Alumni & Friends 2018

Alumni newsletter of the School of Mathematics & Statistics
Bringing past students together

Message from the Head of School

Our School has continued its growth trajectory during 2018. Our new Master of Data Science is growing from strength to strength, and is extremely popular with students. Another area that has seen significant development is pure mathematics, and we have been able to attract some extremely promising young people from Australia and overseas. We were very proud to learn that two of our new staff, Dr Yaping Yang and Dr Gufang Zhao, recently won an ARC Discovery Early Career Award.

In a very exciting development, the School has employed a new University of Melbourne Enterprise Fellow, Dr Hamideh Anjomshoa, jointly with IBM Research. Hamideh will bring her industry experience and expertise to our School, and explore how the areas of artificial intelligence and quantum computing can impact on optimisation and operations research.

We have continued to improve gender balance. Over the past four years we have hired nine female staff members across all levels, doubling the number of female staff since 2014. Furthermore, the School continues to support AMSI's Choose Maths campaign to increase female participation in mathematics and statistics in primary and secondary schools.

This year has also seen the retirement of Professor Richard Huggins and Professor Paul Pearce. Richard was Deputy Head for many years in our School. He has made significant contributions to the area of statistics, and has helped further develop the statistics curriculum. Paul was very well known internationally, and made substantial contributions to mathematical physics. Paul remains active in research and still comes in regularly.

In June the School hosted the highly successful Real World Maths in Action day, which is organised every other year by Dr Christine Mangelsdorf. Around 500 Year 11 and 12 maths students and their teachers attended the day. This 'Maths Fair' promotes the importance and broad applications of mathematics and problem solving skills, and raises awareness of career opportunities for mathematics and statistics graduates.

I am pleased to report that many staff in our School have received major awards and recognition from the Australian and International mathematical communities in 2018. The most exciting news is that Alison Harcourt (nee Doig) and Professor Ruth Williams both received a Doctor of Science (honoris causa) from the University of Melbourne.

Overall it was an extremely successful year for the School and I'm looking forward to a continuation of that success in 2019!

Professor Jan de Gier
Head of School

Staff promotions and prizes

Staff continued to be recognised for their excellence through prizes and promotions in 2018.

Dr Marcy Robertson, Dr Michael Wheeler and Dr Ting Xue have been promoted to Senior Lecturer, Dr Anthony Morphett has been promoted to Lecturer (Level B), and Dr Pengxing Cao and Dr Laleh Tafakori have been promoted to Research Fellow (Level B).

Professor Aihua Xia has been elected a Fellow of the Institute of Mathematical Statistics for demonstrating distinction in research in statistics or probability. In particular, "for innovative and impactful contributions to stochastic approximations via new probabilistic arguments to obtain bounds required by Stein's method".

Professor Aurore Delaigle has been elected a Fellow of the American Statistical Association "for influential contributions to statistical methodology, especially in nonparametric statistics, functional data, deconvolution, measurement errors and high-dimensional data; and for outstanding leadership and service to the profession".

Professor John Sader has been elected a Fellow of the Australasian Fluid Mechanics Society "for fundamental and lasting contributions to our understanding of fluid-structure interactions at the nanoscale and development of the Sader Method used widely in atomic force microscopy".

Kirsten Hoak, an Academic Support Officer in the School, received the Dean's Award for Professional Staff Excellence. Kirsten's caring and genuine approach to building relationships has made hers one of the best known and most trusted names among both staff and students in the School.

Dr Nick Beaton, Professor Jan de Gier and Professor Tony Guttmann received the Gavin Brown Best Paper Prize of the Australian Mathematical Society for an outstanding single article, monograph or book consisting of original research in pure mathematics. The paper, titled *The Critical Fugacity for Surface Adsorption of Self-Avoiding Walks on the Honeycomb Lattice is $1 + \sqrt{2}$*, is co-authored with Mireille Bousquet-Mélou from the Université de Bordeaux and Hugo Duminil-Copin from the Université de Genève.

