## A message from the Head of School

This has been an exciting year and an upcoming time of tremendous opportunities for our school. In 2023, we saw our campus return to its previous vibrancy. I am once again extremely proud of the efforts of our staff and students to maintain excellence in all areas and in the support shown for one another.

Due to the commitment of our academic and professional staff to our world-class education and research, our school has continued to thrive, and I am pleased to say is once again poised for growth. As I write this year-end message, advertising and hiring for several new colleagues is underway to expand on our diversity and expertise, underpinning the key role played by mathematics and statistics in shaping the future.

Our school continues to create opportunities for our staff and students, particularly at times early in their career. This support has come via dedicated commitments from the school to enable systematic support, and from the generosity of our alumni, for which we are extremely grateful.

The school has been able to maintain and increase scholarships and awards recognising our students thanks to many who support and enable these special programs to happen. It is always an annual highlight to host our Student Awards Ceremony in May and celebrate with the students, their families, friends, and colleagues.

Our school continues to expand on our recognised research excellence, exemplified through successful academic promotions of our colleagues and awards, both nationally and internationally. Many of these will be further highlighted through this newsletter. Of particular note, we congratulate Peter Taylor, who was honoured with election as Fellow of the Australian Academy of Science earlier this year.

Finally, I would like to reiterate my gratitude to our staff, students, and alumni for their continued efforts and support in continuing to make our school a dynamic and outstanding environment to work, study, and socialise.

The future of the mathematical sciences continues to remain strong, as innovations and challenges such as understanding and explaining artificial intelligence, highlight the impacts that require our expertise, insight, and training of the next generation.

I wish you all a happy and successful 2024, and if you have not recently been to campus, I invite you to visit and experience our thriving community.

**Professor Howard Bondell**
**Head of School**

# Promotions and Prizes

Our staff continued to be recognised for their excellence through prizes and promotions in 2023.

## *Promotions*

- Alba Santin Garcia and Camelia Walker have been promoted to Lecturer (Level B).
- Nick Beaton, Chris Duffy, Xi Geng, Wei Huang, Stuart Johnston, Pavel Krupskiy, Liuhua Peng, Heejung Shim and Chenyan Wu have been promoted to Senior Lecturer (Level C).
- Lawrence Reeves has been promoted to Associate Professor (Level D).
- David Ridout has been promoted to Professor (Level E).

## *Prizes*

Professor David Ridout was awarded the inaugural Rodney Baxter Prize of the Australian Mathematical Society to recognise an outstanding and internationally significant contribution to the area of mathematical physics primarily carried out in Australia or New Zealand.

Laureate Professor Kate Smith-Miles was awarded the 2023 Moyal Medal by Macquarie University to recognise distinguished research contributions in mathematics, physics, or statistics.

Professor Mark Holmes and Edwin Perkins (University of British Columbia) won the 2022 Gavin Brown Prize of the Australian Mathematical Society for their research article '*On the range of lattice models in high dimensions*'.

Professor James McCaw, in collaboration with colleagues from the Faculties of Engineering and Information Technology and Medicine, Dentistry and Health Sciences, was awarded the University of Melbourne Award for Excellence in Interdisciplinary Research for their work on '*Mathematical and computational modelling to reduce the burden of skin pathogens in Indigenous communities'.*

The Outreach Team (Dr Paul Fijn, Dr Cindy Huang, Dr Susan James, Dominic Maderazo, and Cait Pryse) were awarded the Dean's Award for Excellence in Engagement.

The Executive Assistant to the Head, Jo Harwood, was awarded the Dean's Award for Excellence in Citizenship and Collegiality.

Dr Eva Yiwen Wang was awarded the Dean's Award for Excellence in a PhD thesis for her thesis '*Statistical and Computational Methods for Microbiome Data Analysis*' which was supervised by Professor Kim-Anh Lê Cao.

# Australian Academy of Science Fellow



Professor Peter Taylor was elected as Fellow of the Australian Academy of Science in 2023.

Peter works in the general field of applied probability. He is noted for building mathematical models for real-world systems that are driven by random processes. He has achieved significant advances in the theoretical analysis of the behaviour of such models as well as in computational techniques for solving them. He has applied his theoretical and computational advances to provide solutions to problems across a wide range of areas: telecommunications systems and data networks, queueing theory, the management of natural resources, mechanism design in economics, extreme rainfall and bushfire events, patient flow in healthcare systems, epidemic modelling, systems biology and blockchain modelling.

