Alumni & Friends 2022

Alumni newsletter of the School of Mathematics & Statistics

Bringing past students together

THE UNIVERSITY OF
MELBOURNE

**School of Mathematics
& Statistics**

A message from the Head of School

Throughout 2022, hybrid modes of interaction became the norm. Activities began to move back towards campus, with online access for those unable to interact in person, including multiple starts and stops. I am extremely proud of the efforts of our staff and students to maintain excellence in all areas.

The ability to deliver high-quality education in this dual-delivery mode has been a testament to both our academic and professional staff, and their innovation and dedication. While we have continued to thrive and have become more accustomed to online activities, we are all looking forward to more regular in-person interaction.

Even through the financial challenges brought on by the pandemic, our School continues to create opportunities for our staff and students. Despite these challenges, we have been able to provide continued support for early career researchers and students, who are often the most affected during difficult times. This support has come via dedicated commitments from our school, and from the generosity of our alumni, for which we are extremely grateful.

The school has also maintained scholarships and student awards thanks to many who support and enable these special programs to happen. It is always a highlight to host our Student Awards Ceremony, which we were able to do in-person this year.

Our school continues to expand our internationally recognised research excellence, exemplified through successful academic promotions of our colleagues and a number of awards. Many of these will be further highlighted through this newsletter. We congratulate Kate Smith-Miles, who was honoured with election as Fellow of the Australian Academy of Science. We continue to achieve outstanding success and recognition from the Australian Research Council, including our new ARC Laureate Fellow, Michael Stumpf, truly a distinguished honour, with only 16 awarded, and the only one here at Melbourne. The school will also be home to the new ARC Centre of Excellence for the Mathematical Analysis of Cellular Systems, another outstanding accomplishment that will further highlight and strengthen the impact of our research in the mathematical sciences and beyond.

Our research competition for high school students attracted almost 500 entries from across Australia, and some from New Zealand. This year we included a junior division to involve students in years 5 and 6. This was the third year of the competition and the finalists included teams from VIC, NSW, QLD, and WA. It was amazing to see these students and what they accomplished in small teams to address open-ended research projects, with mathematical maturity showing well beyond their years. The future of mathematics looks bright!

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.

I wish you all a happy and successful 2023, and we look forward to those ongoing face-to-face interactions that we no longer take for granted.

**Professor Howard Bondell
Head of School**

Visit the alumni website for news, benefits, offers, volunteering opportunities and to update your alumni details:
alumni.unimelb.edu.au

Staff promotions and prizes

Our staff continued to be recognised for their excellence through prizes and promotions in 2022.

Promotions

- Paul Fijn and Trithang Tran have been promoted to Lecturer (Level B).
- Chris Baker, Tingjin Chu, Mingming Gong, Hailong Guo, Johanna Knapp, Binzhou Xia and Gufang Zhao have been promoted to Senior Lecturer (Level C).
- Alex Ghitza, Jack Hall, Sophie Hautphenne, James Osborne, Marcy Robertson, Michael Wheeler and Ting Xue have been promoted to Associate Professor (Level D).
- Jennifer Flegg and Kim-Anh Le Cao have been promoted to Professor (Level E).

Prizes

Our Academic Support staff Kirsten Hoak, Roy Ridgway and Tina Soundias (pictured below from left to right) were awarded the Dean's Award for Excellence in Teaching Support in 2021. Their dedication, innovation and perseverance during 2021 made an outstanding contribution to the teaching and learning in the School.

Professor James McCaw was awarded the 2022 ANZIAM Ernie Tuck medal for outstanding research in, and distinguished service to, applied mathematics.

James' research primarily focuses on host-pathogen interactions and epidemiological transmission dynamics. His expertise has been highly sought after by public health authorities, translating fundamental insights on Covid-19 infection derived from mathematical and statistical modelling into policy advice and decision support.

Dr Camelia Walker has been named as one of Australia's newest 60 superstars of STEM.

The program aims to inspire and encourage women and non-binary people to pursue a degree and career in science, technology, engineering and math by supporting and elevating the profile of relatable role models in a variety of STEM jobs around Australia.

Laureate fellowship

Professor Michael Stumpf has been awarded a prestigious five-year Australian Research Council Laureate Fellowship to investigate the industrial biological processes used to make products such as medical vaccines, yoghurt, alcohols, and bread.

Improving biotechnology applications in science, agriculture and medicine can enhance the efficiency, yield and purity of valuable products made by biological processes. Improvements could be achieved by being able to predict conditions that control cell functions, such as temperature, pH levels, and molecular environment.

