



**AUSTRALIAN INSTITUTE OF PHYSICS
TEACHERS' GUILD OF NEW SOUTH WALES
THE ROYAL SOCIETY OF NEW SOUTH WALES
ROYAL AUSTRALIAN CHEMICAL INSTITUTE**

Presents

Frontiers of Science Forum

Friday 22 March 2024

Concord Golf Club, 190 Majors Bay Road, Concord

Exploring major discoveries and theories in physics, mathematics, biology and chemistry at this year's combined AIP, TGNSW, RSNSW and RACI meeting

Ever since the Copernican revolution in the 15th century science has been progressing at an exponential rate. Major discoveries and theories in physics, mathematics, biology and chemistry, have shaped and continue to grow at an exponential rate. The Frontiers of Science forum will have a group of international experts to give brief talks on the latest and future developments in their fields of knowledge.

Presenters:

Professor John Mattick AO FAA FTSE FAHMS FRSN HonFRCPA, Professor of RNA Biology, University of New South Wales, Sydney.

Dr Renee Goreham, University of Newcastle, School of Information and Physical Sciences.

Professor Katrina Jolliffe, University of Sydney, Associate Dean (Research), Professor of Chemistry.

Associate Professor Richard Garner, Macquarie University, School of Mathematical and Physical Sciences.

Schedule:

- 5:15pm Refreshments and Networking
- 6:00pm Welcome – Dr Frederick Osman FAIP FTGN FRSN FACE
- 6:10pm Presentations (25-minutes each)
- 8:20pm Panel Discussion and Q/A with Ian Woolf (Diffusion Radio)
- 9:00pm Vote of Thanks and Close

Frontiers of Science Forum is proudly supported by Laboratories Credit Union



<https://www.lcu.com.au/>

AT A GLANCE

PRESENTERS:

Professor John Mattick AO FAA FTSE FAHMS FRSN HonFRCPA
Professor of RNA Biology,
University of New South Wales,
Sydney

Dr Renee Goreham, University of Newcastle, School of Information and Physical Sciences

Professor Katrina Jolliffe, University of Sydney, Associate Dean (Research), Professor of Chemistry

Associate Professor Richard Garner, Macquarie University, School of Mathematical and Physical Sciences

WHEN:

Friday 22 March 2024

TIME:

**5.15pm refreshments
6.00pm presentations**

LOCATION:

Concord Golf Club, 190 Majors Bay Road Concord

COST:

\$25.00
Includes canapés

R.S.V.P:

[Click Here](#)
to register online
By **Thursday 21st March 2024**

ENQUIRIES:

Dr Frederick Osman
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PRESENTERS AND ABSTRACTS:

Professor John Mattick AO FAA FTSE FAHMS FRSN HonFRCPA The misunderstanding of molecular biology

It has been assumed for decades that genes mainly encode proteins and that the mechanisms controlling human development are the same as those that regulate microbial physiology. It was a shock to find that less than 2% of the human genome encodes proteins and that the number (about 20,000) and repertoire of human protein-coding genes are similar to a worm that only has 1,000 cells. While initially dismissed as 'junk', most of the human genome is in fact dynamically transcribed to produce large numbers of RNAs that do not encode proteins. These RNA are expressed from hundreds of thousands of enigmatic genetic loci called 'enhancers', which control the spatiotemporal patterns of gene expression using sophisticated mechanisms that involve liquid crystal physics and a plethora of feed-forward epigenetic modifications to direct the trillions of cell fate decisions that must be made with high precision between conception and adult

Dr Renee Goreham

Don't Hold Your Breath: Revolutionising Disease Diagnosis through Nanotechnology

The urgent need for early detection of diseases, particularly in cases like lung cancer where symptoms often manifest late, underscores the significance of robust diagnostic methods. Presently, there is no established screening process for lung cancer before symptoms emerge, leaving patients at a disadvantage. Our research introduces an innovative approach harnessing nanotechnology to detect lung cancer using the simple act of breathing. Our ground-breaking method focuses on identifying cancer-specific particles, naturally occurring nanoparticles found in breath, as diagnostic markers. We now aim to engineer a portable and cost-effective device. We have successfully published a proof of concept and are currently advancing towards developing a prototype. Envision a future where lung cancer diagnosis occurs earlier, even before symptoms manifest, by merely analysing one's breath. More exciting are the applications for this work in viral and bacteria detection.

