COMMONWEALTH
SCIENCE
CONFERENCE
2017 SINGAPORE

Speakers’ abstracts
Introduction

The Commonwealth Science Conference 2017 is co-organised by the Royal Society and the National Research Foundation Singapore, and supported by the Queen Elizabeth Diamond Jubilee Trust.

Over 400 scientists from a wide range of scientific disciplines and representing 37 Commonwealth countries have been invited to come together to showcase some of the best science from across the Commonwealth.

The objectives of the 2017 conference are to celebrate excellence in science throughout the Commonwealth; to provide opportunities for cooperation between researchers in different Commonwealth countries; to inspire young scientists, students and pupils; to build understanding about policy issues of common interest; and to encourage scientific capacity building in Commonwealth countries.

The conference is multidisciplinary, including physical sciences, life sciences, engineering and science policy. The programme will include plenary lectures by eminent Commonwealth scientists in a wide range of disciplines; parallel sessions on emerging infectious diseases, the future of the oceans, sustainable cities and low carbon energy; and panel discussions on science policy.

For more information please visit royalsociety.org/csc2017
Speakers’ abstracts
Sir Venki Ramakrishnan

Biography

Venki Ramakrishnan is the current President of the Royal Society and is a Group Leader at the Medical Research Council Laboratory of Molecular Biology in Cambridge, England. He is best known for his studies on the structure and function of the ribosome, the large molecule that translates genetic information to make proteins.

Venki determined the atomic structure of the 30S ribosomal subunit, as well as structures of the entire ribosome in many different states, which have led to an understanding of how the ribosome works. Ribosomes are essential to all life and are ancient molecules that have diverged in bacteria and humans. Many useful antibiotics work by specifically targeting the bacterial ribosome. Structures of the ribosome show how different antibiotics bind to the ribosome, and this work has been used by scientists to understand how they act and how to design improved antibiotics. More recently, he has used electron microscopy to visualise ribosomes in action in higher organisms, including in organelles like mitochondria. He has also studied the structure of histones, which package DNA into units called nucleosomes, and chromatin, which are a combination of DNA and proteins. His research has helped scientists to understand how DNA is organised in cells.

For his pioneering work, Venki was awarded the 2009 Nobel Prize in Chemistry along with Tom Steitz and Ada Yonath. He was also knighted in Britain in 2012 for his contributions to the field of molecular biology. Since his election to the presidency of the Royal Society, he has been leading its efforts to promote excellence in science, provide scientific advice to the British government and support international collaborations.
Emerging infectious diseases
Controlling the global threat of emerging infectious diseases – lessons from the Ebola outbreak

The West Africa Sub region was declared Ebola-free in March 2016 following from an epidemic in 2014 which caused 28,646 cases and claimed the lives of 11,323 people. Many interventions were carried out to bring the epidemic under control. These ranged from local community efforts, regional support from West Africa and efforts of the International/Global community. With the best of intentions, some of these efforts divided communities, further hampering control efforts and also led to export of infections to other countries far away from the index countries where the epidemic began. Could coordination of these efforts have been better done and are there any lessons to learn for the future? This presentation will address these issues.
Biography

Professor Yaw Adu-Sarkodie
Professor of Clinical Microbiology and Dean of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana

Yaw Adu-Sarkodie is Professor of Clinical Microbiology and Dean of the School of Medical Sciences at the Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana. He is actively involved in the training of undergraduate and Postgraduate students of Medicine, Nursing and Medical Laboratory Technology. He mentors students at both Masters and PhD level. He is a Consultant Clinical Microbiologist at the Komfo Anokye Teaching Hospital, Kumasi, Ghana.

He obtained his primary medical qualifications (MBChB) at KNUST in 1988, having previously obtained a BSc Human Biology from the same University in 1983 and intercalated in Medical Microbiology (BMedSci Hons) at the University of Sheffield, UK in 1984. In 1993 and 2004 he obtained MSc (Medical Microbiology) and PhD (Infectious and Tropical Diseases) respectively at the London School of Hygiene and Tropical Medicine. He also holds Fellowships of the Ghana College of Physicians (FGCP) and the West Africa College of Physicians (FWACP).

His research interests are in Emerging Infectious Diseases, Antimicrobial resistance and HIV key Populations. He has long standing research collaborations with the London School of Hygiene and Tropical Medicine, the University of Bonn and others and serves on many national and International committees on Infections.
Future of the oceans
Sink or Swim? – a review of South Africa’s ocean science programme: opportunities and challenges

The 2013 Intergovernmental Panel on Climate Change (IPCC) report, using CMIP5 and EMIC model outputs, suggests that the Atlantic Meridional Overturning Circulation (MOC) is very likely to weaken by 11-34% over the next century, with consequences for global rainfall and temperature patterns. However, these coupled, global climate models cannot accurately resolve important oceanic features such as the Agulhas Current and its leakage around South Africa, which these studies have suggested may act to balance MOC weakening in the future. To properly understand oceanic changes and feedbacks on anthropogenic climate change we need to substantially improve global ocean observations, particularly within boundary current regions such as the Agulhas Current. The South African science community, in collaboration with governing bodies and international partners, has recently established one of the world’s most comprehensive observational networks of a western boundary current system, measuring the Greater Agulhas Current System and its inter-ocean exchanges south of Africa. This observational network, through its design for long-term monitoring, collaborative coordination of resources, and skills sharing, represents a model for the international community. This paper highlights the current status of South African ocean sciences, where opportunities lie and more importantly provides an overview of the challenges that many researchers face.
Biography

**Professor Isabelle Ansorge**
Head of the Oceanography Department, University of Cape Town, South Africa

Professor Isabelle Ansorge is the Head of the Oceanography Department at the University of Cape Town, South Africa. Isabelle's research interests focus on the impact changes in the Antarctic Circumpolar Current in the Southern Ocean have on Subantarctic Islands and the impact on their ecosystem functioning. She has been involved as the South African co-ordinator for the highly prestigious and privately funded Antarctic Circumpolar Expedition (ACE). In addition, Isabelle is responsible for the hands-on sea going training of all postgraduate students at the University of Cape Town and heads up the highly successful SEAmester Class Afloat programme, which enables students from all South African universities and technikons to gain experience working at sea. Isabelle is also the Principle Investigator of the SAMOC-SA (South Atlantic Meridional Overturning Circulation) programme and has a large cohort of postgraduate students and postdocs working on the ocean variability around South Africa. Finally, Isabelle is the Vice President of the International Association for Physical Oceanography (IAPSO) and an Executive Bureau member on the International Union of Geodesy and Geophysics (IUGG).
Dr Amita Bhide

Sustainable cities
Framing social sustainability in the sustainable cities discourse: Completing the loop or disrupting it?

