pertinent topics investigating where and how microbes grow and how we can design drugs to kill them. Congratulations from ASBMB Victoria on completing your research projects for 2022.

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

Science Talent Search winners from Melbourne Girls Grammar School including an ASBMB Bursary awardee (left).

Competition: Cryptic Crossword

Presenting the latest competition for members of the ASBMB: a biochemistry and molecular biology themed crossword. All entries received by the Editor (tatiana.soaresdacosta@adelaide.edu.au) by 1 May 2023 will enter the draw to receive a voucher. With thanks to Joe Kaczmarski.



Clues found on page 26.

Competition: Cryptic Crossword

ACROSS

4. Model flies to see Spanish bear appear in Dr Phil before joining with the head of Australia.

8. Modification after translation leads to degredation and makes Rubi quit in national park.

10. Dainty Bo confused about a key part of the immune system.

11. A positive molecule comes last after removing the last two replies during the process of making a copy**.**

15. It's a wrap! Paranormal film does not have anything normal in it at all.

16. Organelle that breaks down molecules inside easily, so some say.

19. A pigment found in plants gives Caro ten enzymes to extract from.

20. When a pink fish is put in front of Ella, it causes a bacterial infection.

22. Top of Director's Summit contributes to no end of plastic plant organelles.

23. An illness, sickness, or abnormal condition is much like the disordered seaside.

24. It's basic: walk a line without a head!

25. Christmas saying provides a method to detect and quantify enzyme activity.

DOWN

1. Point Ron within and between exons.

2. Cash or money disguises an important type of signalling molecule.

3. The heads of Coronavirus Immunity Network get stuck together in the middle of holiday to create a way to stimulate the immune response!

5. The inside of a cell messes with Calypso trademark.

6. Good at resisting change, they start buff but end in Emergency Rooms.

7. Inorganic phosphate and polyethylene added to the bottom of latte helps us to handle small volumes of liquids.

9. Attached cod on a unit used for genetics.

12. It makes more sense following a complementary template, as employer gets mixed up.

13. The 7th element in disordered poetry creates a degree of disorder or uncertainty.

14. I got stuck in a messed up cabaret encompassing a large group of unicellular organisms.

17. A church instrument comes first and foremost before her French cellular structure.

18. Martha, pop to sister's abode and it will lead to death.

21. Messed up diet begins with the top of pepitas and very little protein.

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SDS Page: Short Discussions for Students Page

A Journey Along the Academic Career Track

Emily Furlong

Research School of Biology, Australian National University

On 1 February 2023, I started my own research lab in the Research School of Biology at the Australian National University. Throughout this article, I reflect on my career so far and share the things I've learnt along the way, which hopefully will be helpful for those of you making career decisions. Before I get into the details of my journey, I would like to start with a disclaimer: My personal circumstances have allowed me to chase an academic career. In recounting my story, I recognise more work needs to be done to make the academic research environment equitable and inclusive for all.

My career so far

My exposure to a career in scientific research started early in my undergraduate degree. Throughout my Bachelor of Science at the University of Queensland (UQ), I completed the Advanced Studies Program in Science. It was through this program that I first met my future PhD supervisor, Professor Jenny Martin. I interviewed Jenny for an assessment piece in my first year of undergrad, then went on to do a second-year undergraduate research project in her lab. Over the next two years, I worked in other labs across the UQ campus, where I contributed to protein biochemistry and medicinal chemistry projects and was mentored by outstanding postdoctoral researchers. By the end of Honours, I was hooked on structural biology research and doing a PhD was the next logical step.

When I first started my PhD, Jenny asked me "what do you want to get out of your PhD?" I was a little taken aback by the question, but I thought for a minute then answered, "I want to learn crystallography, I want to go overseas for a conference, as I have never left Australia and I think it'd be good if I published some papers, because that seems to be important." My PhD experience had its ups and downs, but overall was very positive and I got more than what I wanted. I learnt crystallography, I published a few papers, and I spent six months at the University of Oxford, learning cryo-electron microscopy (cryo-EM) within Professor Susan Lea's lab. This six months in Oxford was a pivotal point in my career and personal development. I also loved my time there, so when an opportunity arose to return to Susan's lab as a postdoctoral researcher, I took it!

Being a Brisbanite, my first winter in the UK was hard and just when things were starting to warm up, we went into COVID-19 lockdown. It was around this time that I decided I would return to Australia at the end of 2020. Susan was also moving the lab to the US, and I wasn't interested in moving to a new country again or staying in the Oxford lab without her. This decision meant that I had limited time to produce enough results for a first-author publication. In collaboration with a senior postdoc in the lab, we determined the structure of the intact bacterial flagellar basal body, and this work was published in 2021.

Throughout my postdoc in Oxford, I kept in contact with Dr Alastair Stewart, who I'd met at a conference as a PhD student and was interested in working for given his expertise in cryo-EM. Fortunately, Alastair was able to offer me a 1 year and 9 month contract in 2021, so I moved to Sydney. In early 2022, it seemed unlikely that my contract with Alastair would be renewed, due to a lack of funding. I did not want to move onto a third postdoc in the space of four years, so I started to investigate other career options. In April 2022, I was discussing my predicament with Dr Joe Brock, while he was visiting Alastair's lab. He mentioned that the Research School of Biology (RSB) at the Australian National University would be advertising lecturer positions and he invited me to give a talk in the school.

Before the visit, I hadn't seriously considered ANU as a place to start my own group, but afterwards, I knew ANU was where I wanted to be if I were to continue down the academic career path. So, I applied for the lecturer job. My application was shortlisted, and I went through a two-day interview process. I was super nervous about giving my half-lecture/half-research talk but, in the end, I felt good about it all. I had to wait three weeks to find

SDS Page: Short Discussions for Students Page

out that I got the job and couldn't tell anyone for another three as we talked through what I'd need to set up my lab. At first, I felt overwhelmed about taking on this new role, but I have become more comfortable with the idea and am excited about the opportunities.

General career advice

1. People are important. All the people I have worked with have supported me, in their own way, and made me a better scientist. Additionally, the friends I've made along the way have become my biggest advocates, so take the time to build those relationships – go to the coffee break and/or after work drinks (even if they are awkwardly done over Zoom). Find people who will look out for you. Mentors are important, but sponsors (i.e., people who will say good things about you and put you forward for opportunities) are essential.

2. Be proactive. Look out for opportunities. You may find these on social media, through society email lists or by just talking to people. Don't wait for things to happen, make them happen. For example, I would recommend building professional relationships with the people you want to work with – don't just randomly apply for jobs.

3. Work out what you value in a workplace. This may sound a bit vague, especially if you've never done any career development workshops. So as an example, three of my values are growth, community and integrity. *Growth:* I like to work in an environment where I'm learning and have the opportunity for growth, both personally and professionally. *Community:* I need to feel like I belong and have support from those around me. *Integrity:* I'm a righteous person and I don't like work environments where I see unfairness and dishonesty. Knowing yourself will help you make good career decisions.

*4. Go where **you** are wanted.* Having a supervisor/manager who is invested in you and values your work and opinions makes a huge difference to your sense of security and the battle against 'imposter syndrome'.

Specific advice for getting an academic job

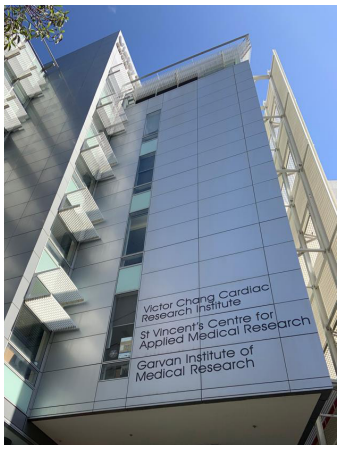
1. Be realistic and have a backup plan. We all know the statistics when it comes to landing a continuing academic job. For me, it helped to know there was always something else I could do if my academic career didn't go to plan.

