Australian Physiological Society

THE PROFESSIONAL ASSOCIATION FOR AUSTRALIAN PHYSIOLOGISTS

AuPS News – July 2024

Mid-Year Update from the National Secretary

A/Prof. Severine Lamon

Half-way through my National Secretary appointment, I have now survived my first annual meeting in this role, and much more. Following the excitement of our first post-pandemic meeting in Hobart, our Society meeting reconvened in Melbourne in November 2023. Nolan Hoffman and his team went above and beyond, ensuring we felt warmly welcomed on the stunning new campus of the Australian Catholic University. A big thank you to Nolan and his team!

One of the standout achievements of last year's meeting, which has even become an internal joke amongst some of us, was the display and sorting of the historical AuPS archives during the conference. I owe many thanks Prof. Robyn Murphy, but undertaking this monumental task is something we should all be eternally grateful to Robyn for. Beyond the practical benefits, the chance to rediscover our rich history left many of us in awe. The photographic documents were particularly fascinating – featuring many seemingly old and serious men, and a few women! It made me reflect on what it must have been like to be a female physiologist in the 1960s or 1970s and realise that many things we take for granted today would be very different without these pioneers paving the way for us. I also enjoyed browsing through the list of abstracts from the AuPS meeting held in 1982, the year I was born. It was interesting to see that substantial cat research was still being conducted during those years!

Melbourne AuPS meetings will always hold a special place in my heart. While I do enjoy the perks of interstate meetings, like nice hotel rooms and waterfront breakfasts, I am constantly amazed by the diversity of physiological sciences conducted in Victoria. As Australia's largest bioscience research community, Victoria boasts no less than eight public universities and 18 world-class medical research institutes, most of which are represented within our Society. This is why Melbourne meetings typically attract a record number of students and early career researcher (ECRs), and last year was no exception. It is always a great pleasure for me to meet new physiology trainees at our meeting. Last year, I was abruptly reminded of my age when I heard that one of our student members wanted to speak to me but did not have the courage to approach me. In my mind, I was one of them not that long ago! Reflecting on my past decade and a half in Australia, I can only hope our junior members realise how AuPS can form the strongest possible foundation of their future network of

colleagues and friends within the discipline of physiology.

AuPS is however not Victoria-centric, and last year's AuPS Lecture was delivered by Prof. Bradley Launikonis. Years ago, Brad chose to leave Melbourne to establish his laboratory and career at the University of Queensland. Rarely has anyone been more deserving of this honour. A past AK McIntyre winner, Brad has served on the AuPS council twice, each time taking on the demanding role of treasurer. More importantly, when I think of Brad and his contributions to AuPS, I think of the consistent success of his students and post-doctoral researchers. I cannot recall a recent year where one of Brad's team members did not win one of our various prizes and awards. This is a testament to Brad not only as a scientist producing high-quality science, but also as a supervisor and mentor for the up-and-coming physiologists who will one day lead our Society.

This year will look a bit different for AuPS. Under the tireless leadership of Prof. Robyn Murphy, our Society will gain international attention as part of the BioMolecular Horizons (BMH) 2024 meeting in September. This event will bring together three prestigious congresses, each with a strong history of attracting the bioscience and biotechnology communities: the Congress of the International Union of Biochemistry and Molecular Biology (IUBMB), held in the Southern hemisphere for only the third time, the Congress of the Federation of Asian & Oceanian Biochemists & Molecular Biologists (FAOBMB) and the ComBio Conference. Six Australian and New-Zealander partner societies, including AuPS, have joined the event. While we cherish our traditional annual meeting, it takes more than just us to attract over 1300 registrants from more than 40 countries, including a couple of Nobel Prize recipients for good measure. I hope we can all embrace the opportunity and novelty brought by BMH 2024, knowing that we will still be able to celebrate as a Society. We are planning our own Society dinner at a local pub – stay tuned – and will retain our AuPS invited lecture, delivered by Prof. Mark Febbraio, as well as our traditional Society awards.

The rest of the year will bring an AuPS election, where we will be replacing at least three council members and one student representative. Additionally, we are launching a new student support initiative that I am particularly proud and excited about. Recognizing the high cost of laboratory research and the challenge of conducting meaningful experiments with limited funds, we have consolidated our existing student support initiatives into one. This new initiative will enable our most successful student members to undertake a research exchange in another laboratory, either in Australia or overseas. This is not only a fantastic research opportunity for an AuPS student member but also a unique way for them to establish a new, independent collaboration with any researcher in the world, provided they are a a member of a physiological society.

