



**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 25 March 2022**

**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, RSNWS 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:**

**Hon Alister Henskens SC MP**, Minister for Science, Innovation and Technology, Minister for Skills and Training

**Professor Andrea Morello**, University of New South Wales, School of Electrical Engineering and Telecommunications – Building a Quantum Computing Lab from the Fundamental Constants of Nature

**Professor Chris Tisdell**, University of New South Wales, School of Mathematics and Statistics – Beyond the Compass: Exploring Geometric Constructions via Circle Templates and a Straightedge

**Professor Dr. Johannes le Coutre, FRSN**, University of New South Wales, School of Chemical Engineering – From Botanists and Butterflies to Populations and Planets

**Professor Martina Stenzel**, University of New South Wales, ARC Future Fellow, School of Chemistry – Going small to make big impacts in medicine: nanomedicine

### **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:**

**Hon Alister Henskens SC MP**  
Minister for Science,  
Innovation and Technology,  
Minister for Skills and Training

**Professor Andrea Morello**  
University of New South  
Wales, School of Electrical  
Engineering and  
Telecommunications

**Professor Chris Tisdell**,  
University of New South  
Wales, School of Mathematics  
and Statistics

**Professor Dr Johannes le  
Coutre**, University of New  
South Wales, School of  
Chemical Engineering

**Professor Martina Stenzel**  
University of New South  
Wales, School of Chemistry

#### **WHEN:**

**Friday 25 March 2022**

#### **TIME:**

**5.15pm refreshments  
6.00pm presentations**

#### **LOCATION:**

**Concord Golf Club, 190 Majors  
Bay Road Concord**

#### **COST:**

**\$15.00**  
Includes canapés

#### **R.S.V.P:**

[Click Here](#) to register online  
By **Monday 21st March 2022**

#### **ENQUIRIES:**

TGNSW Secretariat  
02 9160 8199  
[secretary@teachersguild.nsw.edu.au](mailto:secretary@teachersguild.nsw.edu.au)

## **PRESENTERS ABSTRACT:**

### **Professor Andrea Morello**

#### **Building a Quantum Computing Lab from the Fundamental Constants of Nature**

Quantum computers hold the potential to solve intractable computational tasks, thanks to their ability to encode and process an exponentially large amount of information. Their practical implementation is becoming a reality, both in academia and in industry, with many different ideas being put to the test to build the ultimate computing machine. And yet, every time we see a media coverage on quantum computing, the images always look the same: a shiny refrigerator, a maze of high-frequency cables, some nanoscale device at the bottom of it. Why? In this talk I will explain how the values of certain fundamental constants of Nature – the Planck constant, the electron charge, the speed of light, etc. – conjure up a set of inescapable constraints on the type of equipment necessary to operate a quantum computer. I will illustrate this by giving a virtual tour of the Fundamental Quantum Technologies Laboratories at UNSW, in the hope of clearing some of the “mysteries” around quantum computers and how they work.

### **Professor Chris Tisdell**

#### **Beyond the Compass: Exploring Geometric Constructions via Circle Templates and a Straightedge**

For thousands of years, the compass and straightedge tools have dominated the learning and teaching of geometry. As such, these inherited, long-standing instruments have gained a lustre of naturalized pedagogical value. However, mounting evidence suggests that many learners and teachers struggle to efficiently, effectively and safely use compasses when constructing geometric figures. Compasses are difficult for learners to use, can lead to inaccurate drawings, and can be dangerous. Thus, there is value in reconsidering the role of the compass in the learning and teaching of geometric constructions and to offer better tools as alternatives. The purpose of this work is to address the aforementioned need by proposing an alternative tool to the compass that is safer, more efficient and more effective. We will argue that a circle arc template forms such an alternative tool, and we will illustrate how learners and teachers can add value to their classrooms by using it in conjunction with a straightedge to establish the well-known constructions seen in geometry curricula around the world.