2. Have a research vision. This isn't always easy to develop, but is necessary if you want to start your own lab. I found that working out what I am not interested in was helpful. I also thought about how I could combine the different skills and knowledge I've gained from my PhD and postdocs to create my research vision.

3. Recognise your uniqueness. What makes you different from everyone else? This could be a particular skill that you have (in my case, that's cryo-EM) or your 'soft skills' (communication, teamwork, etc), what your research focus is or even the value you'd bring as a colleague in a research department (e.g. how willing you are to help others or contribute to committees).

4. Move? International experience is incredibly valuable and will possibly make your life easier on the academic job market, but it isn't necessary and can cause a lot of misery if it's not what you want to do. I would highly recommend spending some time in different labs or institutions, as you won't necessarily know what suits you until you experience different environments. In my pretty short career, I've spent time in seven labs across five different schools/institutions. I have also seen major benefits to staying put for a decent amount of time if you are in a good place for you (personally and professionally) and you see opportunities for career progression.

Dr Emily Furlong is a Lecturer in the Research School of Biology at the Australian National University.
@em_furlong
emily.furlong@anu.edu.au



The places Emily has studied and worked, from left: the University of Queensland, Sir William Dunn School of Pathology at the University of Oxford and the Victor Chang Cardiac Research Institute in Darlinghurst, Sydney (VCCRI photo courtesy of Osvaldo Contreras).

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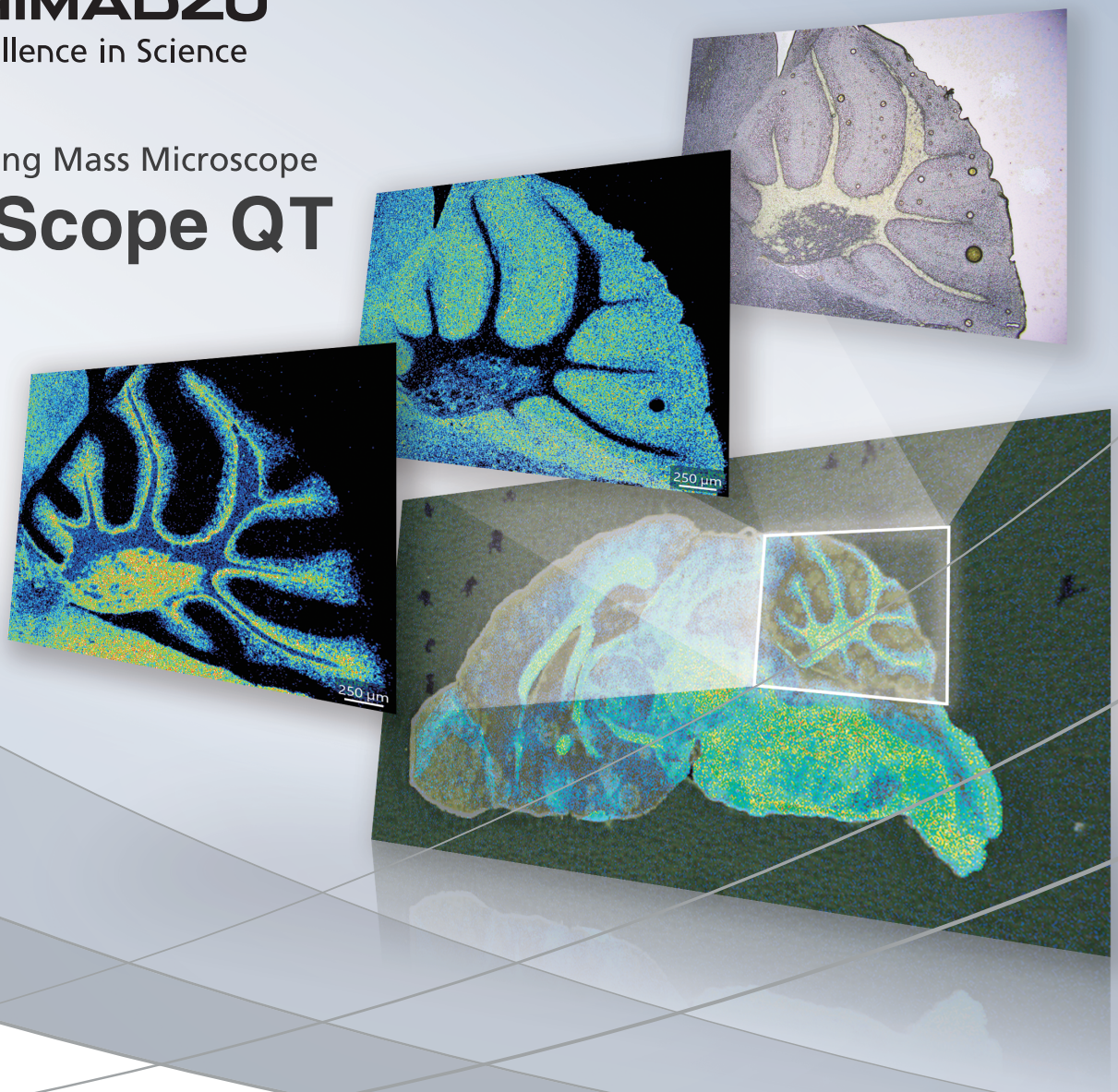

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Off the Beaten Track

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.

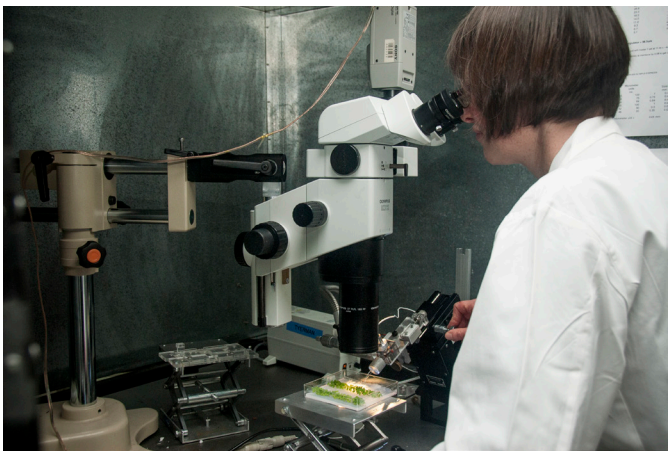
From Dealing with Plant Physiology Data to Budget Spreadsheets

Rebecca Vandeleur, Operations and Research Manager, Waite Research Institute, University of Adelaide

I became the Operations and Research Manager for the Adelaide node of the ARC Centre of Excellence in Plant Energy Biology in 2014 after six years as a postdoctoral researcher at the University of Adelaide. After completing Honours in Agriculture Science at the University of Adelaide, I opted for a change of scenery and worked on a dairy farm in Denmark and travelled through Europe for 12 months. Upon my return to Australia, I worked as a Research Officer in the Department of Agronomy and Farming Systems at the University of Adelaide's Roseworthy Campus for five years. I was responsible for managing a number of field trials researching the ability of improved wheat varieties to outcompete weeds. I was able to present this work at conferences in Australia, a workshop in India and through numerous publications. This reignited my passion for research, but also highlighted the need to have a laboratory-based PhD project where I wasn't at the mercy of weather conditions.

My PhD was supervised by Professor Steve Tyerman, Dr Brent Kaiser and Dr Peter Dry at the Waite Campus of the University of Adelaide in the Department of Horticulture, Viticulture and Oenology. My project examined the water transport of grapevine roots using various instruments to measure water transport at a whole plant, root and cellular level. There was also a molecular biology component to determine gene expression and water transport activity of membrane water transporters, called aquaporins, and the impact of water stress. Following my PhD, I continued working on aquaporins in different plant species and examined their role in nitrogen transport and water status signalling. During my PhD and postdoctoral position, I had three children. Working part-time and my inability to move interstate for employment due to family commitments impeded my ability to obtain grant funding and brought me to a fork in the road of my career path. At this time, the operations and research management position was advertised.

Rebecca Vandeleur.



Postdoctoral researcher: measuring water flow rates in plant root cells.