Finally, it would be short-sighted not keep track of the broader developments in the research sector in Australia. The Federal Government has shown early commitments to building our education and knowledge economy by updating our National Science and Research Priorities and education outcomes, encouraging the development of new industries and addressing diversity in the STEM sector – both among its participants and within its research subjects. However, the practical implications of the recently finalised Universities Accord guidelines for teaching and research in Australian universities remain unclear and could bring about significant changes in how we conduct research and education. As individuals and members of a small Society, we have a role to play in advocating for a better, fairer, more sustainable and equitable research and funding ecosystem in our country.

As the Australian winter sets in, I'm looking forward to a summer break in Europe and witnessing some supraphysiological human performance at the Paris Olympics. Can someone please ensure Australian TV commentators update their knowledge of muscle metabolic pathways and the role of lactic acid before the event?

Take care of yourself and your colleagues and see you in Melbourne later this year!

Au revoir!
Séverine

Member profile:

A/Prof. Puspha Sinnayah

Victoria University

Winner of the 2023 Michael Roberts Excellence in Physiology Education Award

Congratulations on winning the award. Can you tell us about your career in Physiology Research and Education to date?

I received my PhD in neuroscience from the Howard Florey Institute in 1999. My doctoral work, under the supervision of Prof. Michael McKinley, focused on investigating the role of the brain renin angiotensin system (RAS) as a neurosignalling mechanism in fluid balance.

I then spent 10 years working in the United States (1999-2009), investigating the central neural mechanisms of homeostasis of appetite and cardiovascular control under the mentorship of Prof. Robin Davisson and Prof. Michael Cowley respectively. I am currently an Associate Professor with the First Year College at Victoria University, where I focus on physiology education. I am also a research fellow with the Institute for Health and Sport (IHES).

I have extensive experience in curriculum design and innovation in blended and active learning strategies in physiology teaching. In 2018, I received the Australian Awards for University Teaching (AAUT) citation for Outstanding Contributions to Student Learning for 'active learning strategies that improve student engagement in first year bioscience.' In 2020, I received a team AAUT award for Programs that Enhance Learning - Innovation in Curriculum Design and Pedagogy Practice for VU's Block Model.

Can you describe your achievements and teaching innovations for which you received the award?

Anatomy and Physiology (A&P) are core units for approximately 1000 first-year health students at Victoria University (VU). Many of these students find the concepts challenging, especially given VU's unique student population, which includes a high proportion of non-English speaking backgrounds, low socioeconomic status, and first-generation university attendees.

To enhance student progression and retention, I led a team to develop asynchronous technology-enhanced learning activities for self-directed study (SDL) and synchronous in-class active inquiry-based learning. We utilized a flipped learning approach, incorporating H5P platform activities, formative quizzes, and custom vodcasts to promote SDL. This model, embedded across six Physiology units and adapted for VU's Block mode, has reached thousands of students and facilitated effective remote learning during the COVID-19 pandemic.

Our efforts have expanded nationally and internationally, sharing resources with other universities. This initiative aims to create relevant learning experiences for all students. Student feedback, grades, and learning analytics have shown improvements in academic performance, satisfaction, and engagement. This work has now progressed and extended to the development of a bridging Headstart Physiology program which students can access online

before block delivery (2020- current) with the aim to reduce STEM-based anxiety and for Victorian secondary school students in the Western suburbs (2022 initiative) to increase knowledge of the connection of science to allied health professions.

I also established a network of staff for H5P training and SDL activity development, enhancing teaching performance and technology integration. One of initiatives for staff professional learning includes a collaborative peer-observation process to support academic staff's personal and professional development. Thematic analysis of the data revealed that mentorship, leadership, a community of practice and open mindset supported academics' involvement in 'collaborative peer observation learning circles' (CPO/LCs). Academics also benefited from purposeful observation of teaching, opportunities for feedback and self-reflection, ideas regarding curriculum design and collaborative learning. Positive engagement in the peer observation cycle as the potential to improve teaching and the student learning experience. The study highlights that sustaining CPO/LCs in HE may be enhanced and encouraged by supportive university leadership within a collegial community.

What does the society and award mean to you?
Receiving the Michael Roberts Award for our work in Anatomy and Physiology (A&P) education at Victoria University (VU) is truly humbling and signifies a recognition of our innovative approach to addressing the unique challenges faced by our diverse student population. This award highlights the success of our blended learning model, which integrates asynchronous technology-enhanced learning activities and synchronous in-class inquiry-based learning to improve student engagement and performance. Winning this award validates our commitment to creating meaningful and accessible learning experiences for all students.

What are your plans or teaching practice in the future?
I am inspired to pursue future initiatives aimed at further enhancing Anatomy and Physiology (A&P) education at Victoria University (VU). Building on our success, we plan to expand our innovative approach to address the unique challenges faced by our diverse student population. We look to further enhancing the Headstart Physiology program to reduce STEM anxiety and improve science knowledge among secondary school students, particularly those from underrepresented backgrounds.

