

Alumni & Friends 2020

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

School of Mathematics
& Statistics

A message from the Head of School

I have never been more proud of my colleagues and our students than in this pandemic year. At the end of March, a few weeks into the first semester, the pandemic forced us to move all our activities online. Reflecting back, it is hard to fathom the enormous scope of the achievement that within a week all our teaching had moved online without having to cancel any subjects. Thousands of students have since attended online lectures, practice classes and computer labs taught by staff from our School who quickly adjusted to new technology.

It has also become clear what we have lost and took for granted. Online learning is a poor substitute for face to face interaction, and we cannot wait to get back to campus in the new year.

The pandemic brought positives as well. During the lockdown in Victoria our School held an online and informal Zoom meeting every morning, which brought together many staff from across our large and diverse School. This created a camaraderie that will stay with us forever.

By any other measure, our School has had a bumper year in 2020. Professor James McCaw was one of the trusted advisors of national and state governments, proposing policy measures based on rigorous mathematical modelling, and helping Australia to manage the pandemic so well. Professor Kari Vilonen from our pure mathematics group won the University of Melbourne's only ARC Laureate Fellowship on research in the Langlands program, a highly prestigious achievement and a confirmation of the importance of fundamental research.

Professor Kate Smith-Miles and colleagues won the first ever ARC Industrial Transformation Training Centre in the mathematical sciences in Australia. OPTIMA is a partnership between the University of Melbourne, Monash University, three international institutions, and 11 industry partners, spanning the key academic disciplines contributing to the field of optimisation.

We are also very proud of our two new ARC Future Fellows David Ridout and Michael Wheeler (both in mathematical physics) and five early career researchers who will soon start their recently awarded ARC Discovery Early Career Award in our School: Stephane Dartois (mathematical physics), Alexandr Garbali (mathematical physics), Xi Geng (Probability), Mingming Gong (data science) and Jesper Ipsen (mathematical physics).

Despite the financial challenges arising from the pandemic, we are proud to have been able to create four post-doctoral positions that will provide a lifeline and much needed continuity to recent PhD graduates, our future generation of talent to tackle the world's challenges and capitalise on its opportunities. We also maintain support for life-changing scholarships such as our prestigious Exceptional Talent Scholarship, the Ling Xei scholarship for cross-disciplinary research and the Kerry Landman Scholarship for high-achieving mathematics graduates who are passionate about education.

I would like to extend special thanks to Andrew Sisson and Helen Freeman who have continued their generous support for our School during this challenging year. This support was instrumental to the wellbeing of young people and made a real difference to their careers.

I wish you a vibrant and safe 2021!

Professor Jan de Gier



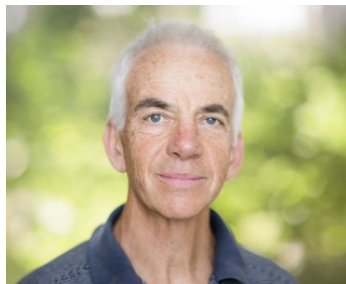
Staff promotions and prizes

Our staff continued to be recognised for their excellence through prizes and promotions in 2020.

Robert Maillardet and Stuart Johnston have been promoted to Lecturer (Level B). Douglas Brumley, Sandy Errey, Davis McCarthy and Yaping Yang have been promoted to Senior Lecturer (Level C). Stephen Leslie has been promoted to Professor (Level E).

Robert Maillardet was also highly commended for playing a critical role in the School's smooth transition to online teaching in the Dean's Award for Excellence for Teaching.

Member of the Order of Australia



Professor Emeritus Anthony (Tony) Guttman has been named a member of the Order of Australia (AM) for significant service to the mathematical sciences and education.

Tony was Director of the ARC Centre of Excellence for Mathematics and Statistics of Complex Systems (MASCOS), and jointly established the Australian Mathematical Sciences Institute (AMSI) in 2001, which is now a national collaborative organisation. From 1988-2017 he was Professor of Mathematics at the University of Melbourne. During that time, he had appointments as Head of Department, Deputy Dean of Science, and President of the Australian Mathematical Society.