The role of Operations and Research Manager for the Centre of Excellence was varied and challenging. I was responsible for meeting compliance requirements for biosecurity and physical containment laboratories and plant growth facilities; managing project finances and financial reporting; outreach; procurement; human resources; event management; management of equipment and instrumentation; health and safety. The tasks often involved working with other departments and services within the university. The role was perfect for that stage of my life, offering the flexibility required when raising children.

Off the Beaten Track

Operations and Research Manager: lots of fun teaching children about plants and salinity at Science Alive.

For the past two years, I have been the Operations and Research Manager for the Waite Research Institute (WRI). The WRI supports research and innovation across the whole of the University of Adelaide and its partner organisations to build capacity for Australia's agriculture, food and wine sector. The WRI supports researchers by providing training opportunities, facilitating business development and supporting strategic initiatives. The WRI also raises awareness about agriculture, food and wine research at the University of Adelaide and our partner organisations through news stories, social media and seminars. I am still responsible for many of the research management tasks that I did in my previous role, supporting the research activities of Professor Matthew Gilliham, Director of WRI. This includes the management of the biosecurity and OGTR compliance for a number of research groups in our building. Additionally, at the start of 2022, I assisted with preparing the successful grant application for the new ARC Centre of Excellence for Plants in Space. I worked with a number of partner investigators and organisations to prepare their sections for the application.

A number of the soft skills developed as a researcher can be applied to a non-research role. Project and time management skills honed as a researcher are required in my role as Operations and Research Manager. The level of organisation necessary to run a research project is essential in my non-research roles. Instead of spreadsheets for experimental data, the spreadsheets are now filled with finances and budgets. I am responsible for managing the spending across multiple projects. My project management skills are now used to organise workshops to share research or enhance the professional development of staff.

Understanding science and scientific technique has been invaluable for delivering outreach to school students. We ran activities at large public events, including Science Alive, and also on campus in undergraduate laboratories for high school students. The background in science is also vital when organising the procurement of scientific equipment, preparing import permit applications and managing biosecurity and physical containment laboratories.

I definitely still miss doing my own research and still look at research papers in my field of research, but my role as an operations and research manager has enabled me to continue to interact with scientists and postgraduate students, and importantly, assist in facilitating their research. I organise and therefore attend seminar series and lab meetings so I am aware of the research being undertaken on the Waite Campus. It is rewarding to support the scientists and postgraduate students in problem solving, navigating the various services of the university and providing resources, so they can focus on their research and develop professionally.

rebecca.coleman@adelaide.edu.au

Melbourne Protein Group: an ASBMB Special Interest Group

The Melbourne Protein Group (MPG) was founded in 2002, initially running as an offshoot of the Lorne Conference on Protein Structure and Function. From 2002–2008, the MPG held an annual single-day symposium with the aim of giving young Victorian researchers an outlet to present their science. In 2009, the MPG became a Special Interest Group (SIG) of the ASBMB, allowing the MPG to broaden its focus and output, and aligning it with the other state protein groups. The aims of the MPG are to provide students (PhD and Honours) and early career researchers with opportunities to present their research and facilitate networking with peers and the broader Victorian protein science community, facilitate mentoring opportunities through the involvement of senior researchers at events, liaise with the ASBMB and other state protein groups and raise awareness of upcoming events and conferences from our network.

The MPG committee is represented by individuals from across the Melbourne protein research landscape, from the Bio21 Institute, the Florey Institute, Monash Institute of Pharmaceutical Sciences (MIPS), and Walter and Eliza Hall Institute (WEHI) in Parkville, to Olivia Newton-John Cancer Research Institute (ONJCRI) and St Vincent's Institute (SVI) across the city, to our suburban research hubs at La Trobe, RMIT and Monash universities. We also have an industry representative from CSL.

The student symposium remains the highlight of the MPG calendar, running annually from 2002–2019, traditionally rotating between the University of Melbourne (Bio21), La Trobe University (Bundoora) and Monash University (Clayton). After skipping 2020 due to COVID-19 restrictions, the MPG held its first virtual student symposium in 2021. In another the first, the symposium was hosted by St Vincent's Institute of Medical Research. The MPG committee is now determined to share the hosting of the annual student symposium, rotating through as many different institutes and universities as possible.

Eighty student delegates attended the 20th annual MPG student symposium, held on 17 July 2022, in the amazing Cossar Hall at the Monash Institute of Pharmaceutical Sciences (Parkville).The program, chaired by David Thal (MIPS), included six student speakers (chosen from submitted abstracts) and three invited keynote speakers (two research-focused presentations and one career-perspective presentation), followed by a Q and A with the keynote speakers.

Our first research-focused keynote was delivered by Associate Professor Denise Wootten (MIPS), who gave a fabulous presentation on the structure and dynamics of class B peptide hormone G protein-coupled receptors, while the second presentation by Associate Professor Andrew Ellisdon (Monash BDI), delighted the audience with his team's latest cryo-EM structures. Associate Professor Ashley Buckle (Head of Protein Engineering at Replay) delivered the career-focused keynote presentation, discussing the permeable barrier between academic and commercial research, while emphasising the importance of maintaining networks, from PhD throughout the many stages of his scientific career. The MPG committee would like to give a big thanks to our amazing keynote speakers, who not only gave up their time and gave tremendous presentations, but were also involved with the judging throughout the day.

We had an excellent lineup of student speakers from across Melbourne (selected from 35 applications), whose research topics include the study of proteins involved in hydrogen oxidation, cell signaling, cell death, mitochondrial disease, male contraception and breast cancer. The six outstanding candidates selected were Lisa Williams (Florey), Morgan Marshall (Monash), Yanxiang Meng (WEHI), Ashleigh Kropp (Monash), Linden Muellner-Wong (Bio21) and Felix Bennetts (MIPS). The winner of the Tilley Prize for the best oral presentation was Ashleigh Kropp, whose presentation revealed the structural basis of hydrogen oxidation in *Mycobacterium smegmatis* and had the added disadvantage of preparing a last-minute prerecorded presentation due to COVID-19 isolation requirements.

In addition to the student oral presentations, the 2022 meeting saw 55 student poster presentations. The posters were of a very high-quality, with the judges selecting eight best poster prizes over two sessions; the

Socially distanced keynote speakers at the 20th MPG student symposium panel Q and A, from left: Andew Ellisdon, Ashley Buckle and Denise Wootten.

Melbourne Protein Group: an ASBMB Special Interest Group

best poster prize winners were: Kaitlyn Clarke (La Trobe), Hayley Turnham (Bio21), Jaison Sa (WEHI), Peter Calic (Monash), Maht Mansouri (Monash), Ayeshah Rosdah (RMIT/SVI), Scott Williams (La Trobe) and Sum Shi Xuan (La Trobe).

The symposium finished with a 45-minute keynote speaker panel Q and A. This session always generates amazing discussion between the audience and the keynote speakers, and this year was no different. There were many topics covered over the session, but there was a distinct desire from the audience to delve into the panels knowledge on commercial/industry work and funding opportunities, a sign of the times perhaps? Happily, the discussions started in the panel session continued over some tasty snacks and beverages at the social hour mixer held at Naughtons Hotel, Parkville. We would like to thank our fantastic sponsors who supported symposium, the ASBMB, MIPS and BMG Labtech.

One benefit from being a SIG of the ASBMB is we can sponsor an outstanding early career researcher to present their science at ComBio2022. The winner (selected from abstracts and CVs) was Luke Formosa from Monash University.

The MPG committee is committed to providing more networking opportunities for our postdoctoral members. In the past, the MPG, has held postdoc symposiums on alternate years to ComBio, but due to the increased number of workshops, methods symposia, and technique specific meetings in and around Melbourne each year, we feel there is no longer a need (or time) for another day-long event. Instead, the committee is in the process of setting up shorter events geared toward socialising and networking – protein postdocs of Melbourne, watch this space!