Professor Katrina (Kate) Jolliffe

Taking inspiration from Nature: Design and applications of selective anion receptors

Prof Kate Jolliffe's research is focussed on the design and development of novel molecular structures capable of selectively binding, sensing, extracting and transporting negatively charged species (anions). These systems have numerous applications in areas as diverse as the environment and medicine. Most of these applications require anion recognition to occur in a competitive aqueous environment, but the design of receptors capable of selective binding to anions in water is fundamentally difficult to achieve. We take inspiration from the anion binding proteins in Nature to design synthetic anion receptors that range in structure from small peptides to large macrocycles and combine both natural and non-natural binding motifs. We then exploit their selectivity in a range of applications.

Associate Professor Richard Garner

Computer games and games for computing

It is a well-known caricature, and one firmly rooted in fact, that mathematicians like playing games. Typically, this is taken to mean something wholesome like backgammon rather than, say, World of Warcraft, but this raises the question: does mathematics have anything to say about computer games? In this talk I will fail to answer this question, but say quite a bit about a related one, by explaining how mathematical games have quite a lot to say about computing. Rather than just a bit of fun, this kind of thing turns out to be extremely important for things like verification of robustness and security of mission-critical code.

BIOGRAPHIES:

Professor John Mattick is the Professor of RNA Biology at UNSW Sydney. He was previously the Foundation Director of the Institute for Molecular Bioscience at the University of Queensland, Foundation Director of the Australian Genome Research Facility, Director of the Garvan Institute of Medical Research, and Chief Executive of Genomics England, where he developed the 2019-2023 UK National Vision and Plan for Genomic Healthcare. Professor Mattick is best known for showing that most of the human genome is not junk, as previously thought, but rather is devoted to controlling human development. He has published over 300 scientific articles, which have been cited over 98,000 times. His honours and awards include the Australian Government Centenary Medal, the International Union of Biochemistry and Molecular Biology Medal, the University of Texas Bertner Award for Distinguished Contributions to Cancer Research, and the Human Genome Organisation Chen Medal for Distinguished Achievement in Human Genetics and Genomic Research.

Dr Renee Goreham is a Senior Lecturer in physics at the University of Newcastle, is a leading expert in NanoBiotechnology. Having earned her PhD in 2014 from the University of South Australia, she has since held notable post-doctoral positions at Flinders University, the University of South Australia, and Victoria University of Wellington. In 2019, Dr Goreham joined the University of Newcastle, where her outstanding contributions were acknowledged with the Women in Research Fellowship in 2020. Her research deeply rooted in NanoBiotechnology allows for multidisciplinary research teams to form. In 2023, she was awarded the AIP NSW Community Outreach Award in Physics for her contributions to disseminating science to the community.

Professor Katrina (Kate) Jolliffe is a supramolecular chemist received her BSc (1993) and PhD (1997) from the University of New South Wales. She held positions at Twente University, The Netherlands; the University of Nottingham, UK and the Australian National University before moving to the University of Sydney in 2002 as an Australian Research Council QEII fellow. She currently holds the position of Payne-Scott Professor at The University of Sydney, is the Associate Dean (Research) for the Faculty of Science and the NSW Node Leader for the Australian Research Council Centre of Excellence for Innovations in Peptide and Protein Science (CIPPS). She is a Fellow of the Australian Academy of Science and has been awarded the Beckwith (2004), Biota (2006), Birch (2017), H. G. Smith (2018) and Margaret Sheil (2021) medals of the Royal Australian Chemical Institute and the Royal Society of Chemistry Macrocylic and Supramolecular Chemistry award (2023).

Associate Professor Richard Garner is an Associate Professor in Mathematics at Macquarie University, Sydney. He grew up in the UK, received his PhD in 2006 from the University of Cambridge, and spent some time on the postdoctoral circuit in Europe before joining Macquarie in 2011. He still says "whilst" rather than "while" but has at least learned to use the word "heaps" heaps. His research is in the mathematical area of category theory, which looks for patterns appearing across different areas of mathematics, theoretical physics, and computer science, and creates new languages for studying them. This research has been recognised, by among other things, his award of the Medal of the Australian Mathematical Society in 2017. He is also a keen teacher, and has tremendous fun explaining discrete mathematics and calculus to first- and second-year computing and engineering students; last year this was recognised through his receipt of a Vice-Chancellor's Student-Nominated teaching award.

**Complimentary Parking:
Concord Golf Club grounds. 190 Majors Bay Road, Concord**