James McCaw wins CIVSEC Innovation Awards

Professor James McCaw, together with Rob Moss (Melbourne School of Population Health) and the Defence Science Technology Group, was awarded the CIVSEC National Innovation Award for Civil Security, along with the Innovation Award for Disaster Relief, Emergency Management and Humanitarian Services. These awards recognise the pioneering system they developed, which detects and predicts the outbreak and spread of diseases such as influenza.
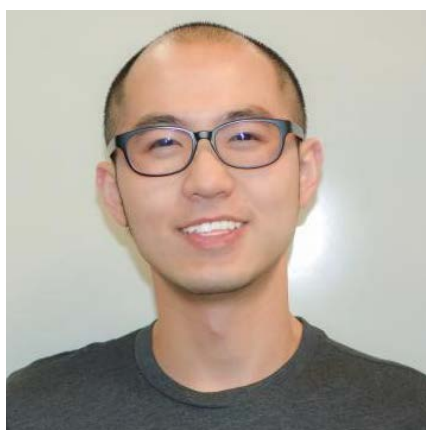
Binzhou Xia wins the Kirkman Medal

Dr Binzhou Xia has been awarded the 2017 Kirkman Medal of the Institute of Combinatorics and Its Applications.

Binzhou has made outstanding contributions to permutation groups and graph symmetry. His research exhibits substantial depth and breadth. He has repeatedly solved long-standing open problems, including the existence of a vertex-primitive 2-arc-transitive digraph (with Giudici and Li), the decomposition of tensor products of Jordan blocks (with Glasby and Praeger), and covering radii of certain groups (with Huang and Zhou).

Roslyn Hickson wins the Victorian Young Tall Poppy Award

Dr Roslyn Hickson has been awarded the Victorian Young Tall Poppy Science Award for her research using mathematical modelling to predict the spread of diseases and control outbreaks. Her research informs policy and practice through mathematical modelling of infectious diseases, particularly applied to accelerating the elimination of malaria in the Asia Pacific region.

Peter Taylor wins the George Szekeres Medal and the Ren Potts Medal

ARC Laureate Fellow and Redmond Barry Distinguished Professor Peter Taylor has been awarded the 2018 George Szekeres Medal. The Szekeres Medal is the highest honour of the Australian Mathematical Society, and is awarded biennially in even years for an outstanding contribution to the mathematical sciences.

Peter was also awarded the Australian Society for Operations Research's 2017 Ren Potts Medal, which recognises outstanding contribution in or for a major development in theory or application of operations research.

Peter Taylor received a BSc (Hons) and a PhD in applied mathematics from the University of Adelaide in 1980 and 1987 respectively. After periods at the Universities of Western Australia and Adelaide, he moved to the University of Melbourne in 2002, where he became a professor of operations research. He was Head of Department from 2005-10.

Peter's research interests lie in the fields of stochastic modelling and applied probability, with particular emphasis on applications in telecommunications, biological modelling, healthcare, economics and disaster management. Recently, he has become interested in the interaction of stochastic modelling with optimisation and optimal control under conditions of uncertainty and with blockchain technology.

Peter has held significant leadership positions in the Australian mathematical science community: Chair of ANZIAM (2006-08), President of the Australian Mathematical Society (2010-12) and member of the Australian Academy of Science's National Committee for the Mathematical Sciences (2007-15). In 2016, he became Director of the ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS).

Ruth Williams awarded Honorary Doctorate

Professor Ruth Williams has been awarded the degree of Doctor of Science (honoris causa) by the University of Melbourne. Ruth obtained a BSc (Hons) and MSc in mathematics at the University of Melbourne from 1973-78, and a PhD at Stanford University in 1983.

Ruth is recognised among the handful of top researchers in the world on stochastic networks. These networks have widespread application to diverse areas such as factory production, and computer and telephone call scheduling, with the internet a more recent application. She recently worked with biological colleagues to uncover insights concerning 'cell queueing behaviour' in biological reaction networks.

Ruth's work has been recognised by many honours such as her election to the National Academy of Sciences, the American Academy of Arts and Sciences, and the Australian Academy of Science as a corresponding member. She is also one of a select few who have been invited to speak at the International Congress of Mathematicians. In 2016, she became the first, and to date only, woman to receive the highly prestigious John von Neumann Theory Prize by the Institute for Operations Research and the Management Sciences.

Since moving to the United States in 1980, Ruth has frequently returned to Australia to visit her family and the University of Melbourne. During each visit she has made it a point to engage with the staff and students in the School and has been especially supportive of female staff. She is an important role model for women in STEM and plays an active role in the advancement of women in the mathematical sciences through organisation of networking, academic and social events.