The MPG committee has undergone significant change in the past year, with President Mike Griffin (Bio21) and long-standing members Mihwa Lee (La Trobe), Daniel Scott (Florey) and Onisha Patel (WEHI) stepping down. On behalf of the committee, I would like to take this opportunity to thank the outgoing members for their hard work and dedication to the MPG community. Changes to the executive committee include Chris Langendorf (President) and Jess Holien (Secretary). New representatives to the MPG committee are Debnath Ghosal, Laura Osellame, Lisa Williams and Tom Murray-Rust (industry representative). We will announce shortly the date for the 21st student symposium, hosted by RMIT University (city campus). We hope you all have a successful 2023, may your proteins be folded and happy.

Poster prize winners at the 20th MPG student symposium, from left: Kaitlyn Clarke, Scott Williams, Ayeshah Rosdah, Jaison Sa and David Thal (chair).

Poster prize winners at the 20th MPG student symposium, from left: Petar Calic, Mahta Mansouri and Hayley Turnham.

MPG Executive Committee
President: *Chris Langendorf (SVI)*
Treasurer: *David Thal (MIPS)*
Secretary: *Jessica Holien (RMIT)*
General committee members: *Debnath Ghosal (Bio21), Tom Murray-Rust (CSL), Laura Osellame (ONJCRI/ La Trobe), Adam Shahine (Monash), Gabby Watson (WEHI) and Lisa Williams (Florey)*

Chris Langendorf, MPG President
Web www.mpg.org.au
Twitter @MelbProtein
Email MelbourneProteinGroup@gmail.com

Has My Research Got What It Takes? Experimental Data for Patents

Dr Harriet Manley, Patent Scientist, and Dr Sarah Hennebry, Associate Principal, from FPA Patent Attorneys discuss considerations and misconceptions around experimental data for patent applications.

Harriet Manley (top) and Sarah Hennebry.

Introduction

Patents can serve multiple commercial purposes. It can be challenging to consider how your research can have commercial impact, and to what extent you need to develop your idea before it may be worthwhile protecting in a patent application.

This article aims to clarify competing aspects of obtaining experimental data for patent applications, and address some common misconceptions that arise when prospective inventors ask the age-old question: 'Have I got enough for a patent?'

What can constitute an invention?

The subject matter of a patent application can be a minor improvement over the prior art, and can provide a simple solution to a complex problem. Patents can provide protection for iterative technological developments, so your invention does not need to be a complete, polished product which is ripe and ready to be the next one on the shelf. Instead, at the relatively 'early' stage of filing a patent application, what is important is establishing that the invention is novel (new), inventive, sufficiently supported and enabled, and directed to patentable subject matter (see our earlier articles – e.g. Dec 2022).

Can I develop an idea from a patented invention?

If you wish to patent an idea developed from an earlier patent, careful consideration needs to be given to how the earlier patent will impact the novelty and inventiveness of your invention, and your ability to commercially exploit your development ('freedom-to-operate'). Patent attorneys can assist in assessing the impact of close prior art documents on the patentability of your invention, and your freedom-to-operate.

Australian patent law (and indeed the law in other jurisdictions) includes provisions exempting certain experimental and research activities from patent infringement. Although the provisions are yet to be tested by an Australian court during infringement proceedings, the intent of the provisions appears to be to provide an exclusion from infringement for researchers to further develop or test a patented invention, including where research may be conducted with a view to ultimately commercialising the end-products of the research. If you have concerns that your research may be considered an infringement, you should seek the advice of a patent attorney. However, it is possible that you have greater freedom to conduct your research than you realise.

Patent data is not necessarily publication-worthy or fit for regulatory approval

The data that goes into a patent application does not need to be of equal quality or quantity to that prepared for a scientific publication, or that required for regulatory approval purposes.

Often what is more important is filing the patent application in a timely manner, because filing an application establishes a priority date. The priority date is the date from which you state that your invention is novel and inventive, and the date from which your patent rights 'start' if your patent is granted. Filing as early as possible reduces the risk of being 'scooped' in patent terms; reducing the amount of prior art that existed before your patent was filed.

Of course, tensions arise when valuable potential intellectual property (IP) is identified, but experiments are incomplete. Do you file now to reduce the risk of being 'scooped', or do you hold off filing to obtain more data and strengthen the initial position of the patent application?

Patent attorneys are well-practiced in balancing the timing of filing applications and preparing data, and can advise strategies to maximise IP protection in view of ongoing experiments and data collection.

Quality over quantity

Patent applications need to provide sufficient evidence to demonstrate that the invention works, and describe the invention with enough information that a person in the field would be able to perform the invention. The information included within the patent specification directly influences how narrow or broad the claims can be, impacting the scope of the granted patent's monopoly.

It is becoming increasingly difficult to claim more broadly than exactly what is shown in the examples of a patent specification. If a patent is limited in this way, then third parties may be able to design around a patent claim which reduces the commercial value of the patent.

Has My Research Got What It Takes? Experimental Data for Patents

More experimental examples can help more firmly establish proof of a general principle; increasing the scope of a patent application by making it more plausible that the skilled person would extrapolate from the data of the patent specification.

But that does not mean that a patent application needs to include all the examples under the sun. It is important to consider the quality of the data, and the value of certain experiments over others. Certain types of data, if available, would assist in broadening the scope of patent protection. Ideally these data should be included when filing a provisional application, but they can still be of significant benefit if obtained within the next 12 months.

Data that may be important for your patent application may not be as laborious as you think. The multiple experiments that may be necessary to prove a mechanism of action, for example, could have more value for a research paper than a patent, as patents cannot effectively protect mechanisms of action (which are considered abstract ideas not inventions of human intervention that be patented).

Data that can be useful in patents but that are sometimes overlooked include:

- Directly comparing the invention to the accepted 'gold standard' in the field or that which is considered closest to the invention. Inclusion of the right control groups can maximise the value of your experiments, particularly if time and/or resources are limited.
- Negative results. Going down a road and reaching a dead end can be evidence that the path that ultimately yielded the successful result was an inventive, non-obvious path to choose. Student theses can be a good source of negative attempts!
- Extrapolating from one context to another. For example, have you explored a range of concentrations? A range of cell types, antibodies, models (*in vitro*, *ex vivo* or *in vivo*)? Tested different mutations in the same part of the protein?
- Imperfect solutions. Inventors can focus on a 100% solution try and solve a problem completely and perfectly. Minor variations to your invention may result in a less effective result, but a result that may still be worth protecting to prevent competitors designing-around your invention.

Where can your patents lead?

Patent strategy will necessarily reflect your short-term and long-term commercialisation goals, with many paths available to translate an idea from the lab to a product. Importantly, since filing IP is usually an early-stage process, it can be a very long time before the commercial value of an invention is fully realised. Moreover, it may be that the translational impact of your patent application is best leveraged by licensing the technology to other parties to invest in and further develop the invention.

Some misconceptions around the commercial benefit of patents can interfere with progressing to the filing stage, and ultimately result in valuable IP not being protected. These misconceptions include:

- Do you need to develop an entire commercial product? No. Components or methods of administration can be the subject of patent applications. In a similar vein, techniques may be identified on the way to solving your specific scientific question, that can be commercially valuable for different technology areas, e.g. methods for filtering cells, purifying proteins.
- Does the invention need to provide a drastic improvement over the current 'gold standard'? No. In some contexts, an incremental improvement over current therapies or treatment protocols can be of substantial commercial value, e.g. for diseases which experience low treatment success or high levels of drug resistance.
- Does your invention need to be a paradigm shift in order to have commercial impact? No. Again, iterative improvements over 'gold standards' can be valuable products or methods to protect using patents. Further, the invention could form the basis for IP that is licensed to another party, who will develop the idea further and/or combine it with others to develop a viable therapeutic product.