The criticality of cities to the future of the planet is now well established. It is also accepted that the ‘social’ is an important part of the sustainability discourse. There has been very little engagement with the concept of social sustainability. The few definitions that exist bound it by the city context and equate it with social cohesion. However, social sustainability, if it must carry any valence, needs to be seen beyond the confines of the city and social cohesion. It needs to include notions of justice and democracy and a space that links cities to non-cities and other places across the world. Defined in this broad manner, the consideration of the ‘social’ then does not just complete the missing link in the sustainability discourse but adds new tensions, complexities and disrupts the neat techno-economic visions of environmental sustainability. The paper argues that this is because of the fundamental problematique of the urban. Urbanization is produced through particular forms of socio-physical metabolism (Swyngedow,2004) and exploitation and injustice are embedded within at multiple scales. Defining social sustainability then is a political act. The presentation elucidates some of these complexities and suggests possible ways forward.
Biography

Dr Amita Bhide  
Professor and Dean, School of Habitat Studies, Tata Institute of Social Sciences

Amita Bhide is a faculty in the Center of Urban Planning, Policy and Governance in the School of Habitat Studies. She did her MA in Social Work, specialising in Urban and Rural Community Development in 1990 and has been engaged in teaching at the Institute for over sixteen years. A former faculty in the School of Social Work in the Department of Urban and Rural Community Development, she has been deeply involved in issues related to urban poor communities, community organization and housing rights movements and advocacy groups. She has also worked on issues of tribal development and rural governance. She has been involved in several Committees of the local and state government in addressing issues of housing and poverty. She is the recipient of the Inaugural fellowship of the India China Institute on New School University, New York.

Professor Bhide's recent work at the School of Habitat Studies has been on urban governance reforms, housing and land issues with a focus on small and medium towns. Her recent publications include *The Regularising State*, and *Comparing Informalities*. She also heads the M East Ward Social and Economic Transformation Program, an action research project that seeks to create a model of inclusive urban development in M East Ward, the poorest municipal ward in Mumbai.
Sir Philip Campbell

General issues of science, society and policy
Towards better science: supporting inclusivity and research-group integrity.

In this talk I will highlight two issues lurking behind the glowing promises of science, which between them point to ways in which academic research can become healthier as an enterprise. There is a need for more inclusive thinking in science and science policy, leading to functional research engagements with under-represented collaborators and beneficiaries outside academia. And there is also a need for a more proactive approach to enabling good leadership in research institutions, especially at the research-group level. Flaws in the scientific literature and in the delivery of societal impacts can result from inadequate attention to these issues.
Biography

Sir Philip Campbell
Editor-in-Chief, Nature

Sir Philip Campbell is Editor-in-Chief of Nature and of Nature publications. His areas of responsibility include the editorial content of Nature, and assuring the long-term quality of all Nature publications. He is based in London.

He has a BSc in aeronautical engineering, an MSc in astrophysics and a PhD and postdoctoral research in upper atmospheric physics. Following his research, he became the Physical Sciences Editor of Nature and then, in 1988, the founding editor of Physics World, the international magazine of the UK Institute of Physics. He returned to Nature to take on his current role in 1995.

He has worked with the UK Office of Science and Innovation, the European Commission and the US National Institutes of Health on issues relating to science and its impacts in society. For ten years until 2012 he was a trustee of Cancer Research UK. He is a founding trustee and now the Chair of the research funding charity MQ: transforming mental health.
New technologies plenary
Reprogramming cells through synthetic biology

Synthetic biology aims to engineer genetically modified biological systems that perform novel functions that do not exist in nature, with reusable, standard interchangeable biological parts. The use of these standard biological parts enables the exploitation of common engineering principles such as standardization, decoupling, and abstraction for synthetic biology. With this engineering framework in place, synthetic biology has the potential to make the construction of novel biological systems a predictable, reliable, systematic process. While the development of most synthetic biological systems remains largely ad hoc, recent efforts to implement an engineering framework in synthetic biology have provided long-awaited evidences that engineering principles can facilitate the construction of novel biological systems. Synthetic biology has so far demonstrated that its framework can be applied to a wide range of areas such as energy, environment, and health care. In this talk, our recent efforts to develop synthetic microbes with programmable behaviors will be presented. In this talk, our recent efforts to develop synthetic microbes with programmable behaviors will be presented. In particular, an emphasis will be placed on our recent development of auto-regulatory genetic circuits for cell factories and therapeutics.
Biography

Professor Matthew Chang
Associate Professor in Biochemistry, Yong Loo Lin School of Medicine at the National University of Singapore (NUS), and Director of NUS Synthetic Biology for Clinical and Technological Innovation (SynCTI)

Matthew Chang is Associate Professor in Biochemistry in the Yong Loo Lin School of Medicine at the National University of Singapore (NUS), and Director of NUS Synthetic Biology for Clinical and Technological Innovation (SynCTI). He also heads the Singapore Consortium for Synthetic Biology (SiNERGY). His research interests lie in the development of biological systems that perform programmable functions. His work has received international recognition and is featured in leading media agencies worldwide. He has been honored with the Scientific and Technological Achievement Award from U.S. Environmental Protection Agency. He serves as an editor for Biotechnology for Biofuels, IET Synthetic Biology, Applied Biochemistry and Biotechnology, and Critical Reviews in Microbiology, and as an editorial board member for Biotechnology Journal, ACS Synthetic Biology and Cell Systems. He serves on the international advisory panel of the Synthetic Biology Open Language (SBOL), an open standard designed to facilitate the exchange and storage of genetic designs.
Professor Ya-Huei (Cathy) Chin

Towards low carbon energy
Catalytic production of low carbon fuels

Lignocellulosic biomass is an attractive, renewable feedstock for producing sustainable fuels and chemicals. It is structurally complex and contains not only carbon and hydrogen, but also oxygen, thus its deconstruction and chemical transformation face significant technological challenges. I will discuss the various catalytic processing strategies aimed for the removal of oxygen heteroatoms from biomass derived molecules, focusing specifically on the reactivity and selectivity tuning via designing catalysts and chemical processes to enable selective oxygen removal. I will describe the chemical strategies for creating catalytically active sites and local reaction environment that promote kinetically coupled reactions, minimizing the use of hydrogen and the loss of carbon atoms to lighter products. The emphasis is on applying catalytic knowledge at the molecular scale level to rationally design the highly effective and selective active surfaces with atomically precise structures. The fundamental knowledge of catalytic chemistry, when applies together with reaction engineering strategies, would allow us to improve the atom and energy efficiencies.
Biography