Professor Stumpf will develop refined mathematical models of these biological processes to investigate how they operate and enable prediction of different conditions that will enhance the overall process and achieve scientific and commercial benefits.

Australian Academy of Science fellow

Professor Kate Smith-Miles has been elected Fellow of the Australian Academy of Science in 2022.

Kate is renowned for spearheading a new paradigm in reliable algorithm testing, through her Instance Space Analysis methodology. This is a mathematically rigorous foundation for "stress-testing" algorithms, including innovative techniques for generating unbiased test instances and visualisation of insights into algorithm reliability. The methodology is transforming academic research practice across many fields and is supporting industry partners keen to avoid disasters when deploying critical algorithms.

New professor: Jennifer Flegg

Jennifer Flegg is an applied mathematician. Her research focuses on using mathematics and statistics to answer questions in biology and medicine. In particular, she develops mathematical models in areas such as wound healing, tumour growth and infectious disease epidemiology.

Jennifer was awarded a PhD in 2009 from Queensland University of Technology on "Mathematical modelling of chronic wound healing." From 2010 to 2013, she was at the University of Oxford developing mathematical models for the spread of resistance to antimalarial drugs. From 2014 to 2017, Jennifer was a Lecturer in the School of Mathematical Sciences at Monash University.

In 2016 she started an ARC Discovery Early Career Research Award to study and mathematically model venous leg ulcers. In 2017 Jennifer joined the School of Mathematics and Statistics at the University of Melbourne as a Senior Lecturer in Applied Mathematics. She was promoted to Associate Professor in 2020 and to Professor in 2023.

Jennifer is the recipient of the JH Michell Medal (2020) for excellence in research by ANZIAM (Australian and New Zealand Industrial and Applied Mathematics), the Christopher Heyde Medal (2020) from the Australian Academy of Science and the Society for Mathematical Biology Leah Edelstein-Keshet Prize (2021). She currently serves as an Editorial Board member for PLOS Computational Biology, eLife and the Bulletin of Mathematical Biology.

In 2022, Jennifer started an ARC Future Fellowship to develop mathematical frameworks that integrate data from multiple sources to facilitate informed decision making for responding to infectious diseases. Jennifer is passionate about promoting gender diversity in mathematics at all levels of education. She was previously the secretary of the Women in Mathematics Special Interest Group (WIMSIG) of the Australian Mathematical Society and is the current incoming chair of WIMSIG.

New professor: Kim-Anh Lê Cao

Advances in sequencing technologies have revolutionised our ability to understand biology at a deep molecular resolution. Kim-Anh Lê Cao works at the interface between statistics and biology and develops computational statistical multivariate methods, software, and tools to interpret and integrate big biological data.

Kim-Anh has a mathematical engineering background and graduated with a PhD in statistics from the Université de Toulouse, France. She then moved to Australia to forge her own non-linear career path. After a brief stint as a postdoctoral fellow, she decided to broaden her expertise as a biostatistician consultant at QFAB Bioinformatics, then returned to academia as a research group leader at the biomedical University of Queensland Diamantina Institute.

She currently continues her strong research focus at the University of Melbourne, focusing on developing statistical methods for biological data and the mixOmics R package. In numerous multi-disciplinary collaborations, she has applied her methods in diseases ranging from cancer, neurological disorders, and auto-immune diseases. She has also extended the breadth of her applications to microbial ecology and microbiome research.

Kim-Anh has secured two consecutive NHMRC fellowships since 2014. In 2019 she received the Australian Academy of Science's Moran Medal for her contributions to Applied Statistics. As a strong advocate for women in STEMM, she was selected to the international Homeward Bound leadership program for women in STEMM, culminating in her trip to Antarctica in 2019, and the 'Superstars of STEM' women scientists' program from Science Technology Australia.

Kim-Anh has been an avid rock climber since starting her PhD. You may bump into her in the city climbing gyms during the week, and in Djurite (Mount Arapiles) during the weekends, else she might be hiking across multiple days in the Victorian Alps.

Obituary

Dr Bruce Craven

We report with sadness the passing of a former alumnus and long serving staff member, Dr Bruce Desmond Craven, on 25th January 2022, after a long illness.

Bruce was born on 7th May 1931 in Hampton, Melbourne. Apart from his time in the UK, Bruce lived in the same family home until he moved into aged care. Bruce attended Hampton High School until he was awarded a scholarship to Wesley College. In his final year at Wesley, he studied Piano and Music theory, Physics, Pure and Applied Mathematics, Chemistry and English, and was Dux of the School. He was a talented pianist who also learnt French, German and Russian.