Take home messages

When assessing data in the context of patent filings, it is important to balance:

- Timing of a patent filing to minimise the risk of novelty-destroying prior art (i.e. getting pipped to the patent post)
- The nature of the experimental data that will strengthen your application (which may not be the same as the data for publishing!)
- Resources available to develop the invention further
- Your short-term and long-term commercial goals

Your patent attorney will be able to best assist you with this balancing act: appropriately advising you as to the patentability of your idea, and the appropriate experiments and strategies for maximising patent protection of your invention.

harriet.manley@fpapatents.com
sarah.hennebry@fpapatents.com

Extending Australian Biochemical Hands of Friendship Towards Asia and Oceania

Last year marked the 50th anniversary of the Federation of Asian and Oceanian Biochemists and Molecular Biologists (FAOBMB). The Federation was founded in 1972, with the original name Federation of Asian and Oceanian Biochemists (FAOB). A detailed account of the 50-year history of the Federation was published in December 2022 (1). This article was part of a special issue of *IUBMB Life* (2) published in recognition of the 50th anniversary of FAOBMB. After presenting a summary of the contents and scope of the published 50-year history of the Federation, I highlight the many contributions made by Australian biochemists and molecular biologists to the foundation and development of the FAOB/FAOBMB.

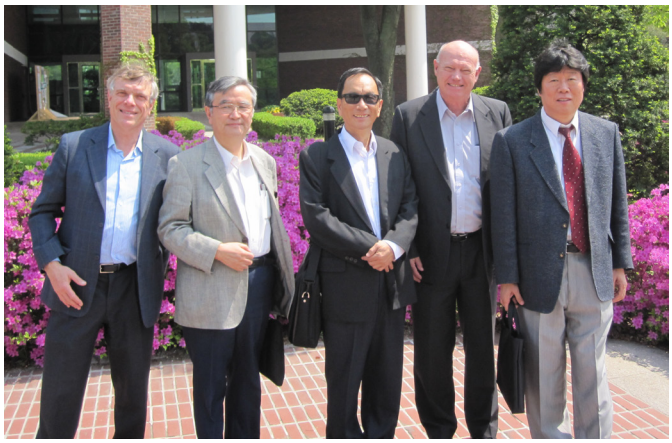
The Federation now comprises 20 Constituent Members, made up of national societies encompassing biochemistry and molecular biology, within the Asian and Oceanian regions. This article can be downloaded as PDF file from the FAOBMB webpage.

Included in the history, as an Appendix, is a compilation of the personal reflections of 11 former office bearers of FAOBMB. These reflections provide a series of engaging personal accounts and opinions of leaders of FAOBMB, and in the case of Jisnuson Svasti, Thailand, going back to the 1970s. Whilst ten of these reflections were gathered during 2022 from living former office bearers, one was recovered from the written records of the Federation, namely a document by Kay Hoon Lee (Singapore) at the end of his term as Secretary General in 1993. This and several other reflections refer to the FAOBMB journal, *Journal of Biochemistry, Molecular Biology and Biophysics*, which was published from 1997–2002.

The connections of the Federation to Australia to be discussed below not only involve personalities. After 20 years of not having a formal home address and legal status, in 1992, FAOB became an Incorporated Association in the State of Victoria, Australia.

Australians were at the forefront of the conception and foundation of FAOB. In the late 1960s, Tony Linnane in Melbourne, working with his colleague Kunio Yagi in Japan, encouraged early plans for the formation of FAOB. These plans were brought to fruition in a series of meetings in 1971–1972 between representatives of biochemical societies in Australia, India and Japan. Bill Elliot (as President of ABS) and Edwin Webb (as representative of Australia) were both signatories on the historic agreement that marked the foundation of FAOB on 1 August 1972. Webb drafted the original Rules of FAOB and was foundation President of the Federation (1972–1974). Linnane was the second President of FAOB (1975–1977) and the other Australian President was Bill Sawyer (1999–2001).

Other Australian office bearers of the FAOB/FAOBMB comprise Secretary General: Fyfe Bygrave (1980–1987), John de Jersey (2006–2011), Phillip Nagley (2012–2017); Education Chair: Susan Hamilton (2002–2005); and Fellowships Chair: Paul Gleeson (2018–present). Bill O'Sullivan was a long-term Editor of the Federation's newsletter (1983–1994). After the FAOB News became the FAOBMB Bulletin in 1993, O'Sullivan was assisted by Bruce Stone, who took over the editorship of the Bulletin (1995–1998). As Representative of ASBMB on Council of FAOB/FAOBMB in the early 1990s, Stone was a strong advocate for adding the rubric 'Molecular Biologists' to FAOB, as he had done with ABS transitioning to ASBMB in 1990. Thus, FAOB became FAOBMB in 1993. A full list of Australian Representatives to the FAOB/FAOBMB can be found on the ASBMB website.



FAOBMB Executive Committee in Seoul, Korea, in May 2010. From left: Phillip Nagley (ASBMB Representative and Co-chair of OzBio2010), Masamitsu Futai (President, Japan), Andrew Wang (President-Elect, Taipei, China), John de Jersey (Secretary General, Australia), Uhtaek Oh (Treasurer, Korea).

Two of the annual scientific meetings of the Federation have been held in Australia: the 7th FAOBMB Congress held in Sydney in 1995 (held jointly with the ASBMB annual scientific meeting) and the 21st FAOBMB Conference held in Melbourne in 2010 (in conjunction with the 12th IUBMB Conference; the meeting included ComBio2010 and was named OzBio2010). This list does not include the 12th IUB Congress held in Perth in 1982 because the FAOB scientific meeting that year was not held. These days, joint meetings are held, such that the 17th FAOBMB Congress will be held in Melbourne in 2024, jointly with the 26th IUBMB Congress and ComBio2024.

The ASBMB has been very supportive of activities at scientific meetings of the Federation. Such support

Extending Australian Biochemical Hands of Friendship Towards Asia and Oceania

has included the provision of a plenary ASBMB lectureship at two FAOBMB Congresses during the 1990s, and strong support for young scientists from Australia to attend Young Scientist Programs preceding congresses or training courses in the FAOBMB region with special fellowships provided by national societies.

Finally, it is worth mentioning that in addition to the present 50-year history of FAOBMB (1), earlier articles relevant to the history of the Federation have been published by Australian biochemists, including those by Linnane (3), Svasti and Sawyer (4), de Jersey (5). These and other articles about the history and profile of FAOBMB can be found on the FAOBMB website.

Phillip Nagley is Emeritus Professor of Biochemistry and Molecular Biology at Monash University and is Archivist of FAOBMB.
phillip.nagley@monash.edu

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Australia Day Honour for ASBMB Member

Professor David Hume was awarded an Officer of the Order of Australia (AO) for distinguished service to biological science, particularly molecular biology, and to tertiary education.

David completed his PhD in Biochemistry at ANU in 1979 under the supervision of Dr Maurie Weidemann. He has been a member of ABS/ASBMB for more than 40 years, and received the Boehringer Medal in 1988 and the Amersham-Pharmacia Biotechnology Award in 2001. David is currently an NHMRC Professorial Research Fellow at the Mater Research Institute-UQ located at the Translational Research Institute in Brisbane. He was previously Director of The Roslin Institute at the University of Edinburgh (2007–2017). From 1988–2007, he was at the Institute for Molecular Bioscience at the University of Queensland, serving as Deputy Director of the CRC for Chronic Inflammatory Diseases, and Director of the ARC Special Centre for Functional and Applied Genomics.

David has authored over 450 scientific publications and has supervised more than 60 PhD graduates. He is an international authority in genome sciences, with a particular focus on the function of macrophages – specialised cells of the immune system involved in development, innate immunity against infections and inflammatory disease. His work in the macrophage biology area was recognised in 2011 by the Bonazinga Award from the Society for Leukocyte Biology. Since 2000, he has been a leading member of the FANTOM Consortium, which has made extensive contributions to mammalian genome and transcriptome annotation. He received the OSC Omics Award from RIKEN in 2012.

David is a Fellow of the Royal Society of Edinburgh and the UK Academy of Medical Sciences.

Eppendorf Edman ECR Award Report

Immunological Party: Gathering of Immune Cells and Minds

I am honoured to have received the 2020 Eppendorf Edman ECR Award. Due to the COVID pandemic, my conference travel had been delayed. For the first time in two years, I attended an interstate meeting in person: the 50th Annual Scientific Meeting of the Australian and New Zealand Society for Immunology (ASI) from 29 November to 2 December 2022, which was held at the Melbourne Convention and Exhibition Centre.