# ARC Future Fellowship

Associate Professor James Osborne has been awarded a four-year Australian Research Council Future Fellowship to develop cutting edge mechanobiological mathematical models of organ development and function. The expected outcomes of this project are a step-change in the fidelity of multicellular models of three-dimensional tissues and the scientific investigations into the mechanobiological processes regulating organ development, currently not possible, that these models support. In addition to significant benefits from advances in fundamental mathematical and biological knowledge, this project plans to develop a mechanobiological modelling framework which is made available to the wider scientific community.
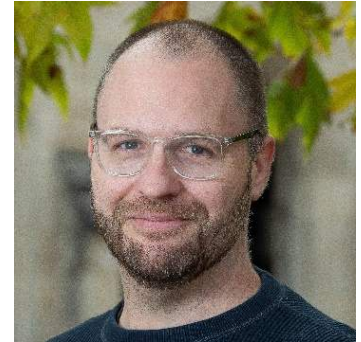


# New Professor David Ridout



David Ridout works at the interface of mathematical physics and pure mathematics. His research addresses fundamental questions in conformal field theory and the representation theory of vertex operator algebras. These areas have applications in category theory, combinatorics, geometry and even number theory, as well as statistical physics, string theory and supersymmetric versions of the gauge theories that underlie the standard model of particle physics.

David received his PhD in 2005 from the University of Adelaide before undertaking postdoctoral fellowships in Québec, Hamburg and Montréal. He returned to Australia in 2010 as an Australian Research Fellow at the ANU. The University of Melbourne offered him a continuing position in 2015 and his research has been rewarded with a Future Fellowship in 2020 and Discovery Projects in 2016 and 2021. In 2023, David received the inaugural Rodney Baxter Prize in Mathematical Physics.

Australia has a strong tradition of mathematical physics research and David has been actively promoting this both domestically and internationally. He served on the Executive Committee of the Australia and New Zealand Association of Mathematical Physics for eight years (two as chair) and on the Council and Steering Committee of the Australian Mathematical Society for four. David is an advisory editor for Nuclear Physics B (which, despite its name, is a top math physics journal).

David is also passionate about the educational side of academia, having developed many advanced courses during his time at Melbourne and the ANU. He has lectured at the AMSI Summer School and regularly volunteers his time with MathsCraft and outreach talks to high school students and undergraduate physics and mathematics societies. David also served as the School's Director of Undergraduate and Postgraduate Studies for four years (but not at the same time!).

In his (limited) spare time, David enjoys playing the piano, cooking, gardening, eating delicious cheese and subjecting his children to arguably superior music, books, films, comics, etc…
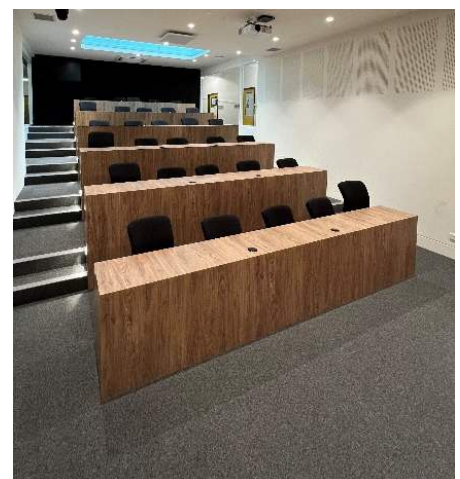
# New Seminar Room
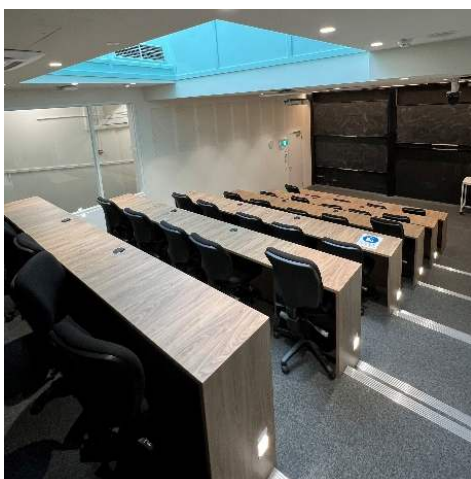


The school's new Seminar Room opened in 2023.

The seminar room seats 30 people and is equipped with computing facilities and six panels of blackboards.

It is located on the first floor of the Peter Hall building above the Maths and Statistics General Office.

# Obituary – Dr Allen Russell

We report with sadness the passing of a former alumnus and long serving staff member, Dr Allen Maurice Russell, on 9th February 2023, after a long battle with cancer.

Allen was born on 4th May 1938 in Ulverstone, Tasmania. He was initially schooled locally but finished his studies at Devonport High. He was an accomplished Australian rules footballer, playing for local teams at Ulverstone and Sandy Bay. He completed a BSc with honours in mathematics in 1958 and then a Diploma in Education, both from the University of Tasmania.