Tony is internationally renowned for his outstanding research contributions to computational applied mathematics. His research is in mathematical studies of critical phenomena, with emphasis on numerical and combinatorial problems that arise in modelling phase transitions.

Tony is also known for his generosity of spirit and mentoring. For more than 20 years Tony has been the main organiser of the University of Melbourne School Mathematics Competition for school students throughout Victoria, helping to inspire and challenge the next generation of mathematicians.



Academy of Science Fellow

Professor Aurore Delaigle was elected as Fellow of the Australian Academy of Science in recognition of her scientific achievements as well as leadership and mentorship capabilities.

Aurore is internationally known for her innovative contributions to mathematical statistics, where she has made transformative contributions in several statistical subfields, including functional data analysis and measurement error.



JH Michell Medal and Christopher Heyde Medal

Associate Professor Jennifer Flegg has been awarded the Christopher Heyde Medal and the JH Michell Medal for an outstanding record of research by an early career researcher in applied mathematics.

Two of her key contributions are developing mathematical models of the spread of resistance to the drugs used to treat malaria and developing experimentally-validated mathematical models which provide biological insight into tissue repair in chronic wounds and allow assessment of treatment therapies.



Statistical Society of Australia Awards

Dr Alison Harcourt AO, a lifelong supporter of the Statistical Society of Australia and contributor to the statistical discipline, was nominated for Honorary Life Membership in recognition of her inspiring career, remarkable achievements, and dedicated service.

Professor Ian Gordon has been awarded a Service Award in recognition of sustained and significant service to the Statistical Society of Australia. He served on the Victorian Branch Council for 11 years and was president from 2009 to 2010.



Superstars of STEM

Associate Professor Kim-Anh Le Cao has been selected as one of Australia's 60 new women superstars of science, technology, engineering and mathematics (STEM).

The program aims to increase the visibility of women in STEM and encourage girls and young women to aspire to an exciting STEM career.

Research fellowships

Laureate Fellowship



Professor Kari Vilonen has been awarded a highly prestigious five-year Australian Research Council Laureate Fellowship, to address deep and longstanding questions about real groups, algebraic objects which describe the basic symmetries occurring in nature.

The study of these basic symmetries is central in all areas of mathematics and they arise in many applications. The expected outcomes include solving a central 50-year-old problem of unitarity as well as making major progress in the Langlands program, a grand unification scheme of mathematics that makes connections between number theory and geometry. The benefits include raising Australia's international research profile and building a large network of international collaboration with top institutions in the world.

Future Fellowships



Doctors David Ridout (top left) and Michael Wheeler (bottom left) have been awarded four-year Australian Research Council Future Fellowships.

Conformal field theory provides powerful methods for attacking problems in theoretical physics and furnishes beautiful connections between branches of pure mathematics. David Ridout's project aims to greatly expand our knowledge of the logarithmic conformal field theories. Advancing these theories is crucial to progress in high-energy physics and pure mathematics.



Exactly solvable stochastic processes have cross-disciplinary links to quantum physics, quantum algebras and probability theory. Michael Wheeler's project aims to significantly expand our knowledge of exactly solvable stochastic processes by extending them to new algebraic frameworks. These theoretical developments allow better prediction of randomly growing interfaces from tumour growth to forest fires.

New professor - Stephen Leslie



Stephen Leslie is a statistical geneticist with a background in mathematics and statistics. Stephen has an undergraduate degree from the Australian National University, with an honours thesis in pure mathematics. He switched disciplines for his doctorate, moving into statistical genetics at the University of Oxford, working with Prof. Sir Peter Donnelly FRS, a leading figure in the field. After completing his D.Phil. in 2008, he held various post-doctoral positions at Oxford. In 2012 he returned to Australia to establish his own research group at the Murdoch Childrens Research Institute and in 2016 he joined Melbourne Integrative Genomics at the University of Melbourne.