Bruce completed a BSc in 1951, a MSc (Honours) in 1953 and a BA (Honours) in 1959, all at the University of Melbourne. Although he never undertook a PhD, he was awarded a University of Melbourne DSc in 1973 based on his extensive research achievements.

In 1954 he moved to London to work in the Research Division of the General Electrical Company. He returned to Melbourne in 1955 to work as a Senior Research Physicist in the Research Division at Australian Paper Manufacturers. In 1962 Bruce joined the Mathematics Department at the University of Melbourne as Senior Lecturer, becoming Reader in 1968. He remained at the University until his retirement in 1996. He was made an honorary Principal Fellow in the Department of Mathematics and Statistics and continued to engage in research and to publish while his health permitted.

Bruce's main area of research was mathematical programming and optimisation, including optimal control, duality theory, generalised convexity, fractional programming, non-smooth optimisation, multicriteria optimisation algorithms, operations research models and optimal control in economic growth and finance models. He also made contributions to both classical and functional analysis and to Markov processes.

Bruce collaborated with mathematicians in Vietnam (Mathematics Institute, Hanoi), China (Institute of Systems Science), India, Italy (University of Pisa) and France. He was the author of six books and published 89 research papers.

In 1997 Bruce was awarded the inaugural Ren Potts Medal of the Australian Society for Operations Research for outstanding contributions in theory and practice of operations research in Australia.

In memoriam fund

The School of Mathematics and Statistics Fund has established student awards in memory of recently departed members of the School, to honour their active contribution to the School when they passed. The precise details of the new student awards will be decided in 2023.

If you would like to contribute to an award in memory of either Dr Richard Brak, Professor Edmund Crampin or Professor Omar Foda (pictured below from left to right), please see the website:

https://ms.unimelb.edu.au/engage/support/in-memoriam

Staff departure

Professor John Sader

In September this year, John Sader left our School and the University of Melbourne after 30 years of service to take up a position as Research Professor of Aerospace and Applied Physics at the California Institute of Technology (USA).

John completed a Bachelor of Engineering (Honours) in 1989 and a PhD in Electrical Engineering in 1993 at the University of New South Wales. He joined the University of Melbourne in 1992 as a postdoc working with Professor Lee White in the Department of Mathematics. After a postdoc with Professors Derek Chan and Barry Hughes, he was appointed as a lecturer in applied mathematics. After promotions to Senior Lecturer and to Associate Professor and Reader, he was promoted to Professor of Applied Mathematics in 2008.

John's research interests cover a broad range of areas, including fluid mechanics, colloid science, plasmonics, mass spectrometry and atomic force microscopy. He is best known for developing experimental methods for atomically resolved force measurements using the atomic force microscope (AFM). The Sader Method is an international standard for AFM force calibration as is the Sader-Jarvis Method for atomically resolved AFM force measurements. These methods appear in textbooks and are used in commercial instruments.

John's research is driven by collaboration with experimentalists, that has led to visiting positions at the California Institute of Technology (USA), Trinity College Dublin (Ireland) and Argonne National Laboratory (USA). He has collaborated on projects that include nanoelectromechanical systems for mass spectrometry, rarefied gas dynamics, fluid-structure interactions of flags, shape morphing mechanical structures, dynamic stability of thin elastic films for space deployment and the vortex dynamics of start-up flows.

He was awarded the 2004 Woodward Medal for Science and Technology from the University of Melbourne, and the inaugural Barry Inglis Medal from the National Measurement Institute, Australia in 2008. John is an elected Fellow of the Australian Academy of Science, the Australasian Fluid Mechanics Society, and the Australian Mathematical Society.

In the classroom

'Next generation' tutorials
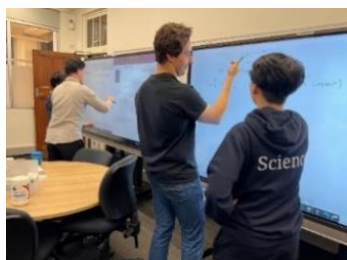
Our whiteboard tutorials have long been a highlight of our undergraduate teaching, where students work in groups to solve mathematics and statistics problems on whiteboards. However, there is limited access to computing resources in most tutorial rooms.

In 2021 the School fitted out two tutorial rooms with large touchscreen electronic whiteboards. The boards can be used to handwrite mathematics like a regular whiteboard and can also run software and access the internet. In these 'Next generation' tutorial rooms, students can seamlessly switch between working on mathematics by hand, using interactive visualisations and software such as R, and looking up information on the internet, all done collaboratively in a small group.