After several school-teaching appointments in Tasmania, he began a long association with the University of Melbourne, first as a tutor at Queen's College and subsequently as a senior tutor and later lecturer in the then Department of Mathematics. Allen produced an MSc thesis on Riemann-Stieltjes integrals in 1963 and completed a PhD thesis on functions of bounded $k$th variation and Stieltjes-type integrals under the supervision of Professor E.R. Love in 1974. In due course, he was promoted to Reader and Associate Professor.



*Photo from left to right: Peter Gill with Richard Dillon (background) and Allen Russell at the 1960s Graduate Reunion held in 2011.*

Although his postgraduate research was in classical analysis, Allen later became interested in mathematical economics through his association with John Rickard, a traditionally trained applied mathematician who moved into economics. They became long term collaborators, co-authoring over 20 research journal articles in mathematical economics.

Allen was passionate about providing mathematics enrichment to secondary school students. In 1972, he started assisting John Rickard and Derek Holton with running the IBM School Mathematics Competition, and gradually took over as principal organiser. He was awarded the 1997 BH Neumann Award for Excellence in Mathematics Enrichment for running the IBM Competition for 25 years. He also ran holiday enrichment classes and assisted with the Australian Mathematical Olympiad Program. He was a member of the Board of Examiners for the Victorian Year 12 Pure Mathematics subject for 26 years.

In 1994, Allen took up a position as a Professorial Fellow and Associate Dean (Special Projects) in the Faculty of Business and Economics at Monash University, where John Rickard was the Dean. Allen proved to be an excellent senior administrator, holding the Associate Dean position until his retirement in 2001.

Allen was an excellent lecturer, teaching subjects in analysis and linear algebra as well as mathematical economics from first year through to honours level. After retiring, Allen returned to the University of Melbourne where he enjoyed working as a sessional tutor for about 20 years. His kindness, mathematical knowledge and rigour, and high-quality teaching skills benefited a great many students.

Allen is survived by his wife Wendy and his son Richard.

# Staff Retirements

## Associate Professor Craig Hodgson



Craig developed a fascination for maths during his school years and his BSc (honours) degree at the University of Melbourne, completed in 1979. After a research MSc degree at Melbourne, he moved to Princeton University in 1981 to do a PhD in low-dimensional topology and geometry. Craig's dissertation on deforming geometric structures on 3-dimensional manifolds was completed in 1986 under the supervision of Fields medallist William Thurston. This was followed by a postdoctoral position at the Mathematical Sciences Research Institute in Berkeley, California and a four-year position at Columbia University in New York. He returned to the University of Melbourne in 1990 in a research position. He then became a Lecturer and has been an Associate Professor and Reader since 2005.

Over the years Craig's research has focussed on the use of geometric methods to understand the topology of 3-dimensional spaces and knots. This work has used a wide range of techniques including hyperbolic geometry, triangulations, surfaces, group theory, number theory, partial differential equations, complex analysis, and quantum invariants arising from mathematical physics. Craig has also played a key role in the development of computer programs to study 3-manifolds and their invariants, and a widely used database of the simplest hyperbolic 3-manifolds.

One of the most rewarding aspects of Craig's time in Melbourne has been teaching both undergraduate and postgraduate students. He found great pleasure in helping them discover new areas of mathematics as they progressed through their degrees. Craig also greatly enjoyed guiding the research of many undergraduate and postgraduate students, and Research Fellows, introducing them to the joys of topology and geometry.

Craig is looking forward to continuing his research in retirement, as well as spending more time indulging in other areas of interest including bush walking, travel, and music.

## Tutors

This year we farewell three of our long serving tutors. Christine (Chris) Armstrong retired in June, and Edward (Ted) Clarke and Pamela (Pam) Norris retired in November.

Chris started working at the university in 1978, with breaks to have two children, and was appointed as a Teaching Associate in 2022. During her 41 years of teaching for the university, Chris taught a wide variety of first, second- and third-year maths subjects in our school and the Faculty of Engineering. Ted started in 1994. During his 30 years at the university, Ted taught many first-year maths subjects as well as engineering maths. Pam started in 2000 and has worked for the school for 23 years, tutoring first year maths, and first, second- and third-year statistics.

Over the years, thousands of students have benefited from the excellent teaching, subject knowledge, detailed assessment feedback, and commitment shown by Chris, Ted, and Pam. They have also provided valuable mentoring and support to many new tutors and will be greatly missed by staff and students.