Stephen has made significant contributions in developing and applying novel statistical approaches to detecting and understanding fine-scale genetic variation in human populations and how that variation relates to the history and demography of populations. He has also made major methodological contributions to understanding genes central to human immunity. He has applied his methods to high-profile studies of human disease and health. His ongoing interests include studies of Indigenous Australian genomics; work on the causes of multiple sclerosis and other autoimmune diseases; fundamental methods for analysing genome-scale data; and understanding the genetics of the immune system.

Stephen taught extensively at the University of Oxford in both graduate and undergraduate courses. In 2009 he won the University of Oxford's Teaching Excellence Award. In 2016 Stephen was awarded the Woodward Medal in Science and Technology, the University of Melbourne's highest award for research by faculty members. In 2019 Stephen was awarded the Moran Medal of the Australian Academy of Science, which is awarded for outstanding research by scientists up to 10 years post-PhD.

In his spare time Stephen enjoys spending time with his daughter and playing tennis and guitar (independently and, he notes, in both cases poorly).

Melbourne Centre for Data Science

“Data is everywhere” isn’t a new or shocking statement in 2020. It is abundantly clear, especially given the year that has been, that collection, analysis, and use of data touches almost everything in our modern lives and holds the potential for big change, positive or negative.

As the world continues to move deeper into a data driven space, the value of quality research, advancement and training is increasing. The interdisciplinary melding of mathematical and statistical methods and computational analysis hatched what we now know as data science. While mathematics, statistics and computer science are the base, data science is often called the great unifier as it encourages the collaboration of interdisciplinary research, the engagement of subject matter experts and the cohesion of skilled, diversified teams in order to best solve complex problems. To create this environment, a new University research centre, the Melbourne Centre for Data Science (MCDS) has been established as a joint initiative from the School of Mathematics and Statistics and the School of Computing and Information Systems.

It is imperative that the foundations of the data science field be continuously studied, researched, analysed, reviewed, and challenged in order to best inform future applications and outcomes. Indeed, at its core, mathematical and statistical expertise underlies the ability to extract information from data in all areas. While the processing of the massive influx of data has already led to major breakthroughs, both scientifically and in informed decision-making, the influx has also spawned new challenges; the circular demand on advancements in theory and methodology continues. At MCDS the focus is on this deep core research, while enabling collaboration across all disciplines and sectors.



Soon to be located in the new Melbourne Connect building (pictured), MCDS aims to build a hub to create a focus around data science research, training, and engagement activities. Fitting perfectly into the ethos of the Innovation Precinct, MCDS will be surrounded not only by academic rigour but entities from the private and public sector. Expanding the possibilities of engagement and collaboration opens up options for diverse teams to work on deep projects, an allowance not necessarily available to those directly employed in industry - diverse teams means diverse research outputs that benefit a wide audience.

This work feeds back to the ever-growing cohort of Master of Data Science students, through to the new MCDS Doctoral Academy, to the MCDS Seed Funding Program and out into all the other programs, projects and activities the Centre is running.

To find out more about MCDS, visit science.unimelb.edu.au/mcdis or contact us at mcdis@unimelb.edu.au

Obituary - Professor Omar Foda



It was with great sadness that we learned of the passing of our colleague and friend Professor Omar Foda on 4th May 2020 after a long illness.

Omar was born in Cairo, Egypt on 18th March 1953. He obtained a BSc degree in Electrical Engineering from Cairo University in 1975, an Honours level degree (Part III of the Mathematical Tripos) in mathematical physics from Cambridge University in 1979, and a PhD on renormalization in quantum field theory from Purdue University, USA, in 1983.

His first postdoctoral position was at ICTP, Trieste, Italy from 1983 to 1985. From 1985 to 1991 he held Research Fellowships at the State University, Utrecht and the Catholic University, Nijmegen, both in The Netherlands. He joined the University of Melbourne as a lecturer in 1992 and was promoted to Professor in 2010.