### **Professor Johannes le Couteur**

#### **From Botanists and Butterflies to Populations and Planets**

Life Sciences make up for the most stimulating and intellectually challenging endeavours of the 21<sup>st</sup> century - and there is probably little dispute with this statement. Being the *Science of Life*, Biology has come a long way. Having started as a purely empirical activity in the pursuit of beauty or even a *vis vitalis* (living force) early biologists catalogued plants and animals. Throughout several centuries this activity has developed into the dominating branch of all-natural sciences. Biology today is a global high-tech endeavour featuring a wealth of sub disciplines and research fields with massive involvement of both industry and academia. Moreover, as we have seen in other sciences such as Physics or Chemistry, Biology evolves from a purely investigative science into an area of creative engineering, where the discoveries made are being put into tangible innovation. Interestingly, simple principles of biology, such as competition, collaboration and economy do apply not only to organisms but also to communities, populations and the workings of our entire planet.

### **Professor Martina Stenzel**

#### **Going small to make big impacts in medicine: nanomedicine**

One of challenges in the development of new drugs is the often unfavourable biodistribution: the drug is either quickly cleared from the body, is deactivated or is accumulation in organs where they do rather harm than good. Entrapping drugs into nanoparticle has shown to improve the treatment of many diseases. The first therapeutic nanoparticles that appeared on the market were designed to enhance the treatment of cancer, but more recently nanoparticle helped to vaccinate the world as mRNA vaccines are delivered in these tiny-nano-sized carriers. In this lecture we will briefly review the nature of various nanoparticles and discuss opportunities and challenges. We will look more in-depth at the nanoparticles already used in FDA approved formation. Finally, I will give an overview of current activities in this field in research labs.

## BRIEF BIOGRAPHIES:

**Andrea Morello** is the Scientia Professor of Quantum Engineering at UNSW Sydney (Australia), and a Fellow of the American Physical Society. He received his PhD from the University of Leiden in 2004, followed by a postdoc at the University of British Columbia. His group at UNSW has pioneered the use of donor spins for quantum information processing, demonstrating the first electron and nuclear spin qubits in silicon. For these contributions he received numerous awards, including the 2017 Landauer and Bennett Award for Quantum Computing. His interests further extend to quantum chaos, quantum foundations and quantum sensing.

**Professor Chris Tisdell** is an Honorary Professor of STEM & Digital Education at UQ (Brisbane). My significant and innovative contributions to the student experience have positively impacted millions of people around the world by exploring the challenges of scale, flexibility and personalized learning. For example, I lead Australia's earliest YouTube channel dedicated to learning mathematics, now in its thirteenth year of operation with more than 15 million views; and I have authored free e textbooks that have a global audience of more than 10 million readers. I am proud to collaborate with key partners within the education industry, ensuring continuous improvement and collaborative advantage therein.

**Professor Johannes le Coutre** joined the University of New South Wales (UNSW), Sydney in 2019 as a full Professor Food & Health. He is responsible for the UNSW Food program, and currently he is developing a broad research agenda on cellular agriculture. Johannes obtained a Ph.D. in Biophysics at the Max-Planck-Institute of Nutrition Physiology in Germany, where he identified intricate details of the reaction mechanism underlying light driven bacterial proton transport. With a Human Frontiers award, he went to the Howard Hughes Medical Institute at UCLA to investigate molecular mechanisms of membrane transport. In 2000 he was asked to build a research program on taste physiology at the Nestlé Research Center in Lausanne, Switzerland. His contribution and expertise have been pivotal in making the Nestlé work on taste perception and central integration internationally valued and recognized. From 2009 to 2017 le Coutre held a visiting Professorship at the University of Tokyo, where he has been involved with teaching and with a project on taste perception in the Elderly (Mikaku). Professor le Coutre is the founding Field Chief Editor for FRONTIERS in Nutrition, an open access journal by the Frontiers Media company.

**Professor Martina Stenzel** studied chemistry at the University of Bayreuth, Germany, before completing her PhD in 1999 at the Institute of Applied Macromolecular Chemistry, University of Stuttgart, Germany. She started as a postdoctoral fellow at UNSW in 1999 and is now a Scientia Professor in the School of Chemistry at UNSW as well as an ARC Laureate Fellow. Her research interest is focused on the synthesis of functional nanoparticles for drug delivery applications. Her team is working closely with medical researcher and together they develop new nanoparticles to improve the treatment of cancer. She is the editor in chief of Materials Horizons and currently serves on a range of editorial boards. She received a range of awards including the 2011 Le Fèvre Memorial Prize of the Australian Academy of Science.

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