Chris Armstrong



Ted Clarke



Pam Norris

# Outreach

In 2023, the school's outreach programs evolved to respond to the demands of students and schools. This year, outreach offerings were accessed by over 2,300 participants comprising students, volunteers, and members of the public.

Our flagship Mathematics and Statistics research competition saw another successful year of creative, open-ended research projects. This year, 560 projects from 1,108 students were submitted to the competition and over $9,000 in prize money was awarded to high-quality projects.

The Micro Mathematicians program received funding from the Victorian Government to continue providing enrichment and extension activities as part of the Victorian Challenge and Enrichment Series (VCES). Aimed at high-ability students, VCES provides free access to Micro Mathematicians in-school workshops for students from Victorian government schools. Since securing the grant, Micro Mathematicians has been taken on the road to 30 state schools this year, reaching as far as Kaniva, Shepparton, Dromana, Wangaratta, and Wodonga. If you would like to learn more about Micro Mathematicians see the website: **https://go.unimelb.edu.au/55qe.**

This year, we were delighted to welcome a new member to our team, Cait Pryse. She is passionate about education systems and social equity. Since joining Cait has dived straight into her role, quickly becoming an integral part of the team with her unique take on workshop design and delivery.

The Outreach Team was recognised by the Faculty of Science this year through the Dean's Award for Excellence in Engagement. We are grateful to be recognised in this way and look forward to working with many more academics, students, teachers, and schools in the coming year through Micro Mathematicians, the Research Competition, public lectures, and more.

If you would like to get involved with outreach by giving a presentation, or creating an activity with us, please contact: ms-outreach@unimelb.edu.au.

Susan James, Cindy Huang, Dominic Maderazo, Paul Fijn and Cait Pryse



*2023 Mathematics and Statistics Research Competition Senior Finalists accompanied by Volker Schlue, Marcy Robertson, Howard Bondell, and Joyce Zhang.*



*Students in a Micro Mathematicians workshop asking some burning questions.*

# Centre of Excellence for Biosecurity Risk Analysis (CEBRA)

What would happen if foot-and-mouth disease (FMD) establishes in Australia? It's a disease circulating in an estimated 77% of global livestock and a recent outbreak in Indonesia places it right on Australia's doorstep. A large domestic outbreak could cost up to A$80 billion, mostly from losing export markets that hinge on our FMD-free status.

Keeping Australia free from many damaging pests and diseases like FMD depends on a strong biosecurity system. How great exactly are the benefits this system provides? Now in its eleventh year, the Centre of Excellence for Biosecurity Risk Analysis (CEBRA) led by Professor Andrew Robinson, has developed a repertoire of quantitative capabilities to answer such questions. CEBRA provides strategic thinking and practical, rigorous solutions across the biosecurity continuum — the body of management activities that protects against the damaging impacts of pests and diseases, through data-driven research to support the Australian and New Zealand governments.

One product of this research is the Australian Animal Disease Spread Model (AADIS), an innovative decision support tool for informing emergency animal disease policy and response strategies. It combines mathematical, agent-based, network, and cellular automata modelling approaches to simulate disease incursions. AADIS simulations capture disease epidemiology, regional and seasonal variability in transmission, disease control interventions, and detection, surveillance, control, and proof-of-freedom. The model has been applied to other animal diseases including bluetongue virus, African swine fever, Mycoplasma bovis, lumpy skin disease, and even rotavirus in humans. The modelling approach has also been extended to include Oriental fruit fly, a damaging pest of over 400 agricultural crops, and the voracious, formic acid spraying yellow crazy ant. Currently, the model is being used to assess the risk of spillover FMD transmission between feral pigs and livestock. Inferences from the FMD model can help authorities prepare for, prevent, and respond to an outbreak that could devastate Australia's multibillion-dollar livestock industry.

While high-value agricultural industries are often the focus, a well-functioning biosecurity system also protects the environment, social amenity, and human health. Ultimately, the question of how great these benefits are to Australia can be answered by CEBRA's groundbreaking Value model, which calculates the net-present value and return on investment for Australia's entire biosecurity system. This model uses benefit transfer to estimate the current value of the ecosystem services and infrastructure (collectively, assets) that are protected by the biosecurity system and then estimates assets' relative 'vulnerability' to 40 types of invasive species. The result of this endeavour shows that the biosecurity system delivers a return on investment — avoided economic damages— of $30 for every dollar invested, equivalent to $314 billion over 50 years.

This tremendous value highlights how essential reliable, risk-based research is as an input into the biosecurity system that protects our economy, environment, and wellbeing.

For more information about CEBRA, see the website: **https://cebra.unimelb.edu.au/.**



*Photos from left to right: Yellow crazy ant, Detection dogs at airport, Biosecurity control zone.*