In subjects such as statistics, this removes the somewhat artificial distinction between tutorials for learning the concepts, and computer lab classes for learning how to use software. Students can now do both in the one class, all while helping each other learn in a small group setting. It also better matches the reality of modern mathematics and statistics, where researchers often collaborate with peers, discuss theory, retrieve information, run simulations, and analyse data, all in one session.

Our alumni: what are they up to now?

Frank Calegari

Frank Calegari completed a BSc (Hons) at the University of Melbourne in 1997 and a PhD at the University of California at Berkeley in 2002. In 2006, he joined Northwestern University as an Assistant Professor and was promoted to Associate Professor in 2009 and to Professor in 2012. In 2015, he moved to the University of Chicago as a Professor of Mathematics.

Frank's research is in algebraic number theory. He is particularly interested in the Langlands program, especially the notion of reciprocity linking Galois representations and motives to automorphic forms. He was awarded a Sloan Research Fellowship in 2009 and in 2013 he became a Fellow of the American Mathematical Society.

Frank's other interests include coffee, cooking, cricket, and classical piano, and he has even performed live with Zubin Mehta and the Israeli Philharmonic Orchestra.

Public lectures

Behrend lecture

The Behrend Memorial Lecture in Mathematics is in memory of Associate Professor Felix Behrend for the advancement of mathematics at the University of Melbourne.

The 2022 Behrend lecture was given by alumnus Professor Frank Calegari from the University of Chicago as part of the Mahler Tour. Frank talked about the 'Arithmetic of Power Series' including what constraints are imposed on the power series of a holomorphic function P(z) of a complex variable around $z = 0$. He discussed some variations on this problem leading up to a resolution of a 50-year-old conjecture, as well as links to differential equations and group theory.

Peter Hall lecture

The Peter Hall lecture is in memory of Professor Peter Hall who made profound and extremely creative contributions in mathematical statistics and probability theory.

The 2022 Peter Hall Lecture was given by Professor James Stephen (Steve) Marron from the University of North Carolina. He is a world leader in data visualisation and in high dimensional, functional and object-oriented data analysis.

A major challenge in the age of Big Data is the integration of disparate data types into a data analysis. Steve talked about 'Data Integration Via Analysis of Subspaces' which allows the simultaneous exploration of the joint and individual variation within each data block. He illustrated the technique using mortality, cancer and neuroimaging data.

Sir Peter Donnelly lecture

Professor Sir Peter Donnelly gave a lecture aimed at graduate students and early career researchers.

Peter has made fundamental contributions to developing the mathematical/statistical methods underpinning much 21st century population and disease genetics research. With colleagues, Peter founded Genomics plc in 2014 and became its CEO in 2017. The company is pioneering Genomic Prevention, the sophisticated use of genetic information to get more of the right individuals into the appropriate prevention and screening programs in healthcare and to identify better drug targets.

In the talk, Peter discussed the impact of identifying high risk individuals through sophisticated risk prediction tools powered by genomics, and their application in heart disease, diabetes, and breast, bowel, and prostate cancer.

Mathematics and statistics outreach

The School Outreach Team had an incredible year of delivery and growth. This year, several outreach programs transitioned to in-person delivery. A major achievement was our flagship Mathematics and Statistics Research Competition, which held the final presentations on the Parkville campus for the first time. We spent the year focusing on expanding our reach and developing a growing suite of modular, hands-on, learner-centred workshops.

Our Research Competition experienced immense growth this year: 479 projects were submitted (compared to 346 in 2021) from 118 schools (compared to 62 in 2021) in every major state and territory as well as New Zealand for the first time. We reached more schools and developed new relationships with teachers, particularly in government schools, girls-only schools and schools in regional/remote areas.

The Micro Mathematicians program expanded from a virtual six-week program to include half-day on-campus workshops that took place over the Victorian school holidays. This year's Micro Mathematicians program catered to nearly 400 high-achieving students across years 5 to 10 from schools all around Australia, including Christmas Island! We also delivered two enrichment seminars on reinforcement learning and knot theory. These were presented on-campus and virtually, with around 100 students in attendance.

We successfully delivered programs for Year 10 Work Experience and Open Day, and workshops for students identifying as female or non-binary. The team also completed a tour of Perth, during which we delivered workshops to 400 students across seven schools and presented at the Mathematics Association of Western Australia annual conference.

The team looks forward to growing our programs further in 2023 and delivering more in-person offerings, particularly to audiences in regional/remote areas. If you would like to get involved with outreach by giving a presentation, providing a career profile, or creating an activity with us, please contact ms-outreach@unimelb.edu.au

We would love to hear from you!

Susan James, Cindy Huang, Domenic Maderazo and Paul Fijn