Melbourne was busy and alive. The weather was windy but spectacularly sunny. The ASI 2022 conference covered everything from fundamental, clinical and translational immunology, right through to molecular and cellular processes controlling immune activation and diseases. As a researcher working on the molecular mechanisms underpinning inflammation and inflammasome activation, I was delighted that these research topics were well-represented in both the symposia sessions and themed sessions across the four-day period. The work of both established researchers and many emerging researchers was featured. Their research continues to inspire me and reminded me why I got into scientific research in the first place. Professor Jennifer Stow's plenary talk enlightened me to the existence and roles of cellular remnants or 'footprints' left over by crawling macrophages. These cellular remnants were shown to have cell–cell communication functions. I caught up with Jenny over lunch to discuss methods to isolate these cell remnants for further characterisation of their physiological functions.

Bustling poster session at ASI 2022.

One of my personal favourites was the poster session every afternoon at 4:00pm. These sessions provide the perfect opportunity to interact one-on-one with students, postdocs and group leaders, and to learn more about their work and how we might collaborate. I was also tasked with judging several posters. Judging posters is an incredibly difficult process because the researchers I spoke to communicated so effectively and demonstrated passion for their high-quality work. In my eyes, they were all winners.

Another highlight for me was the opportunity to chair the invited plenary speaker Dr Feng Shao. Feng spoke about the biochemical mechanisms controlling the cell death pathway called pyroptosis. It was an illuminating talk which highlighted how pyroptosis is used by the host to fight bacterial infections. Feng also discussed the mechanisms by which bacteria, such as *Shigella flexneri*, encode virulence factors to block pyroptosis and counteract the mammalian antibacterial defence system. Further, the emerging roles of pyroptosis proteins in cancer cells were highlighted. Feng's talk was fittingly followed by another plenary talk delivered by Dr Kim Newtown, who effortlessly explained the molecular mechanisms of caspase-8 activation. I was delighted that the fields of biochemistry and molecular biology were so well-represented at the largest and most prestigious immunology conference in Australia.

Overall, it was a fantastic week of catching up with collaborators and colleagues at the heart of Melbourne to exchange new ideas, just like the gathering of different innate and adaptive immune cells at the lymph node to facilitate cell–cell communication. I sincerely thank ASBMB and Eppendorf South Pacific for this honour and travel support.

Si Ming Man is a Group Leader and Professor, who works in the research area of innate immunity at the Australian National University.

ASBMB Fellowship Report

A Full Kinase Breakfast in Shakespeare Country

I was honoured to be awarded an ASBMB Fellowship, which supported me to travel to Warwickshire, UK (otherwise known as Shakespeare Country), to attend the 88th Harden Conference – Beyond Catalysis: Kinases and Pseudokinases (31 October – 3 November 2022). Hosted by the Biochemical Society, this conference at a Tudor-style hotel brought together leading international experts in the field, as well as early career researchers and students. After the curveballs of the COVID-19 pandemic, which postponed the meeting multiple times, we were finally able to share the latest discoveries in the field with the ever-expanding community of kinase and pseudokinase researchers.

To kick off the long-awaited conference, we were treated to a keynote by Professor Susan Taylor (UCSD, USA) who pioneered the field by solving the crystal structure in 1991 – the catalytic subunit of the cAMP-dependent protein kinase, PKA. In recognition of this seminal discovery and her ongoing contribution to protein kinase research, which spans over four decades, Susan was awarded the prestigious IUBMB Jubilee Award.

Chris presents at the Harden conference.

Following this were four intense days at the conference, where themes including the evolution of protein kinases/pseudokinases, mechanisms of allostery and the implication in human disease were explored. Amongst these talks, I was thrilled to share my research in a dedicated session on understudied kinases/pseudokinases and their emerging functions in humans. This talk was positively received and led to some fruitful discussion, which reflects a global interest in advancing knowledge of these human signalling proteins.

Since this conference was held at a standalone hotel in the middle of Shakespeare Country, it provided an intimate environment where students and early career researchers (such as myself) could network with the kinase/pseudokinase community over breakfast, lunch and dinner. As one of the few from this side of the globe, this was one of the most rewarding elements of the conference, enabling me to foster several new research collaborations.

Ainfield, the home of Liverpool FC.

Outside the conference, this was my first trip to the UK, so I took the opportunity to briefly explore before and after the conference. Starting in Liverpool, I ticked something of my bucket list by visiting Anfield, the home of Liverpool FC. Near the conference, I visited the small medieval towns of Warwick and Stratford-upon-Avon, which still feature Tudor-style manors that are famous from the Shakespeare era. Before heading home, I visited London and aside from going into full tourist mode, I managed to go to an English Championship football game between Queens Park Rangers and West Bromwich Albion. This was hilarious, as despite the home team losing, their fans switched chants to raucously acknowledge their misfortune.

Finally, I would like to thank the ASBMB for providing this incredibly rewarding experience. As an early career researcher within the field, it was a fantastic opportunity for me to present my research at a specialist conference.

Dr Chris Horne is a postdoctoral researcher at the Walter and Eliza Hall Institute for Medical Research.

Tudor-style manors in Warwick.

ASBMB Fellowship Report

Talking Kinases in the British Countryside

As the recipient of the 2022 Fred Collins Award and ASBMB Fellowship, I was able to attend the 2022 Biochemical Society's 88th Harden Conference – Beyond Catalysis: Kinases and Pseudokinases held in Warwickshire, UK. This meeting brings together kinase/pseudokinase researchers from all over the world, providing a platform for sharing the latest developments and an opportunity to foster new collaborations. After the uncertainties and reschedules in the past year due to Covid, we were excited to finally attend this conference.

The day before the conference, I arrived in Birmingham, where I took a short train ride to the hotel where the conference was being held. It was an enormous historic hotel surrounded by nice views of the British countryside. It was in early autumn when the leaves are just turning golden, but in a typical British fashion, it started raining. As I always struggle with jet lag, I went to bed immediately and enjoyed a night of complete silence, unlike the constant noisy traffic we have in Melbourne.

The following day, the conference officially started in the late afternoon, so I still had half a day to spare. Fortunately, it stopped raining, so I visited the historic Warwick Castle, which is a famous landmark only a short bus ride from the hotel. The castle is situated right next to the main street of Warwick old town centre, sitting on top of a small hill next to the River Avon. As I have never been to a medieval European castle before, I was excited to check it out. The castle has a large courtyard, and the interior is very well maintained with many exhibitions about the British histories. In the palace there is an impressive collection of medieval to early renaissance weapons and armour, with tour guides explaining the histories behind them, which I listened to with great curiosity. The towers enjoy a perfect view over Warwick and surrounding countryside. I spotted a trebuchet with a 'For Sale' sign on it. I was tempted to buy it to use it on my noisy neighbours!

Entrance to Warwick Castle.

Trebuchet for sale.

Yanxiang presents at the Harden conference.

The conference began with an excellent keynote lecture by Professor Susan Taylor, a founding figure in the field, who determined the very first structure of a protein kinase four decades ago. Because my project focuses on a pseudokinase (catalytically inactive protein with kinase domain fold) and a protein kinase, the theme of this conference aligns with my interests perfectly. I had the pleasure of discussing my research and networking with many fellow kinase researchers, including some of the world-leading experts.

I particularly enjoyed the discussions arounf the idea that since kinases are not the most efficient enzymes or catalysts for chemical reactions, their primary roles are to act as 'switches' to control signalling pathways. That is exactly the findings of my PhD research, that the pseudokinase domain acts as a 'molecular switch' to control the activity of my protein. After I presented my research as a 15-minute oral presentation on day 3 of the conferences, it attracted a lot of interesting discussions with the audience. I was pleased to see people very interested in my research of this pseudokinase 'switching' mechanism.