Since 2016, Ruth has been an active member of the Scientific Advisory Committee of the ARC Centre of Excellence for Mathematical and Statistical Frontiers (ACEMS). As continuing member of its Governance Board from 2015, Ruth has also been a very strong international advocate of the Australian Mathematical Research Institute, MATRIX.

Alison Harcourt awarded Honorary Doctorate and named Victorian Senior Australian of the Year

In 2018, in recognition of her significant achievements and contributions to society, the University of Melbourne awarded Alison Harcourt its highest honour - the degree of Doctor of Science (honoris causa). She was also named the 2019 Victorian Senior Australian of the Year. Here, we highlight some of her remarkable accomplishments.

Alison Harcourt (nee Doig) is an alumnus and past staff member of the University. She completed a BA (Hons) (1950), BSc (1952) and MA (1958) at the University of Melbourne, majoring in mathematics and statistics.

Alison is a pioneer in the field of optimisation, having co-authored the seminal paper: A. H. Land and A. G. Doig, *An Automatic Method of Solving Discrete Programming Problems, Econometrica*, vol. 28, no. 3, 1960.

Pictured: Alison Harcourt in The Sun newspaper in 1965, and today.

This ground-breaking paper is well-known to researchers in optimisation since it proposed a method for solving integer programming problems that later became known as the 'branch-and-bound' method. It underpins modern day optimisation software packages that provide efficient solutions to challenging combinatorial optimisation problems. Applications include logistics, transportation, scheduling, telecommunications and radiotherapy treatment planning. This seminal paper has 3000 Google Scholar citations and has had enormous impact in the academic literature as well as for practical problem solving for economic and social benefits.

Alison co-authored the paper while working as a research assistant together with Ailsa Land at the London School of Economics. They published without identifying themselves as women due to the perceived stigma against female mathematicians at the time. By the mid-1960s, Alison returned to the University of Melbourne to take up a position as a Senior Lecturer in Statistics. Her talents were in high demand as a statistical collaborator, and she went on to have a strong career as a statistician.

Alison's statistical analyses have had profound impacts influencing government policy. Examples include the first attempts to estimate poverty in Australia (informing the 1972 Royal Commission of Inquiry into Poverty, work headed by Professor Ronald Henderson) and, in conjunction with Dr Malcolm Clark, a statistical analysis of bias that lead to an amendment of the Commonwealth Electoral Act in 1984. This amendment introduced a 'double randomisation' method for allocating positions of political parties on ballot papers that is still used today.

Alison was also foundation secretary of the Victorian branch of the Statistical Society of Australia (1963-67), and has co-authored two books and written numerous journal articles.

She formally retired in 1994 but continues to make a difference to the lives of our students, sharing her passion for teaching as a sessional tutor in undergraduate statistics subjects at the University.

On a more personal note. Alison loves the Australian bush (she was a very keen rogainer) and animals such as lyrebirds and echidnas, the music of Bach, Beethoven and Mozart, and firmly believes that St Kilda will win at least one more AFL premiership. To relax, she enjoys deep thinking (i.e. doing nothing), reading books and Scottish country dancing.

Peter Hall Building revamp
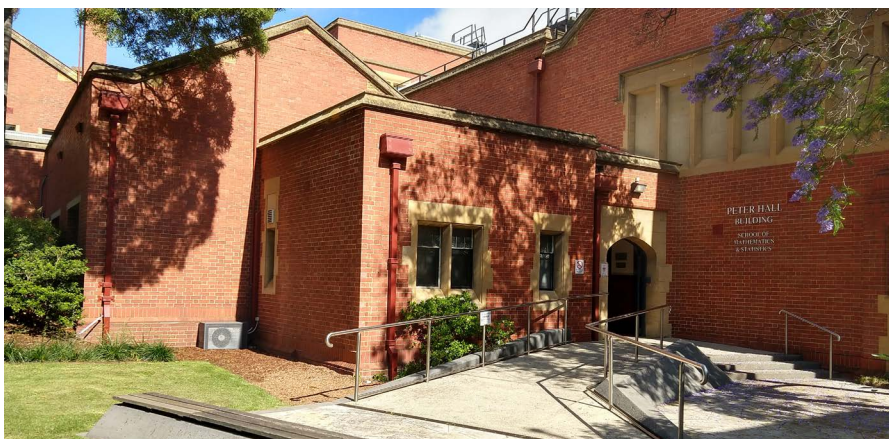
This is the new west entrance of the Peter Hall building, pictured after the old house and annex adjoining the School were demolished and replaced by a garden. Plans are currently being developed to landscape the garden.