Ya-Huei (Cathy) Chin
Assistant Professor of Chemical Engineering and Applied Chemistry
University of Toronto

Ya-Huei (Cathy) Chin is Assistant Professor of Chemical Engineering and Applied Chemistry at the University of Toronto. She is a Canada Research Chair (Tier II) in Advanced Catalysis for Sustainable Chemistry (2016). She is a recipient of an Ontario Early Researcher Award (2014) and the Imperial Oil University Research Award (2014) and she also received the Bill Burgess Teacher of the Year Award for Large Classes (2016).

She joined the University in 2011, after receiving her Doctor of Philosophy (PhD) degree in Chemical Engineering from the University of California, Berkeley. She was a research engineer (2000 – 2002) and then senior research scientist (2002 – 2005) at Pacific Northwest National Laboratory (PNNL), one of the ten National Research Laboratories in the USA.

Cathy’s research addresses the technological challenges in catalytic processing of hydrocarbons and oxygenates, emission control, microchemical reactor development, and on-anode natural gas reforming in solid oxide fuel cell. Her recent work focuses on elucidating the molecular events during catalytic conversions of alkanes, alkenes, and oxygenates to liquid fuels and value-added chemicals. Specifically, she applies isotopic, kinetic, and density functional theory methods to investigate the dynamics of catalyst surfaces and their kinetic consequences.
Professor Anthony Chen

Towards low carbon energy
Will market forces suffice?

This talk will briefly outline the work of the Intergovernmental Panel on Climate Change (IPCC) of which the author was a member. It will discuss the timeline for low carbon energy in order to avoid the dangerous consequences of climate change. Technology to achieve low carbon will be reviewed briefly, but emphasis will be placed on renewable energy. The work of the University of the West Indies on renewable energy will be briefly mentioned but, in the light of the variability of renewable energy, the emphasis of the talk will be on storage of energy which will make solar and wind energy a genuine substitute for fossil fuel. The special problem of small islands in this respect will be discussed. Massive investment to solve the problems of renewable energy, such as envisaged by the Global Apollo Programme in climate change, has not materialised. An opportunity for this was lost in the Green Climate Fund initiative. Market forces seem to be the only one capable of solving the problem of renewables energy and storage. A suggested project, in which the Commonwealth scientists and economists can participate, for driving market forces to accelerate research and development in order to meet low carbon timelines will be discussed.
Biography

A Anthony Chen
Professor Emeritus, Department of Physics, University of the West Indies, Jamaica

A Anthony Chen is Professor Emeritus in the Department of Physics at the University of the West Indies, Jamaica. He holds a BSc degree in Physics and Mathematics from Boston College; a MA in Teaching from Harvard University; a MSc in Atmospheric Physics from the University of Maryland and a PhD in Atmospheric Physics from the University of the West Indies. He was a Fellow of the Royal Meteorological Society. His research interest includes Atmospheric Physics and Meteorology, Environmental and Energy Studies and Physics Education. He has been the Principal Investigator/Co-Principal Investigator for several funded projects. He has published works in books, journal articles, conference papers and reports to government and industry. His refereed publication lists over 30 titles and he served as the Lead author for the Small Island Section of Chapter 11 (Regional Projections) of Working Group I publication (Climate Change 2007, The Physical Science Basis) for Intergovernmental panel on Climate Change (IPCC) 4th Assessment, when IPCC shared the 2007 Nobel Peace Prize with Al Gore. Though retired, he still teaches part-time and works on projects in climate change and energy. He is an advocate of climate change mitigation and renewable energy for small islands.
New technologies plenary
Meeting the challenge of food production with robots

Food production faces many challenges: we need to produce more food with less land, water and labour in the face of changing climate, rising input costs and emerging threats such as herbicide resistant weeds. This talk will briefly discuss these challenges and then introduce robotic technologies for broad-acre weed control and for horticultural fruit harvesting.

Biography

Professor of Robotic Vision, Queensland University of Technology, and Director of the ARC Centre of Excellence for Robotic Vision

Peter Corke is a professor of robotic vision at Queensland University of Technology, and Director of the ARC Centre of Excellence for Robotic Vision. His research is concerned with enabling robots to see, and the application of robots to mining, agriculture and environmental monitoring. He is a fellow of the IEEE, former editor-in-chief of the IEEE Robotics & Automation magazine, founding and associate editor of the Journal of Field Robotics, founding multi-media editor and editorial board member of the International Journal of Robotics Research, member of the editorial advisory board of the Springer Tracts on Advanced Robotics series, recipient of the Qantas/Rolls-Royce and Australian Engineering Excellence awards, and has held visiting positions at Oxford, University of Illinois, Carnegie-Mellon University and the University of Pennsylvania. He created the Robotics Toolbox for MATLAB which has been used for teaching globally for over 20 years, wrote the best selling textbook Robotics, Vision & Control, created two MOOCs and has won national and international recognition for teaching. He received his undergraduate and Masters degrees in electrical engineering and PhD from the University of Melbourne.
How do plants respond to phosphate limitation?

Over application of phosphate fertilizers in modern agriculture contaminates waterways and disrupts natural ecosystems. Nevertheless, this is a common practice among farmers, especially in developing countries. Understanding how plants respond to phosphate deprivation at the molecular level is essential to designing crop plants with enhanced fertilizer usage. Our lab has been investigating gene expression changes underpinning the responses of a model plant, Arabidopsis thaliana, to phosphate deprivation (Woo et al, 2012). We found that both transcriptional and post-translational events are involved in regulating phosphate-responsive genes.

A major regulator of phosphate response is PHO2 which encodes a putative E2 ligase UBC24. The NITROGEN LIMITATION ADAPTION (NLA) gene was initially shown to function in nitrogen limitation responses. We found that NLA is an E3 ligase that specifically requires UBC24 for targeted degradation of a phosphate transporter PT2. Under Pi-replete conditions, NLA and UBC24 target the PT2 transporter for destruction. During the Pi deprivation response, NLA and PHO2 transcripts are cleaved by specific microRNAs and this downregulation allows PT2 to accumulate and participate in Pi uptake (Park et al, 2014).