Nationally and internationally, we will continue to share our resources and collaborate with other universities, emphasizing the scalability and adaptability of our teaching strategies. We plan to build on developing more robust collaborative peer-observation processes. These efforts will enhance teaching performance and technology integration across the university, ensuring our staff are equipped to deliver high-quality, engaging education.

By pursuing these future initiatives, we aim to create even more meaningful and accessible learning experiences for all students, building on the foundation of the Michael Roberts Award-recognized work.

Member profile:

Dale Taylor

Victoria University

Winner: Best student oral presentation at the 2023 AuPS in Melbourne.

What sparked your interest in physiology?
I'm Dale, a 4th-year PhD student at the Institute for Health & Sport at Victoria University. I've always had a

deep fascination with understanding the intricate and interconnected mechanisms that allow us as humans to exist. This passion led me to pursue an undergraduate degree majoring in biochemistry and molecular biology at the University of Melbourne, and combined with my lifelong interest in exercise, has culminated in undertaking my current PhD project. Following the completion of my PhD in the latter half of this year, I hope to continue with a career in exercise and physiology research. I am particularly interested in adapting newer 'omics'-based techniques for use within exercise science and using these datasets to generate translational outcomes for optimising exercise prescription for both health and athletic outcomes.

Tell us more about the research you presented at AuPS 2023

At the 2023 AuPS conference, I was fortunate enough to present work completed within my PhD, investigating changes in the assembly of the respirasome - the stable association of complex I, III, and IV of the mitochondrial electron transport chain, in skeletal muscle following 8 weeks of high-intensity interval training. Although the function of each individual complex has been well characterised, the role of the respirasome is unclear, with theories including improved stability of individual complexes, enhancement of substrate channelling, and reduction of deleterious reactive oxygen species production. Due to conflicting results and the lack of differentiation based on sex within the two previous studies, this research aimed to identify whether the proportion of complexes assembled into respirasomes could be altered in young healthy sedentary men and women.

Using blue-native polyacrylamide gel electrophoresis, an immunoblotting technique that does not denature proteins or disrupt protein-protein interactions, we observed no changes in the proportion of complexes assembled into respirasomes between male and females. This was despite a significant increase in mitochondrial content, as assessed by citrate synthase activity, and respiratory function, as assessed by high-resolution mitochondrial respiration. Although this research does not conclusively prove the respirasome lacks an energetic advantage, it does indicate that short-term training does not significantly change its proportion relative to free complexes.

What research or projects are you undertaking currently?

Aside from investigating sex-specific differences in other mitochondrial characteristics resulting from training, such as mitochondrial content, respiratory function, and morphology, my PhD project also examines exercise-induced gene expression from a single session of exercise. This involved collecting nine muscle biopsies prior to and within 48 hours following a session of high-intensity interval exercise from 20 healthy sedentary male and 20 healthy sedentary females, allowing for the generation of the most comprehensive time course of exercise-induced gene expression to date. By combining these studies, I aim to connect acute changes from exercise to chronic changes from training.

Where do you see yourself in the future?

Ultimately, I hope my research will serve as both a resource for others to generate new hypotheses for the role of specific exercise-induced genes or pathways and help inform more effective exercise prescription for inducing beneficial mitochondrial adaptation in both males and females.

Member profile:

Carlie Bauer

Victoria University

Winner: Best PhD student publication

Can you tell us about your award-winning publication?

My publication is the first experimental chapter I completed in my PhD thesis: "Circulating lipocalin-2 and features of metabolic syndrome in community-dwelling older women: A cross-sectional study" (for anyone wanting to read it: https://doi.org/10.1016/j.bone.2023.116861).

Ageing is a non-modifiable risk factor for cardio-metabolic disease. Due to the ageing population, the prevalence of these diseases is expected to increase in the future which will significantly impact individuals' health and quality of life and the Australian health care system. Despite current advances in risk identification,

there is still no modifiable biomarker that effectively identifies individuals who are at risk of future cardio-metabolic diseases, which allows for early commencement of preventative interventions. As such, improved early identification of older-adults who are at risk of cardio-metabolic disease is clinically important. Using data from 781 older women (mean age = 75 years), I identified that older women who have elevated levels of lipocalin-2 (LCN2), a hormone released by multiple organs including adipose tissue and bone, are at an increased risk for metabolic syndrome and type 2 diabetes. The measurement and monitoring of LCN2 may promote earlier identification of these conditions. My future research will extend on this to examine whether exercise can modify LCN2 and whether this can prevent, or reduce the risk, of future development of cardio-metabolic disease.

Thank you to our collaborators from Western Australia (Perth Longitudinal Study of Ageing Women), Prof Richard Prince, Associate Prof Joshua Lewis, Dr Marc Sim and team.

