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

Presents

Frontiers of Science Forum

Friday 12 March 2021

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 and RACI meeting

Ever since the Copernicun 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:

Dr Cathy Foley AO PSM, Introductions as Chief Scientist of Australia

Professor Judith Dawes, Macquarie University, Department of Physics and Astronomy, MQ Photonics Research Centre – Sensing with nanoparticles and random lasers

Dr Daniel Mansfield, The University of New South Wales, School of Mathematics and Statistics – New Arithmetic from Ancient Mesopotamia

Professor Antoine van Oijen, The University of Wollongong, Director, Molecular Horizons – Microbes, microscopes, and molecules: the molecular machines of life under the magnifying glass

Dr Markus Müllner, The University of Sydney, School of Chemistry – Architects at the nanoscale – how modern polymer chemistry advances technology

Schedule:

5:15pm	Registration and Refreshments
6:00pm	Welcome – Dr Frederick Osman FAIP FTGN FRSN FACE
6:05pm	Presentations
8:00pm	Panel Discussion and Q/A with Ian Woolf (Diffusion Radio)

AT A GLANCE

PRESENTERS:

Dr Cathy Foley AO PSM, Introductions as Chief Scientist of Australia

Professor Judith Dawes Macquarie University, Department of Physics and Astronomy

Dr Daniel Mansfield, Academic Mentor, The University of New South Wales, School of Mathematics and Statistics

Professor Antoine van Oijen The University of Wollongong, Director, Molecular Horizons

Dr Markus Müllner The University of Sydney, School of Chemistry

WHEN:

Friday 12 March 2021

TIME:

5.15pm refreshments
6.00pm presentations

LOCATION:

Concord Golf Club, 190 Majors Bay Road Concord

COST:

$15.00
Includes canapés and beverages

R.S.V.P:

Click Here to register online
By **Thursday 11th March 2021**

ENQUIRIES:

TGNSW Secretariat
02 9160 8199
secretary@teachersguild.nsw.edu.au

PRESENTERS ABSTRACT:

Professor Judith Dawes
Sensing with nanoparticles and random lasers
The sensitive and quantitative detection of trace amounts of specific molecules is important in areas such as biomedical diagnosis. Nanoparticles can be readily introduced into various solutions and tissue samples to enable sensitive detection, and can be located and observed with light. We have investigated the collective phenomena that arise in random lasers consisting of nanoparticles mixed with various optical gain materials. The laser action amplifies the optical response, leading to improved detection of trace molecules in solution.

Dr Daniel Mansfield
New Arithmetic from Ancient Mesopotamia
Mathematics is said to have begun long ago in ancient Mesopotamia, also known as the cradle of civilization. This culture had slipped into legend until the late 19th century when archaeologists uncovered thousands upon thousands of clay documents from lost cities such as Sippar, Lasa, and Babylon. Amongst these were mathematical and geometric texts, many are yet to be translated and some are surprisingly advanced. This talk introduces new discoveries regarding their unique form of base-60 arithmetic.

Professor Antoine van Oijen
Microbes, microscopes, and molecules: the molecular machines of life under the magnifying glass
All living organisms are made up of cells, the tiny building blocks that each themselves consist of a mix of biological molecules, such as proteins, DNA and lipids. The organisation and housekeeping of a cell is controlled by proteins, little machines that coordinate thousands of specialized tasks at the microscopic level. What seemed to be science fiction a few decades ago has become reality: using powerful microscopes with lasers and ultrasensitive cameras we are now able to visualise individual proteins and watch them do their various jobs. In my presentation, I will describe how we use these so-called 'single-molecule' techniques to visualize one of the processes fundamental to life: the copying of DNA. Further, I will show how we use these tools to visualise how bacteria become resistant to antibiotics and how we develop approaches to deal with this rapidly growing health crisis.

Dr Markus Müllner
Architects at the nanoscale – how modern polymer chemistry advances technology
The year 2020 marked the 100th anniversary of the first scientific publication on polymerisation (the synthesis of polymers). Polymers have since become irreplaceable in our daily lives. While many commodity polymers (think plastics) haven't changed much since their discovery almost a century ago, modern day polymers are fast becoming integral components for revolutionary advances in health and energy. The ability to precisely tune polymer composition and architecture allows researchers to progress the frontiers of personalised medicine, batteries and sustainability. In this talk, I will highlight recent progress in these areas and share some of our own research findings. I will also provide an outlook on the future of the polymer field.

BRIEF BIOGRAPHIES:

Dr Cathy Foley commenced as Australia's ninth Chief Scientist in January 2021.Dr Foley was appointed to the role after a lengthy career at Australia's national science agency, the CSIRO; she was appointed as the agency's Chief Scientist in August 2018, the second woman to hold that role. Dr Foley's career in physics began with her PhD at Macquarie University on the semiconductor indium nitride. She and her colleagues were one of the first groups to carry out pioneering research that examined the properties of indium nitride in light-sensitive devices, the best-known application being white light emitting diodes used for household low energy lighting.

Judith Dawes is Professor of Physics at Macquarie University and Director of MQ Photonics Research Centre. She is Treasurer for Science and Technology Australia and she is a former President of the Australian Optical Society. She is active in promoting Women in STEM and is a Fellow of SPIE and OSA, major international Optics societies. She graduated with a BSc (Hons) and PhD from the University of Sydney, and has worked in the Laboratory for Laser Energetics, University of Rochester, NY, USA, and at the University of Toronto, Ontario, Canada, before returning to Australia to take up a position at Macquarie University.

Dr Daniel Mansfield has been lecturing in the UNSW School of Mathematics and Statistics since 2015. His particular interest is in how to best use technology to enhance learning and teaching. He is an inspiring educator who has received many teaching awards, such as the KPMG Inspiring Teacher Award in 2017 and the AustMS Teaching Excellence Award (Early Career) in 2018. He is notable for his research with prof. Norman Wildberger on the famous Plimpton 322 tablet, and more recently for his work on Mesopotamian geometry and land measurement.

Professor Antoine van Oijen obtained his BSc and PhD degrees in the Netherlands, where he was trained as a physicist. After having established research labs at Harvard Medical School in the USA and Groningen University in the Netherlands, he moved to the University of Wollongong (UOW) in 2014. He was awarded a prestigious Laureate Fellowship by the Australian Research Council to develop powerful microscopes that can make movies of the molecular processes that define life, down to the level of single molecules. As the driver behind UOW's newly established Molecular Horizons institute, he is bringing together researchers from various disciplines to transform our approach to understanding and tackling disease.

Dr Markus Müllner received his PhD in polymer chemistry at the University of Bayreuth, Germany. Markus is a Senior Lecturer in the School of Chemistry at The University of Sydney and heads the *Polymer Nanostructures Group* (@PolymerNano on Twitter) within the Key Centre for Polymers and Colloids. He currently holds a prestigious Future Fellowship by the Australian Research Council, serves on the international advisory boards of leading publications in his fields of research and is regularly invited to speak at international chemistry conferences. Since 2019, he is the Chair of the Royal Australian Chemical Institute's NSW Polymer Group and part of the steering committee for the annual Australasian Polymer Summer School.

Complimentary Parking:
Concord Golf Club grounds. 190 Majors Bay Road, Concord (Entry via Flavelle Street)