What are our alumni doing now?

Dr Loretta Bartolini

I came to Melbourne University in 2000 to do a BSc in pure maths. I enjoyed anything with a spatial aspect - vector calculus, differential geometry, topology. In third year, I did a reading project from John Stillwell's 'Geometry of Surfaces' that sowed the seeds for further study. I did honours with Hyam Rubinstein in low-dimensional topology, and then a PhD on non-orientable surfaces in 3-manifolds.

As a PhD student, I was very involved in the graduate student community. I was Research Education Officer of what is now the Graduate Student Association (GSA) and President of the Statistics and Mathematics Postgraduate group (STAMP). I was student representative on various committees at the Department, Faculty and University level during the interesting times surrounding the announcement of the Melbourne Model.

After finishing my PhD in 2008, I took up a post-doc at Oklahoma State University in the US. Unfortunately, my arrival coincided with the Global Financial Crisis, which took a heavy toll on the academic job market. In 2011, I began a teaching position at Loyola University, Chicago. Having kept an eye on opportunities outside academia, I got a job at the National Museum of Mathematics in New York City in 2014. This experience was short lived and followed by stints teaching at local colleges, until an opportunity arose to shift into publishing.

In 2016, I became an editor at Springer NY, where my portfolio consists of the well-known textbook series, Graduate Texts in Mathematics, Undergraduate Texts in Mathematics and Universitext. As acquisitions editor for these series, my goal is to maintain awareness of mathematical progress across all of pure mathematics. This primarily involves talking to mathematicians: is the literature meeting the needs of students entering your field? Are you changing the way you prepare students as mathematics progresses? Have classic textbooks become outdated? The perspective of working mathematicians is crucial to ensuring the literature keeps up with mathematics.

In this job, I travel frequently to visit campuses and attend conferences. I use many of the networking and collaboration skills I learnt as a student representative at Melbourne. Among the many well-known mathematicians and authors I have met, none was more exciting than John Stillwell, whose Universitext set me on the path into mathematics.
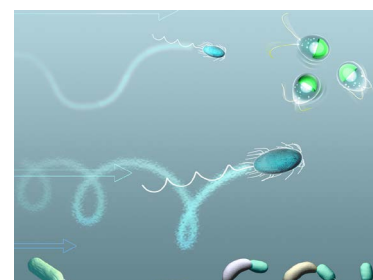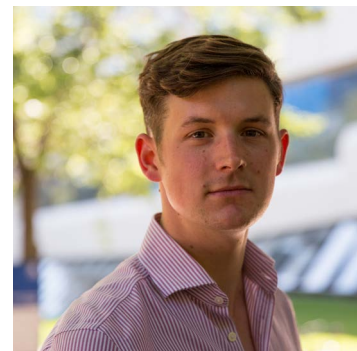
Dr Douglas Brumley

I completed a BSc (Hons) at the University of Melbourne in 2008, majoring in applied mathematics. After receiving the Gates Cambridge Scholarship and Trinity College External Research Fellowship, I undertook a PhD at the University of Cambridge using analytical models, numerical simulations, and experimental approaches to investigate fundamental problems in biological fluid mechanics, collective phenomena and synchronization.

In 2013 I was awarded a Cross-Disciplinary Fellowship through the Human Frontier Science Program to conduct Postdoctoral research at Massachusetts Institute of Technology and ETH Zurich. During this time, I worked in the laboratory of Professor Roman Stocker, and developed tools for imaging and modelling dynamical processes in biology.

I was appointed as a lecturer at the University of Melbourne in 2017 and was awarded a Discovery Early Career Researcher Award (DECRA) to investigate the mechanisms driving microbial navigation in marine systems.

The behaviour of individual microbes ultimately determines global-scale phenomena, controlling oceanic biogeochemistry and influencing the amount of carbon dioxide stored in the planet's oceans. Microbial activity in the ocean has typically been sampled and studied at large scales governed by human factors, assuming that waves and currents create a well-mixed environment. However, at the length scales relevant to microbes, the ocean is an intricate jungle of nutrient patches too small to be mixed by turbulence.

Individual marine microbes navigate unsteady environments and fluid flows in search of food.
Image: Glynn Gorick.