In Arabidopsis the SPX proteins function as negative regulators of phosphate deprivation response by binding to the transcriptional activator PHR1 and this association is promoted by InsPs (Inositol poly-phosphates). Under phosphate limiting conditions, PHR1 is released from the SPX/PHR1 complex to activate phosphate-responsive genes. How SPX/PHR1 association is dynamically regulated was unknown. We identified a non-coding RNA named PINC1 which is induced by Pi deprivation. We found that PINC1 binds to PHR1 and causes its dissociation from the SPX/PHR1 complex. Consistent with this finding pinc1 mutant seedlings are hyposensitive in Pi deficient condition whereas PINC1 overexpression plants are hypersensitive. Our work characterises the function of a noncoding RNA and explains how this non-coding RNA regulates transcription of phosphate-responsive genes (Park et al, unpublished).
Biography

**Professor Nam-Hai Chua**  
*Andrew W Mellon Professor and Head of the Laboratory of Plant Molecular Biology,  
Rockefeller University, USA*  
*Deputy Chairman, Temasek Life Sciences Laboratory, Singapore*

Professor Nam-Hai CHUA is the Andrew W. Mellon Professor and Head of the Laboratory of Plant Molecular Biology at Rockefeller University, USA. He is a fellow of the Royal Society of the United Kingdom, a Foreign Academician of the China Academy of Sciences and of the Academia Sinica in Taiwan. Professor Chua is also Deputy Chairman of Temasek Life Sciences Laboratory, Singapore and Distinguished Visiting Professor of the Department of Biochemistry, Yong Loo Lin School of Medicine, National University of Singapore.
We are in the throes of an extraordinary demographic transition, with an increasing proportion of the world’s population living in large urban areas. In 1950 there was just one city with a population of over 10 million (the usual definition of a megacity); today there are over 30. Because large cities are such a recent phenomenon, we still know little about how they develop and function, and about the impact they have upon surrounding rural areas. But such knowledge will be essential if we are to construct and manage urban areas in ways that are both sustainable and resilient.

Against this background, many universities are now investing heavily in new forms of urban research that link science, engineering and design, and make heavy use of information technology and ‘big data’. One of pioneers in this ‘new urban science’ is the Singapore-ETH Centre (part of Singapore’s CREATE campus), with its programmes Future Cities Laboratory and Future Resilient Systems. In this presentation I show how these programmes apply concepts from ecology, complexity science and network theory in their effort to understand cities and develop ideas to make them more liveable and resilient. And at a larger scale, I show some of the complex inter-dependencies between cities and their surroundings, characterised by flows of natural resources, people and wealth, and by less tangible things such as ideas and cultural influences. I argue that this kind of multidisciplinary research, conducted in close collaboration with stakeholders, will be essential for a sustainable urban future.
Biography

Professor Peter Edwards
Director of the Singapore-ETH Centre

Peter Edwards is Director of the Singapore-ETH Centre. He studied at Cambridge University, specialising in botany, and graduated in 1970. In 1973 he obtained his PhD degree, also from Cambridge, for a thesis entitled Nutrient cycling in a New Guinea montane forest. He lectured in ecology at the University of Southampton, England, from 1973 – 1993. Since 1993 he has been professor of plant ecology at the Swiss Federal Institute of Technology (ETH).

He is author of around 350 refereed scientific papers and author/editor of several books covering a wide range of environmental fields including ecosystem processes, insect–plant interactions, environmental management and biodiversity. His recent research has focused on large-scale processes in terrestrial ecosystems, including interactions between large herbivores and vegetation, biological invasions, and the role of biodiversity in agricultural and urban landscapes.

Peter Edwards has always had a strong interest in the application of science and technology for better management. He was a founder and first executive secretary of the Institute for Ecology and Environmental Management, a professional organization for environmental scientists in the UK. He was also a member of the executive board of the Alliance for Global Sustainability, a research partnership between several leading universities.
Professor Terrence Forrester

Plenary session
The double burden of malnutrition: mechanistic insights for better management

Today, 159 million children are stunted, 50 million are wasted and more than two billion people are overweight or obese; all suffer a form of malnutrition. Undernutrition underlies 45% of childhood deaths under 5 years and importantly increases the risk for later obesity, diabetes, hypertension and vascular disease. Children who survive severe acute (wasting) or severe chronic (stunting) malnutrition suffer poor brain development, cognitive impairment, turn in poor school performance that then constrains economic activity in adulthood. Resultant impaired labour productivity costs between 3% and 16% of GDP annually in Africa and Asia where malnutrition is a massive problem. Investments in optimum nutrition during the critical first 1,000 days of life help prevent the devastating, lifelong consequences of childhood malnutrition and enable children to be healthy, educated, productive members of society. The scale-up of a set of nutrition interventions needed to reach the global nutrition targets would generate enormous economic benefits: $417 billion for stunting, $110 billion for anemia, $298 billion for breastfeeding, and $25 billion for the treatment of severe wasting. Returns on every dollar invested in reaching the global nutrition targets range from $4 for wasting to $11 for stunting, $12 for anemia, and $35 for investing in exclusive breastfeeding. We can accomplish even more if we understand the underlying molecular, metabolic and physiological substrates that underlie adaptation to sustained undernutrition. This knowledge will help us customise not only life-saving care to reduce mortality in childhood, but also improve long term health and performance outcomes.
Biography

Professor Terrence Forrester
Professor of Experimental Medicine, University of the West Indies, Jamaica

Terrence Forrester is Professor of Experimental Medicine at the University of the West Indies (UWI). He is Chief Scientist at UWI Solutions for Developing Countries (UWI SODECO) and pursues a longstanding interest in the etiology and pathogenesis of cardiovascular disease, primarily hypertension. This work has been significant in the Caribbean and West African contexts, given the high and rising prevalence of hypertension in both and the high death rate from cardio-metabolic disease in the Caribbean. Prior to setting up UWI SODECO in 2011 he was founding Director of the Tropical Medicine Research Institute at UWI.

Since 1999, he has received 18 significant research grants to better understand the underlying basis of hypertension and cardiometabolic risk with a focus on populations with intergenerational undernutrition. In particular he has been pursuing discovery research to understand how man adapts to nutritional stress and the costs and consequences of such adaptation to the later risk of obesity, hypertension and insulin resistance. The three areas of work contributing to understanding the aetio-pathogenesis involved are intermediary metabolism in children with severe malnutrition, epidemiology and mechanisms of hypertension, and research into the developmental origins of health and disease.