Omar’s research expertise was in mathematical physics, in particular on the application of combinatorics and integrable models to quantum spin chains, conformal and quantum field theory, and string theory. Omar’s collaborations with distinguished academics around the world, especially in Japan, earned him lifelong deep respect from that community.

Omar worked actively on his research projects until the very end, supervising two research associates and two students (an MSc student and a PhD student) by email and skype. His most recent work on WZW conformal blocks was published in the journal Nuclear Physics B in July 2020.

Omar was widely known as a deeply caring supervisor of students, a committed teacher and lecturer, a supportive and helpful friend and colleague, and a man of the utmost integrity. His colleagues will long cherish his memory.

Omar is survived by his wife Marleen and his two children Adel and Sarah, both of whom are alumni of our School, and his granddaughter Audrey.

Maths and statistics outreach

At the end of 2019, the Outreach team began to create new programs and initiatives to engage students across the entire pipeline (from primary school to master's level) in mathematics and statistics. The new team, Hayley Ellul, Paul Fijn, Susan James and Sam Povall, each specialise in a different area of mathematics, statistics and education, allowing them to create activities that will appeal to all students.

Unfortunately, due to COVID-19, all in person outreach programs were cancelled in 2020. However, the Outreach team were able to adapt and ran most of their programs virtually. Their two flagship programs Micro Mathematicians and the inaugural Research Competition were a virtual success. Both programs attracted the interest of more than 1000 students in Victoria.

Micro Mathematicians, an extension program aimed at students in grades 5-8, introduced research mathematics, allowing students to apply their knowledge beyond the classroom.

The Research Competition, a 12-week project-based competition, aimed at students in grades 7-12, allowed students to investigate, experiment, analyse and discuss a chosen research question to give them an insight into the life of a mathematician. An example of a research question for grade 7-9 students is shown below. The ten finalists presented their research projects via Zoom. If you would like to check out the winners of the 2020 Research Competition, all the projects of the finalists can be found at ms.unimelb.edu.au/engage/mathematics-and-statistics-research-competition

The Outreach team are building on the success of their virtual 2020 programs and will be expanding the reach to allow all students in Australia to apply in 2021. For this, we need your help.

Question 7 - Transformations

Given two mappings:

$$T_1(x) = 2 - \frac{1}{x} \quad \text{and} \quad T_2(x) = 1 - \frac{1}{x},$$

and their inverses

$$T_1^{-1}(x) = \frac{1}{2-x} \quad \text{and} \quad T_2^{-1}(x) = \frac{1}{1-x},$$

create a method (if one exists) to reduce any fraction $\frac{a}{b}$, where a and b are integers, to 0.

1. If you know of an interesting mathematical or statistical topic that you think would inspire the next generation of students, send it to the Outreach team. Together, you may be able to help design a question for the next research competition or create a real-life problem solving activity to use in a workshop.

2. The Outreach team are continually informing students about the importance of studying mathematics and statistics. We discuss where our alumni are now, as well as the interesting careers they've had since their time at Melbourne. Contact us if you are interested in taking part in a presentation or providing your written career profile for our career website.

To contact the outreach team, please email: ms-outreach@ms.unimelb.edu.au

Public lectures

In 2020 the School hosted two public lectures, the first at the University of Melbourne and the second run virtually via Zoom. Both talks were very well attended.



The first talk was held in March, titled 'Statisticians: The Quiet Heroes of Research', by Dr Rheanna Mainzer (top left). Rheanna is a former Level A lecturer in our School and is now a Postdoctoral Researcher at Murdoch Childrens Research Institute. Rheanna talked about what a statistician does - and why it matters - to demonstrate that statistics is much more than crunching numbers. She shared some of her favourite stories from lottery scandals to tea tasting etiquette that champion mathematics and statistics



The second talk was held in September, titled 'Random Matrix Theory: A tale of drums, earthquakes and mobile phones', by Dr Mario Kieburg (bottom left) of our School. Mario talked about random matrix theory and how it is a versatile mathematical tool for modelling and statistical analysis. Mario discussed applications of random matrices to harmonic resonances in musical instruments, patterns that earthquakes can create under cities like Mexico City, and wireless telecommunications.