In my spare time after the conference, I spent a day in London, where I visited the Tower of London and the Windsor Castle. I enjoyed the rich histories and cultural heritage of these iconic landmarks. I thank the ASBMB and the Collins family for this opportunity to travel abroad and attend this excellent conference.

Dr Yanxiang Meng is a Research Officer at the Walter and Eliza Hall Institute of Medical Research.

ASBMB Fellowship Report

Discovering the Tasmanian Beauty Through Biophysics

I was honoured to receive one of the 2020 ASBMB Fellowships, which was used to attend the 2022 Australian Society of Biophysics (ASB) conference in Hobart, Tasmania from 20–23 November. This conference focuses on the recent advancements in biophysics, bringing experts in the field together annually. I was one of the finalists for the Young Biophysicist Award, and was selected to present a talk at the conference. My talk was entitled 'Developing C-reactive protein modulators as new treatments for inflammation'. The conference had a high calibre of invited guest speakers and I was particularly interested in learning about new developments in microscopy as I am currently trying to master this technique.

I was invited to judge the poster sessions along with the student talks and was impressed by the variety of skills that was presented, ranging from computational techniques such as molecular dynamics to imaging methods under various contexts. I especially liked this year's meeting as it was a joint conference with the Australian Physiological Society and the plenary speakers were from a diverse range of backgrounds, offering the opportunity to see the overlap between the different fields. I particularly enjoyed the plenary lecture by Professor Michael Karin from UC San Diego about how he only recently started working on insulin hyperresponsiveness by serendipity and managed to become a world recognised expert in the field as a result of the strategic collaborations that he established. His story was very inspiring, reminding us that science doesn't always turn out the way we predict, and it is our resilience and meticulousness that might make a big difference. The conference was an enlightening experience, and I would encourage any budding biophysicist, especially early career researchers, to attend.

Tasman Bridge crossing the Derwent River in Hobart.

Steffi presents her research at the 2022 ASB conference.

This was my first time in Tasmania and it was a good opportunity to discover this beautiful part of Australia. After the conference, I had time to visit the city of Hobart, its harbour and savour some fresh fish and chips near the river. Tasmania has a more relaxing vibe compared to Melbourne and it felt revitalising to have my first face to face conference after two years of online meetings. It has been an enriching experience and I would like to sincerely thank the ASBMB for giving me this opportunity.

Dr Steffi Cheung is a postdoctoral fellow in the Structural Biology and Computational Design laboratory in the Department of Biochemistry and Pharmacology at the Bio21 Institute, University of Melbourne.

Australian Society for Biochemistry and Molecular Biology Inc
PUBLICATION SCHEDULE FOR *AUSTRALIAN BIOCHEMIST*, volume 54, 2023

Issue	ASBMB Content	Copy Deadline	Issue Date
April 2023 54(1)	Profiles of medal, award and fellowship winners Nominations for Executive/Council	Monday 6 February	Monday 3 April
August 2023 54(2)	Nominations for medals, awards and fellowships Notice of AGM/proposed constitutional changes	Monday 5 June	Monday 31 July
December 2023 54(3)	Annual reports ASBMB meeting report	Monday 2 October	Monday 4 December

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Election of Council 2024

Nominations are called for the following positions on the Council of the Australian Society for Biochemistry and Molecular Biology Inc for 2024: President Elect, Secretary, Treasurer, Editor, Education Representative, FAOBMB Representative, Secretary for Sustaining Members and State Representatives.

Eligible for re-election
§ Position open

The ASBMB Council for the period 1 January 2023 to 31 December 2023 is composed of the following members:	President	R Hannan
	Past President	J Matthews
	Secretary	D Ng #
	Treasurer	K Quinlan #
	Editor	T Soares da Costa #
	Education Representative	T Kuit #
	FAOBMB Representative	N Samarawickrema #
	Secretary for Sustaining Members	Vacant §
Representatives for:	ACT	C Spry §
	NSW	L Sharpe §
	VIC	L Osellame §
	QLD	M Landsberg §
	SA	M Roach #
	TAS	Vacant §
	WA	A Van Dreumel #

Nomination forms are available on the ASBMB website and are to be submitted online: https://www.asbmb.org.au/asbmb/council-nomination/Site/Register. 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 BY 5PM 20 OCTOBER 2023
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The winner of the Eppendorf & *Science* Prize for Neurobiology is awarded US$25,000 and publication of his or her essay in *Science*. The essay and those of up to three finalists are also published in *Science* Online.

The award will be announced and presented at a ceremony during the week of the annual meeting of the Society for Neuroscience. Eppendorf also provides financial support to help enable the grand prize winner to attend the meeting.

Deadline for Submissions: 15 June 2023

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To support the ongoing vaccine reformulation programmes, The Native Antigen Company is pleased to announce that Haemagglutinin (HA) and Neuraminidase (NA) antigens are now available to cover the 2023 southern hemisphere vaccine formulation. Available in multiple vial sizes and in bulk quantities, antigens can be used in a range of applications, including immunoassay development and as immunogens.

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Knowing how plants work and how they interact with their environment is fundamental to multiple challenges posed by global environmental change. This was well recognised by plant scientists presenting at the ComBio conference in Melbourne in 2022. The new Wiley journal, *Plant-Environment Interactions (P-EI)*, was honoured to sponsor a symposium session entitled 'Plants and their environments'. The session covered fascinating and important research topics, ranging from mycorrhizal fungal interactions, drought adaptation and nitrogen uptake in trees, to cereal spike phenotyping and *Arabidopsis* shoot architecture.

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Scientists screening biomolecule libraries and working to the goals of discovering and identifying the best lead candidates often face the inevitable challenges of throughput, speed, resolution, and sample consumption. PerkinElmer as the only authorised distributor of the Carterra LSA system in Australia is proud to offer you the Carterra LSA instrument which performs high-throughput surface plasmon resonance (HT-SPRTM) and can rapidly generate high quality kinetic data from 384 candidates in parallel using a minimal amount of sample material. In addition, the LSA can perform epitope binning on up to 384 candidates per array to obtain unique epitope discrimination and characterisation.

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FlexAble Antibody Labeling Kits

Any Antibody. Any Colour. Any Time.

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Currently the range includes kits for mouse IgG1 and rabbit IgG with 6 different options, CoraLite 488, CoraLite Plus 405, CoraLite Plus 555, CoraLite Plus 647, CoraLite Plus 750 and FITC Plus.

For further information, please contact United Bioresearch Products who distribute the Proteintech range in Australia.

United Bioresearch Products
Kirrily Smith
Phone (02) 4575 0309
info@unitedbioresearch.com.au

Using Super Resolution Microscopy to Study EVs

Extracellular vesicles (EVs) have become a popular topic of research as they are ideal candidates for disease diagnostics and therapeutic applications. New super resolution microscopy (SR) techniques and the ONI Nanoimager S have enabled more accurate and detailed studies to be performed opening up new doors for researchers.

EVs resemble the composition of their parental origin, secreted vesicles are becoming a promising source for biomarker discovery, as the specific types of surface proteins and cargo may have a profound pathophysiological significance. Traditionally, researchers have used techniques such as flow cytometry, nanoparticle tracking analysis (NTA), epifluorescence imaging techniques and electron microscopy (EM) to study them. Unfortunately, they often fail to give the necessary resolution to accurately characterise individual EVs.