Professor Forrester has received several awards in recognition of his work. In 2003, he received the Vice Chancellor’s Award for Excellence in Research at UWI. In 2006, he was the recipient of the prestigious Anthony N. Sabga Caribbean Awards for Excellence, one of the Region’s leading recognition programs. That same year, the inaugural Caribbean Laureate also earned the Boehringer Ingleheim Award for Hypertension Research in Developing Countries. In 2010 he was awarded the Gold Musgrave Medal for excellence in science and in 2012 received national honours, The Order of Jamaica for research in medicine. In 2016 he was elected a Fellow of The World Academy of Sciences.

He has served in an advisory capacity to several health organizations, including the Caribbean Community’s Caribbean Commission of Health and Development, the Caribbean Health Research Council, the International Atomic Energy Agency, the International Society of Hypertension, the Pan American Health Organization (Advisory Committee on Health Research), the United Kingdom Medical Research Council, US Centers for Disease Control and Prevention, and the World Health Organization, Dr. Forrester was a member of the board of the Pan American Health and Education Foundation in 2009 – 2013. He is a current member of the WHO expert advisory group on Ending Childhood Obesity.
Dr Bernie Fanaroff

Plenary session
Making Africa great: radio astronomy and big data in Africa

The Square Kilometre Array Telescope, the world’s largest science infrastructure, will be built in nine African countries (eight in the Commonwealth) and Australia over the next 15 years. Its core will be on a large, arid site in South Africa, protected by law. An SKA precursor, the MeerKAT radio telescope, designed and built by South African engineers and scientists, is the largest and most sensitive cm-wavelength radio telescope in the world until the SKA is built and will be integrated into the SKA. The low-frequency array of the SKA will be built in Australia. I will show recent MeerKAT commissioning observations.

South Africa is collaborating with partners in Africa to rebuild old satcom dishes for the African Very Long Baseline Interferometry Network (AVN). The first refurbished dish, in Ghana, recently started commissioning science observations. The AVN is being used as a focus for the training of scientists, engineers, technicians and artisans.

South Africa has also funded an extensive Human Capital Programme, to develop cutting-edge science, engineering and data science expertise in South Africa and its African partners. Training in data science is being funded partly through the Newton Fund.

The African Research Cloud is a new flagship programme, which builds on the data challenges of radio astronomy. It will facilitate collaboration across Africa and with the rest of the Commonwealth and the world. It will be multi-disciplinary and will facilitate access to huge data sets and tools in astronomy, health, genomics, earth observation and other subjects.
Biography

Dr Bernie Fanaroff
South African Square Kilometre Array, South Africa

Dr Bernard Fanaroff was the Project Director of the South African Square Kilometre Array Telescope Project from its inception in 2003 until the end of 2015, and now works part-time as an adviser to the project. He is the co-chair of the BRICS Working Group on ICT and High Performance Computing.

He holds a PhD in Radio Astronomy from Cambridge University and honorary doctorates from six South African universities, and was a Visiting Professor in Physics at Oxford University. He has been awarded the national Order of Mapungubwe and has served on the boards of Eskom SOC and the South African National Biodiversity Institute.

In 1994 he was appointed Deputy Director General in the Office of President Mandela and the Head of the Office for the Reconstruction and Development Programme. From 1997 he was the Deputy Director General of Safety and Security, Chairman of the Integrated Justice System Board and Chairman of the Inter-Departmental Steering Committee for Border Control.

He was for eighteen years National Organiser and National Secretary of the Metal and Allied Workers Union and the National Union of Metalworkers of South Africa.

He is the first author of the Fanaroff-Riley classification of radio galaxies and quasars.
Plenary session
Weird animal genomes, sex and the future of men

Genomes of Australian animals are a goldmine of information. This is because Australia has been isolated for a long time, so genes and regulatory systems have had time to evolve differently. These genome differences can provide insights into many fundamental processes. Our studies have been on sex, and here, Australian animals – kangaroos, platypus and dragon lizards, have delivered stunning insights into what chromosomes and genes determine sex in humans, how they work and how they evolved.

In humans and other mammals, females have two X chromosomes, but males have a single X, and a Y. Kangaroos played a part in identifying the gene on the Y (SRY) that kick-starts testis differentiation in the embryo, unleashing masculinizing hormones. The human X has 1500 genes, but the tiny Y is full of genetic junk and bears only 45 genes.

Our sex chromosomes were originally an ordinary pair of chromosomes, so how did they get to be so weird? We compared chromosomes, genes and DNA in distantly related mammals and even birds and reptiles (with completely different sex determining systems). Kangaroo sex chromosomes reveal the original mammal X and Y. But platypus sex chromosomes are like those of birds, showing that our sex chromosomes, and SRY, are quite young, and the Y is degrading rapidly. I predict the Y will disappear in just 5 million years. If humans don’t become extinct, new sex determining genes and chromosomes will evolve, maybe leading to the evolution of new hominid species.
Biography

**Professor Jennifer Graves**  
**School of Life Sciences, La Trobe University**

Jenny Graves is an evolutionary geneticist who works on Australian animals, including kangaroos and platypus, devils (Tasmanian) and dragons (lizards). Her group uses their distant relationship to humans to discover how genes and chromosomes and regulatory systems evolved, and how they work in all animals including humans. Her laboratory uses this unique perspective to explore the origin, function and fate of human sex genes and chromosomes, (in)famously predicting the disappearance of the Y chromosome. Jenny received her BSc and MSc from Adelaide University, then a Fulbright Travel Grant took her to the University of California at Berkeley, where she completed her PhD in molecular biology. She joined La Trobe University (Melbourne) in 1971 and worked there for many years before moving to the Australian National University (Canberra) in 2001, where she founded the Comparative Genomics department and directed the ARC Centre of Excellence in Kangaroo Genomics. She returned to La Trobe as Distinguished Professor in 2011, and also is Professor Emeritus at ANU, Thinker-in-Residence at Canberra University and Professorial Fellow at the University of Melbourne. Jenny has produced three books and more than 400 research articles. She has received many honours and awards, including the Academy’s Macfarlane Burnet medal in 2006 and an AO in 2010. She is a Fellow of the Australian Academy of Science, and was on the Executive for 8 years, first as Foreign Secretary, then as Education Secretary with responsibility for the Academy’s science education projects. She is 2006 L’Oreal-UNESCO Laureate for Women in Science.
Towards low carbon energy
How did silicon solar cells get so cheap?