What is your current position/role?
I am an accredited exercise physiologist with clinical experience and am currently a PhD candidate at Victoria University, planning to submit my thesis early – mid 2025. My PhD project has involved conducting a randomised control trial examining effects of exercise on bone-muscle-fat interaction in middle-aged and older adults free of major disease.
I am also currently a research assistant on the 'Waitlist project' investigating the physical and mental health of patients on an orthopaedic wait list and 'the effects of gender affirming hormone therapies on fitness and muscle health in transgender Australians: The GAME Study'.

What made you want to follow a career in research, and where do you see yourself heading professionally?
During my Master's degree (Master of Clinical Exercise Science and Rehabilitation), I was lucky to be taught by academics with a passion for research that really resonated with me. Later in my degree, the opportunity to do a minor thesis and experience the research process had me convinced to pursue a PhD.
I aim to stay in academia and obtain a postdoctoral position once I have completed my PhD. I really love working with clinical populations and would like to continue in exercise physiology research.

Outside of work/research, what do you do to relax?
I enjoy exercising, whether that's lifting weights, a reformer class, or getting outdoors for a hike or paddle when it's not freezing down in Victoria. I also have two dogs, a husky and german shepherd, that keep me on my toes.

Member profile:

James McNamara

Murdoch Children's Research Institute

Winner: Best post-doc publication

Firstly, I would like to express my sincere gratitude to the Australian Physiological Society for the honour of receiving the 2023 postdoctoral publication award.

Congratulations on the prize. Can you tell us about your award-winning publication?
For nearly a decade, my research has focused on the molecular mechanisms underlying inherited heart

diseases, with a specific emphasis on hypertrophic and dilated cardiomyopathy. These complex and heterogeneous conditions disrupt the normal function of the heart's muscular walls, affecting up to 35 million people worldwide. Patients diagnosed with HCM or DCM experience abnormal growth and impaired pumping function of the heart. Sadly, effective treatments for these conditions are lacking and patients will often subsequently develop heart failure, for which cardiac transplantation remains the most effective treatment. While variants in the genes that encode sarcomeric proteins—responsible for heart contraction—have long been considered primary contributors to HCM and DCM, recent findings have highlighted the role of non-sarcomeric gene variants. One such gene is *ALPK3*, encoding the atypical kinase Alpha Kinase 3. Prior to our study, there was a significant gap in understanding the biology of ALPK3 and its connection to cardiomyopathy.

Our paper, published in *Nature Cardiovascular Research*, aimed to fill this gap by defining the molecular function of ALPK3 in the heart. Utilizing CRISPR-Cas9 technology, we engineered human pluripotent stem cells with knockout, patient-specific knock-in variants, or endogenous tags to the *ALPK3* gene. We were also fortunate to have the support of Phenomics Australia to develop a mouse model carrying an endogenous patient variant in *ALPK3*. By combining these tools with physiological and molecular experiments, we discovered that ALPK3 localizes to the sarcomere, particularly the M-Band, a mechanically crucial yet poorly understood region of the contractile apparatus. This was particularly exciting as many other genes implicated in HCM are also located at the sarcomere, hinting at potential common mechanisms. Mutation to ALPK3 led to reduced pumping function and impaired relaxation in both stem cell-derived cardiac cells and mice, mirroring the symptoms observed in HCM patients— pretty cool we could model this in a dish! Our extensive 'omics collaboration with Ben Parker (UniMelb) revealed a previously unrecognized network regulated by ALPK3. We found that ALPK3 regulates a node at the sarcomeric M-Band linking contractile proteins to protein quality control mechanisms. Given the strong association of inherited cardiomyopathies with impaired protein quality control, I believe our findings have significant implications for understanding fundamental muscle physiology and cardiac disease mechanisms.

What is your current position/role? and where do you see yourself heading professionally?
I had worked on this project since joining Murdoch Children's Research Institute in 2020. I am Team Leader of the Muscle Signalling team within the Heart Disease group. My research program is focused on discovering novel regulators of muscle contractility, understanding the early signals that drive inherited heart disease, and identifying novel therapeutic targets for these at need patients. In the next couple of years, I am hoping to establish my own independent research group and am very excited by the prospect of this new challenge!

Outside of work/research, what do you do to relax?
Outside of work, I have a wife and two young children who I love spending my free time with. I also am a total cricket tragic, enjoy cooking, and when I can find the time, I love homebrewing my own beers.

We invite AuPS members to join over 1500 colleagues from across the globe at Biomolecular Horizons. A detailed program will be available on the website next week. Visit www.bmh2024.com for more details and to register now!

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All contributions for AuPS News should be sent to: danielle.hiam@deakin.edu.au before the end of August.

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