SR utilising single-molecule localisation microscopy (SMLM) techniques such as dSTORM allow precise and detailed molecular characterisation of EVs. The Nanoimager S has been used to characterise EVs isolated from HCT116 cell line (adult male colon cancer) for CD81, CD63 and CD9. The EVs were then characterised by single, double and triple positivity. More information can be found here: https://www.axt.com.au/applications/extracellular-vesicle-characterisation-using-super-resolution-microscopy/

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ASBMB Council 2023

PRESIDENT
Professor Ross Hannan
John Curtin School of Medical Research
Australian National University
ACTON ACT 2601
Ph (02) 6125 6312
Email: ross.hannan@anu.edu.au

PAST PRESIDENT
Professor Jacqui Matthews
School of Life and Environmental Sciences
University of Sydney
SYDNEY NSW 2006
Ph (02) 9351 6025
Email: jacqueline.matthews@sydney.edu.au

TREASURER
Associate Professor Kate Quinlan
School of Biotechnology and Biomolecular Sciences
UNSW
SYDNEY NSW 2052
Ph (02) 9065 2160
Email: kate.quinlan@unsw.edu.au

SECRETARY
Associate Professor Dominic Ng
School of Biomedical Sciences
University of Queensland
ST LUCIA QLD 4072
Ph (07) 3365 3077
Email: secretary@asbmb.org.au

EDITOR and CHAIR OF COMMUNICATIONS
Dr Tatiana Soares da Costa
Waite Research Institute
University of Adelaide
GLEN OSMOND SA 5064
Ph (08) 8313 0258
Email: tatiana.soaresdacosta@adelaide.edu.au

EDUCATION REPRESENTATIVE
Associate Professor Tracey Kuit
School of Chemistry and Molecular Bioscience
University of Wollongong
WOLLONGONG NSW 2522
Ph (02) 4221 4916
Email: tracey_kuit@uow.edu.au

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

SECRETARY FOR SUSTAINING MEMBERS
WALDRONSMITH Management
119 Buckhurst Street
SOUTH MELBOURNE VIC 3205
Email: asbmb@wsm.com.au

www.asbmb.org.au **@ITSASBMB** **ComBio**

Directory

COUNCIL FOR 2023

PRESIDENT
Professor Ross Hannan
John Curtin School of Medical Research
Australian National University
ACTON ACT 2601
Ph (02) 6125 6312
Email: ross.hannan@anu.edu.au

PAST PRESIDENT
Professor Jacqui Matthews
School of Life and Environmental Sciences
University of Sydney
SYDNEY NSW 2006
Ph (02) 9351 6025
Email: jacqueline.matthews@sydney.edu.au

TREASURER
Associate Professor Kate Quinlan
School of Biotechnology and Biomolecular Sciences
UNSW
SYDNEY NSW 2052
Ph (02) 9065 2160
Email: kate.quinlan@unsw.edu.au

SECRETARY
Associate Professor Dominic Ng
School of Biomedical Sciences
University of Queensland
ST LUCIA QLD 4072
Ph (07) 3365 3077
Email: secretary@asbmb.org.au

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Dr Tatiana Soares da Costa
Waite Research Institute
University of Adelaide
GLEN OSMOND SA 5064
Ph (08) 8313 0258
Email:
tatiana.soaresdacosta@adelaide.edu.au

EDUCATION REPRESENTATIVE
Associate Professor Tracey Kuit
Department of Biochemistry and Molecular Biology
Monash University
CLAYTON VIC 3800
Ph (03) 9902 0295
Email: nirma.samarawickrema@monash.edu

FAOBMB REPRESENTATIVE
Dr Nirma Samarawickrema
School of Chemistry and Molecular Bioscience
University of Wollongong
WOLLONGONG NSW 2522
Ph (02) 4221 4916
Email: tracey_kuit@uow.edu.au

SECRETARY FOR SUSTAINING MEMBERS
WALDRONSMITH Management
119 Buckhurst Street
SOUTH MELBOURNE VIC 3205
Email: asbmb@wsm.com.au

STATE REPRESENTATIVES

AUSTRALIAN CAPITAL TERRITORY
Dr Christina Spry
Research School of Biology
Australian National University
ACTON ACT 2601
Ph (02) 6125 0640
Email: christina.spry@anu.edu.au

NEW SOUTH WALES
Dr Laura Sharpe
School of Biotechnology and Biomolecular Sciences
University of New South Wales
SYDNEY 2052 NSW
Email: laura@unsw.edu.au

QUEENSLAND
Associate Professor Michael Landsberg
School of Chemistry & Molecular Biosciences
University of Queensland
ST LUCIA QLD 4072
Ph (07) 3365 3756
Email: m.landsberg@uq.edu.au

SOUTH AUSTRALIA
Dr Michael Roach
College of Science and Engineering
Flinders University
ADELAIDE SA 5001
Email: michael.roach@flinders.edu.au

TASMANIA
Position Vacant

VICTORIA
Dr Laura Osellame
Olivia Newton-John Cancer Research Institute
HEIDELBERG VIC 3084
Ph (03) 9496 5726
Email: laura.osellame@onjcri.org.au

WESTERN AUSTRALIA
Dr Alyssa Van Druemel
School of Molecular Science
University of Western Australia
CRAWLEY WA 6009
Ph (08) 6488 4779
Email: alyssa.vandreumel@uwa.edu.au

ASBMB NATIONAL OFFICE
WALDRONSMITH Management
119 Buckhurst Street
SOUTH MELBOURNE VIC 3205
Email: asbmb@wsm.com.au

COPY DEADLINE FOR NEXT ISSUE:
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SPECIAL INTEREST GROUPS

ADELAIDE PROTEIN GROUP
Chair: Bethiney Vandborg
University of Adelaide
ADELAIDE SA 5005
Email: bethiney.vandborg@adelaide.edu.au

AUSTRALIAN YEAST GROUP
Chair: Dr Alan Munn
Griffith University Gold Coast
SOUTHPORT QLD 4222
Ph (07) 5552 9307
Email: a.munn@griffith.edu.au

BIOCHEMICAL EDUCATION
Chair: Associate Professor Tracey Kuit
School of Chemistry and Molecular Bioscience
University of Wollongong
WOLLONGONG NSW 2522
Ph (02) 4221 4916
Email: tracey_kuit@uow.edu.au

CANBERRA PROTEIN GROUP
Chair: Dr Megan Outram
Agriculture and Food, CSIRO
ACTON ACT 2601
Ph 0410 112 122
Email: megan.outram@csiro.au

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

MELBOURNE PROTEIN GROUP
President: Dr Chris Langendorf
St Vincent's Institute of Medical Research
FITZROY VIC 3065
Ph 0410 475 978
Email: clangendorf@svi.edu.au

PERTH PROTEIN GROUP
Chair: Dr Mark Agostino
Curtin University
PERTH WA 6102
Ph 0403 202 742
Email: mark.agostino@curtin.edu.au

QUEENSLAND PROTEIN GROUP
Chair: Dr Thomas Ve
Griffith University Gold Coast
SOUTHPORT QLD 4222
Ph (07) 5552 7023
Email: t.ve@griffith.edu.au

RNA NETWORK AUSTRALASIA
Chair: Dr Archa Fox
Schools of Human Sciences and Molecular Sciences
University of Western Australia
PERTH WA 6009
Ph (08) 6488 3297
Email: archa.fox@uwa.edu.au

SYDNEY PROTEIN GROUP
President: Dr Kate Michie
Structural Biology Facility, UNSW Sydney
RANDWICK NSW 2052
Ph (02) 9348 0441
Email: k.michie@unsw.edu.au

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DISCOVER CREATE INNOVATE

22-26 SEPTEMBER 2024 MELBOURNE AUSTRALIA

IUBMB FAOBMB ComBio 2024 MELBOURNE

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This important forum will bring together three prestigious congresses, each with a strong history of attracting the Bioscience and Biotechnology communities together to discuss and examine the latest developments and research. This truly global forum will bring together renowned scientists from across the world, from Nobel Laureates to early career scientists.

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You will also be able to experience a showcase of the latest products and services in the exhibition, an integral element of the Congress.

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- The Microbial World
- Cell Signalling & Metabolism
- Genomics, Gene Regulation & Epigenetics
- Bioinformatics, Computational Biology & 'Omics
- Structural Biology & Biophysics
- Molecular Basis of Disease
- Molecular Physiology
- RNA Technology
- Gene Editing
- Climate Change
- Education

PLENARY SPEAKERS

Pam Silver
Harvard University

Brian Kobilka
Stanford University

Caixia Gao
Chinese Academy of Sciences

Kathryn Tunyasuvunakool
Deep Mind, Google

Faith Osier
Imperial College, London