Over the last 9 years, the average wholesale selling price of silicon photovoltaic modules has reduced by a factor of twelve while the energy conversion efficiency of standard product has increased from 13 – 14% to the 16 – 17% range. Recent international bids for large scale electricity supply demonstrate that photovoltaics now provide the lowest cost option for such supply, with this technology expected to account for most of the new electricity generation capacity installed over coming decades.

The research leading to this transformation will be described as will the key events underpinning it. Ongoing research targeting commercial efficiencies twice present values by 2030 is also to be described.

Biography

Martin A Green
Director, Australian Centre for Advanced Photovoltaics, Scientia Professor,
University of New South Wales and Australia

Martin Green is Scientia Professor at the University of New South Wales, Sydney and Director of the Australian Centre for Advanced Photovoltaics, involving several other Australian Universities and research groups. His group’s contributions to photovoltaics are well known and include holding the record for silicon solar cell efficiency for 30 of the last 34 years, described as one of the ‘Top Ten’ Milestones in the history of solar photovoltaics. Major international awards include the 1999 Australia Prize, the 2002 Right Livelihood Award, also known as the Alternative Nobel Prize the 2007 SolarWorld Einstein Award, most recently, the 2016 Ian Wark Medal from the Australian Academy of Science.
Dr Demis Hassabis

Evening plenary session

Biography

Dr Demis Hassabis,
Founder and CEO, Google DeepMind

Demis Hassabis is the founder and CEO of DeepMind, a neuroscience-inspired AI company, bought by Google in Jan 2014 in their largest European acquisition to date. He leads projects including the development of AlphaGo, the first program to ever beat a professional player at the game of Go.

Demis is a former child chess prodigy, who finished his A-levels two years early before coding the multi-million selling simulation game Theme Park aged 17. Following graduation from Cambridge University with a Double First in Computer Science he founded the pioneering videogames company Elixir Studios producing award winning games for global publishers such as Vivendi Universal.

After a decade of experience leading successful technology startups, Demis returned to academia to complete a PhD in cognitive neuroscience at UCL, followed by postdocs at MIT and Harvard, before founding DeepMind. His research connecting memory with imagination was listed in the top ten scientific breakthroughs of 2007 by the journal Science. Demis is a 5-times World Games Champion, a Fellow of the Royal Society of Arts, and the recipient of the Royal Society’s Mullard Award and the Royal Academy of Engineering’s Silver Medal.
Professor Gideon Henderson FRS

Future of the oceans
Metals in the ocean

Metals such as iron, zinc, and manganese are required for biological processes to function in the oceans. These metals are present at low concentration, and their supply can limit the amount or type of life present across large areas of the oceans. Metals can also be toxic to life, including notable pollutants such as lead and mercury. Recent scientific advances have overcome analytical challenges to develop a more complete understanding of the natural marine cycling of metals, and the relationship between metals and biological systems. This talk will summarise some of these key developments in understanding.

Oceanic metal cycles are perturbed by human activity. Direct anthropogenic fluxes to the ocean increase metal concentrations, and secondary changes to the ocean, such as acidification and decreasing oxygen concentration, create significant change in metal cycles. Intentional manipulation of the iron cycle has also been proposed, to stimulate fish stocks and ocean CO₂ uptake, but is highly controversial.

A major additional factor in future metal cycles may be the pursuit of mining on the sea floor. Significant deposits of metals are present in nodules, crusts, and mass sulphide formations found on the seafloor of the deep ocean, sometimes at grades higher than those in remaining ore deposits on land. These mineral resources are an attractive resource for supply of the critical metals required for modern information and green technologies, but recovery of these metals could significantly perturb the deep-ocean environment with long-lasted impact to ecosystems. The potential and risks of mining of metals from the seafloor is one focus of a new publication by the Royal Society. This Royal Society Evidence Pack has considered two classes of possible future ocean resource: metal-rich minerals, and marine genetic resources. The report will be launched at the Commonwealth Science Conference, and the findings briefly summarised in this talk.
Biography

Professor Gideon Henderson FRS
Professor of Earth Sciences, University of Oxford

Gideon is a geochemist working to understand the long-term operation of the climate system and the carbon cycle. His research relies on chemical measurements of the modern ocean, and on geological records of past climates. He played a leadership role in initiating the international marine chemistry programme – GEOTRACES – and has interests in future oceanic challenges such as deep-sea mining and negative carbon emissions. His work also seeks to understand components of the climate system with particular relevance to the future, including changes in rainfall, sea level, permafrost, and ocean circulation. He has spoken to diverse audiences on issues relating to climate, oceanography, and geoengineering, including to the World Economic Forum (Davos and Dalian); Virgin Unite (Necker); and Intelligence Squared (London).

Gideon is Head of Department of the Earth Sciences Department at the University of Oxford, and a Senior Research Fellow at University College. He has a degree in Earth Sciences from the University of Oxford, a PhD in Geochemistry from the University of Cambridge, and spent five years at the Lamont-Doherty Earth Observatory of Columbia University, where he continues to hold an associate position.
Peter Ho

General issues of science, society and policy
Dealing with the challenges of complexity and rapid change

The world is changing fast, and its complexity is increasing. The propensity for shock and disruption is growing in tandem. The challenge is to deal with these disruptions and manage the risks.

Biography

Peter Ho
Senior Advisor, Centre for the Strategic Futures, Singapore

Peter Ho is the Senior Advisor to the Centre for Strategic Futures, a Senior Fellow in the Civil Service College, an Adjunct Professor at the S Rajaratnam School of International Studies, a Visiting Fellow at the Lee Kuan Yew School of Public Policy, and the current S R Nathan Fellow for the Study of Singapore at the Institute of Policy Studies.

Peter Ho is Chairman of the Urban Redevelopment Authority of Singapore, Chairman of the Social Science Research Council, Chairman of the Singapore Centre on Environmental Life Sciences Engineering, and Chairman of the National Supercomputing Centre. He is a member of the National University Board of Trustees, a board member of the Lee Kuan Yew Exchange Fellowship, a member of the S Rajaratnam School of International Studies’ Board of Governors, and a council member of the International Institute of Strategic Studies. He is also a member of Statoil’s Strategy Advisory Council, and the McKinsey Center for Government Advisory Council.