My research group utilises high-speed video microscopy to see how microbes swim towards localised nutrient patches and develops mathematical models of active search strategies based on these observations. The mechanistic models involve biased random walks, collective dynamics, background fluid flows, and advection-diffusion of nutrients. A fundamental discovery is that the sensory precision of microbes is close to the fundamental limit set by the biophysics of chemical sensing. These early results demonstrate that fundamental physical limits on sensing accuracy can provide a powerful tool for predicting the location, spatial extent, and lifespan of bacterial aggregations in dynamic environments.

Competitions and scholarships

Exceptional Talent Scholarship

The School of Mathematics and Statistics has introduced a new scholarship for 2019 to support exceptional students in mathematics and statistics enrolled in the Bachelor of Science and intending to major in Mathematics and Statistics. To be eligible for this scholarship, students need to:

- Have demonstrated exceptional talent by having performed outstandingly in high-level competitions such as the University of Melbourne School Mathematics Competition and the International Mathematical Olympiad, or have exceptional performance in the University of Melbourne Extension Program in Mathematics and Statistics.
- Either be an Australian citizen or permanent resident, or a New Zealand citizen, and have completed an Australian Year 12 or the International Baccalaureate in Australia OR be an Australian citizen and have completed an Australian Year 12 or the International Baccalaureate outside Australia.
- Have applied for a University of Melbourne undergraduate course via VTAC for commencement in the year following completion of Australian Year 12 or International Baccalaureate.
- Not have previously undertaken tertiary studies (excluding extension studies completed as part of a Year 12 program).
- Satisfy the prerequisites for a University of Melbourne Bachelor of Science and intend to major in Mathematics and Statistics.
- Not be a recipient of a Melbourne Chancellor's Scholarship.

The Scholarship offers HECS Student Contribution reimbursement for the monetary equivalent of a MAST coded subject for each subject student's enrol in. This is valued up to the standard full-time major in Mathematics and Statistics for the full duration of a Commonwealth Supported Place in the Bachelor of Science.

Simon Marais Mathematics Competition

The Simon Marais Mathematics Competition is a highly competitive annual undergraduate Mathematics Competition in the Asia-Pacific region that started in 2017. It was inspired by the William Lowell Putnam Mathematical Competition in USA.

The competition is named after Dr Simon Marais, a physicist who was a contrarian asset manager in South Africa and Australia. He maintained a passionate interest in mathematical problem solving after completing a PhD in Theoretical Physics in 1991. Dr Marais passed away in 2015.
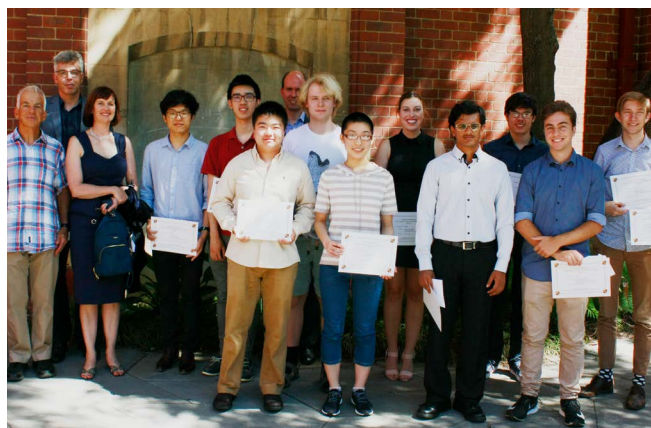
The competition aims to encourage creative mathematical problem-solving among undergraduate students, identify talented students across the Asia-Pacific region, forge links between academics in the region, and promote healthy competition among students as well as between universities.

Pictured: Australian winners at prize-giving ceremony on 20 Feb, 2018

The competition is held in October and students sit the exams at their home universities. It is open to any undergraduate student at a pre-registered University located between New Zealand Standard Time and Indian Standard Time, who has sat the exam at most three times previously.

Students compete as a pair or individually for prizes and there are also prizes for the top Universities. The University of Melbourne was the best performing Australian University in both 2017 and 2018.

In 2017, 459 students participated in the competition. The University of Melbourne came second overall. Yong See Foo and Ilia Kucherov were awarded joint 5th prize in the individual competition.

In 2018, 891 students participated in the competition. The University of Melbourne came third overall and Ilia Kucherov won 5th prize in the individual competition.