Online teaching in 2020

2020 began with all our classes on campus as normal, but two weeks into semester 1 we had to transition all our classes online. Within a week, we moved all lectures, tutorials, workshops and computer labs online.

Fortunately, some members of our School (in particular Robert Maillardet) had been laying the groundwork for fully online classes since the early signs of a possible pandemic in February, and this paid off. Mathematics and Statistics managed the rapid transition to a 'virtual campus' very well in comparison to other schools in the University.

Lectures were delivered either as pre-recorded videos, live lectures via Zoom, or a combination of both. Tutorials, computer labs and workshops were run in Zoom. In tutorials, students worked on the week's questions together in groups of 2-3 students, in breakout rooms on virtual whiteboards. While there were certainly technical challenges for students and tutors to overcome, this model of online tutorials allowed us to retain the groupwork, collaboration and active learning which have been hallmarks of our undergraduate tutorials over the last decade.

Assessment formats and submission methods also had to change as submitting work into assignment boxes and sitting exams at the Exhibition buildings was not possible. Students had to sit their exams at home, supervised over Zoom. Students uploaded pdfs of their handwritten solutions to assignments and exams to the subject website, and tutors marked the work entirely online.

Our School received excellent feedback from students on how well we handled the transition to online learning. Teaching continued entirely online throughout 2020, but we hope to return to in-person classes in 2021.



Image: A tutorial class before COVID-19

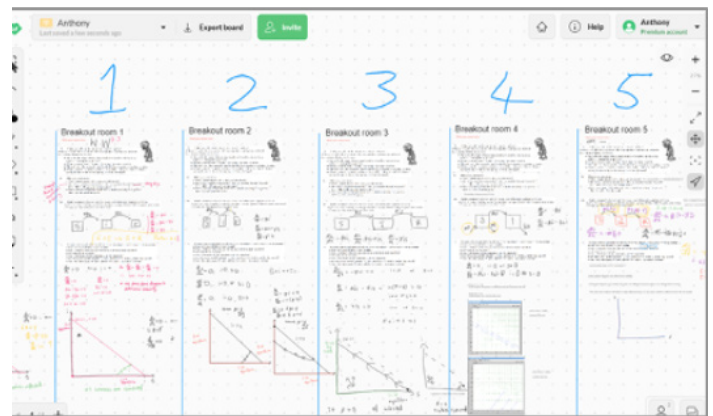
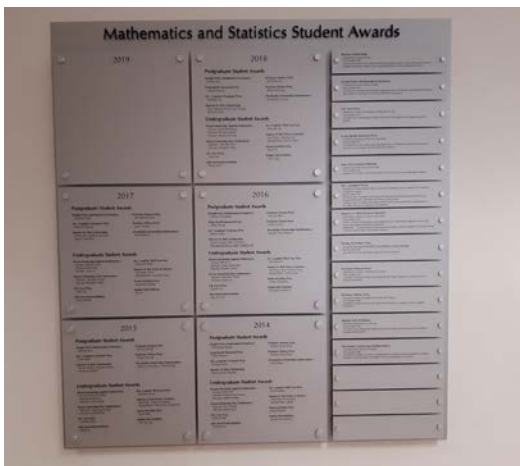


Image: An online whiteboard from a tutorial class in 2020

Maths and statistics student prize board



A Mathematics and Statistics student prize board was installed in the main corridor of the Peter Hall building near the Kerry Landman Room on the 27th March 2020 (last day building was open). The 2019 prize winners will be added to the board when the Peter Hall building reopens.

The prize board shows the prize winners for the last 6 years as well as a brief description of the prize, when it was first awarded and the donor. A full listing of the prize winners is also available at ms.unimelb.edu.au/engage/student-awards

Individual perpetual prize boards will be also made for the major awards such as the Exceptional Talent, Helen Freeman and Kerry Landman scholarships.