When he retired from the Singapore Administrative Service in 2010 after a career in the Public Service stretching more than 34 years, he was Head, Civil Service, concurrent with his other appointments of Permanent Secretary (Foreign Affairs), Permanent Secretary (National Security and Intelligence Coordination), and Permanent Secretary (Special Duties) in the Prime Minister’s Office. Before that, he was Permanent Secretary (Defence).
New technologies plenary
Computing for the future of the planet

Digital technology is an indispensable and crucial component of our lives, society, and the physical environment.

A challenge is how to use the power of computing to deal with the problems facing the world. In his talk, Professor Andy Hopper will present a framework for the role of computing in dealing with sustainability of the planet. The framework has a number of goals: an optimal digital infrastructure; sensing and optimising the use of resources in the physical world; guaranteeing the performance of indispensable systems; and digital alternatives to physical activities.

In this talk, Professor Hopper discusses practical industrial examples alongside research goals and societal challenges and dilemmas.
Biography

Professor Andrew Hopper CBE FREng FRS
Professor of Computer Technology, Computer Laboratory, University of Cambridge, UK

Andy Hopper is an engineer and computer scientist whose contributions to academia and industry have had a significant global impact. A pioneer of network design and mobile computing, Andy has an extensive track record of converting cutting-edge research into commercial success.

Guided by the ambition of connecting people and devices worldwide, in 1992 he developed the Active Badge location system which for the first time allowed an individual to control the computer networks and applications around them based on their position. The founder of over a dozen spin-outs and start-ups, Andy has also served as Chairman of both the RealVNC group and Ubisense, which between them have received five Queen’s Awards for Enterprise.

Appointed a CBE in 2007 for his services to the computer industry, Andrew is a Fellow of the Royal Academy of Engineering and a past President of the Institution of Engineering and Technology. The recipient of numerous prestigious awards for his influential work, the Science Council named him as one of the United Kingdom’s 100 leading practising scientists in 2014.
Emerging infectious diseases
Antimicrobial resistance in Singapore and the region

Antimicrobial resistance is an escalating global health threat. In the local and regional setting, methicillin-resistant Staphylococcus aureus (MRSA), carbapenem-resistant Acinetobacter baumanii-calcoaceticus complex (CRAB) and Enterobacteriaceae (CRE) are increasingly common causes of difficult-to-treat infections, raising the spectre of a return to the pre-antibiotic era. In this discourse, we trace the links between acute, intermediate, and long-term care facilities in terms of MRSA transmission in a regional healthcare system in Singapore. We also review the epidemiology and prevalence of CRAB and CRE in South and Southeast Asia, where the rates of resistance are some of the highest in the world. These countries house more than a third of the world’s population and several are also major medical tourism destinations. There are significant data gaps, and the almost universal lack of comprehensive surveillance programs that include molecular epidemiologic testing has made it difficult to understand the origins and extent of the problem in depth. A complex combination of factors – including inappropriate prescription of antibiotics, overstretched health systems and international travel - including the phenomenon of medical tourism – probably led to the rapid rise and spread of these drug-resistant bacteria in hospitals in South and Southeast Asia. Considerable political will and effort, including from countries outside these regions, is vital in order to reduce the prevalence of such bacteria in South and Southeast Asia, and preventing their global spread.

Biography

Dr Li Yang Hsu
Tan Tock Seng Hospital, Singapore

Dr Li Yang Hsu, MBBS (Singapore), MPH (Harvard), is an infectious diseases physician with private sector experience who is Head of the Department of Infectious Diseases at Tan Tock Seng Hospital and Programme Leader of the Antimicrobial Resistance Programme at the Saw Swee Hock School of Public Health. He is also the Director of the Singapore Infectious Diseases Initiative, which was established to spur collaborative biomedical and clinical research in infectious diseases. His areas of research include the epidemiology of methicillin-resistant Staphylococcus aureus as well as the clinical and socioeconomic impact of antimicrobial resistance, and he has published more than a hundred peer-reviewed articles in these areas.
Emerging infectious diseases
Mosquitoes and Zika virus in the Americas

Historically there have been a relatively small number of mosquito-borne diseases in Canada including a brief, but unsustained, malaria outbreak during the construction of the Rideau Canal in the 19th century. Since 2001, however, there have been several outbreaks of West Nile virus encephalitis in humans. The students in my lab study mosquito systematics, geographic distributions, and arbovirus transmission dynamics. We have been able to model the effects of shorter winters and warmer summers on West Nile virus transmission in Canada and predict that more mosquito-borne viruses will become endemic over time.

To date there are ~500 human cases of travel-related Zika virus (ZIKV) infection in Canada. Understanding which local mosquito species might serve as competent vectors for this emerging disease is the current research focus in my lab. Based on the phylogenetic placement of ZIKV among the flaviviruses, we challenge the current paradigm that it is only Aedes aegypti and possibly Aedes albopictus that are of concern as vectors of ZIKV. Our lab has shown that under certain conditions local Canadian mosquito species can also become infected with ZIKV, develop disseminated infections, and spit out ZIKV in their saliva.

Transmission risks are complicated by the northward range expansions of at least 10 mosquito species over the past 15 years. Most importantly, in September and October of 2016 we discovered breeding populations of the Asian tiger mosquito (Aedes albopictus) and the yellow fever mosquito (Aedes aegypti) in southern Ontario for the first time ever.

With 15 years of intensive mosquito surveillance and viral testing for West Nile virus behind us, we are now setting up mosquito arbovirus surveillance programs in places like Dominican Republic. We would welcome collaborations in Commonwealth countries around the globe to more fully understand the transmission dynamics of emerging mosquito-borne diseases.
Biography

Professor Fiona F Hunter
Professor of Medical and Veterinary Entomology, Brock University, Canada
President, Entomogen Inc

Fiona Hunter is a Professor of Medical and Veterinary Entomology at Brock University, St Catharines, ON, Canada and President of Entomogen Inc, an entomological consulting company.

Fiona earned her BSc (Hons) and MSc degrees from the University of Toronto and her PhD from Queen’s University (Kingston, Canada). She also spent a year in Tuebingen, Germany, studying at the Tropical Medicine Institute. Throughout her academic career she has focused on biting flies – black flies, mosquitoes, deer flies, horseflies, no-see-ums. Fiona has graduated dozens of students from Brock University (both MSc and PhD), many of whom have gone on to work in the field of Medical and Veterinary Entomology. Her research team has done extensive field research in Costa Rica, Ecuador, and Dominican Republic on a variety of mosquito-borne diseases.

When West Nile virus first appeared in Ontario, there was an urgent need for mosquito identification as well as for viral testing of mosquitoes. Fiona and her students helped launch a province-wide surveillance system in collaboration with Public Health Agency of Canada, Ontario Ministry of Health and Long-Term Care, and First Nations Inuit Health Branch. The program is now in its 16th year.

Other research looks at the effects of local climate change on vector range expansions including mosquito species (capable of transmitting arboviruses), tick species (capable of transmitting Lyme disease, anaplasmosis and babesiosis), and biting midges (capable of transmitting bluetongue virus to livestock).

In 2012, Brock University opened a Containment Level 3 lab (including a CL3 Insectary) for studying live WNv-infected mosquitoes. Recent projects in the CL3 are aimed at studying live Zika-infected mosquitoes to understand what makes one species a competent vector, and another a non-competent vector.

Fiona has been active in the Entomological Society of Canada and currently serves as its Second Vice President. She has served as a Member of the Federal Steering Committee for West Nile virus, President of the Entomological Society of Ontario, a Member of several Natural Sciences and Engineering Research Council of Canada grant selection committees, and is a former Director of the Wildlife Research Station in Algonquin Provincial Park. She also sits on the Board of Directors for Alpaca Ontario.
Professor Rees Kassen

Social and policy implications of new technologies
DIY Synthetic Biology
A new geography of knowledge

Synthetic biology uses engineering principles to design biological parts and systems to produce useful biological products like medicines or fuels. The key technological advance is the ability to synthesize – not just read – the genetic code. While there remain significant conceptual and economic hurdles to doing synthetic biology at scale, the barriers to entry are rapidly falling. It will soon be possible to produce a biological product by ordering the relevant genetic parts online and assembling them at home or in a community lab for as little as a few hundred dollars. Consequently, synthetic biology has attracted the attention of entrepreneurs, educators, and young people, many with a mindset disposed towards open-source innovation, disruption, and a Do-It-Yourself attitude that eschews the traditions of formal academic training. The promise of synthetic biology is not just what can be produced but also where and by whom. Reliable advice about how to manage, support, and regulate synthetic biology thus demands that we recognize this new geography and demography of knowledge creation and innovation. We must go beyond the usual sources of ‘accredited’ experts located in academia and industry to engage directly with this new generation of practitioners – some of whom may have little formal academic training – developing new biological products in kitchens, garages, high schools, and community centers around the world.
Biography

**Professor Rees Kassen**  
**Professor and University Research Chair in Experimental Evolution,**  
**University of Ottawa, Canada**  

Rees Kassen is Full Professor and University Research Chair in Experimental Evolution at the University of Ottawa. His research focuses on the really big questions in biology: Why are there so many species in the world and how did they evolve? He uses microbes to answer these questions because their small size and fast reproduction times let him watch the evolutionary process unfolding in the laboratory. Rees has also played leading roles at the interface between science, society, and policy as Chair of the Partnership Group for Science and Engineering (PAGSE; pagse.org), an association of 26 professional and scientific organizations acting on behalf of over 60,000 members from academia, industry and government in Canada, and as a founder and Co-Chair of the Global Young Academy (www.globalyoungacademy.net), an international organization of early-career researchers acting as the voice of young scientists around the world. Rees completed his PhD at McGill University and then went on to an NSERC Postdoctoral Fellowship and Elizabeth Wordsworth Research Fellowship at St Hugh’s College, Oxford. He is a Leopold Leadership Fellow (2013), past NSERC Steacie Fellow (2010) and was a World Economic Forum Young Scientist in 2010 and 2011.
Professor Michael Keith

Sustainable cities
The future of the future city

In many domains we see a proliferation of claims made about how we can predict and measure the future city, how we make visible its form and shape its settlement. This presentation considers the historical context of such claims making around urban futures and the promise (and promises) of attempts to make visible the urban as a ‘lab’ or ‘observatory’ through which we might ‘see like a city’. The paper considers the potential for academic research to inform the capacity of cities to anticipate and reshape the challenges that characterise 21st century urban life through engaged scholarship.
Sir David King HonFREng FRS

Biography

He was born in Durban, educated at St John’s College Johannesburg and at Witwatersrand University, graduating with an Honours degree in Chemistry and a PhD. He has received 23 Honorary Degrees from universities around the world.

He was the UK Government Chief Scientific Adviser from 2000 to 2007. He raised the need for governments to act on climate change and was instrumental in creating the UK’s £1 billion Energy Technologies Institute. He created an in-depth futures process which advised government on a wide range of long term issues, from flooding to obesity. From 2013 to 2017 he served in the British Foreign Office as the Foreign Secretary’s Special Representative on Climate Change, making 96 official country visits over this period. He initiated the Climate Change – A Risk Analysis project with China and India over this period and was the thought leader behind Mission Innovation, the $30 billion pa international thrust in Research funding for missing technologies needed to defossilise the global economy.

He was Member, the President’s Advisory Council, Rwanda, and Science Advisor to UBS, 2008 – 12. He served as Founding Director of the Smith School of Enterprise and the Environment at Oxford University, 2008 – 2012, Head of the Department of Chemistry at Cambridge University, 1993 – 2000, and Master of Downing College Cambridge 1995 – 2000.

He has published over 500 papers on surface science and catalysis and on science and policy, for which he has received many awards, medals etc. Elected Fellow of the Royal Society in 1991; Foreign Fellow of the American Academy of Arts and Sciences in 2002; knighted in 2003; made Officier dans l’ordre national de la Légion d’Honneur in 2009.
Dr Janice Lough

Future of the oceans
A changing climate for tropical coral reefs

Tropical coral reefs are spectacular, complex and diverse ecosystems. Although occupying less than 0.5% of the sea floor (an area about the size of Kenya), they support 25% of all marine species and provide goods and services that contribute to the livelihoods of over 500 million people worldwide. Over 60% of Commonwealth countries contain coral reefs and together these make up 40% of the world’s coral reefs. Reefs are, however, in trouble. Some have suffered decades of over exploitation which is now being compounded, on even the most pristine reefs, by the impacts of a rapidly changing global climate system. This has been most dramatically demonstrated by the recent increase in frequency and extent of mass coral bleaching events – when the delicate, mutually beneficial relationship between the coral animal host and their photosynthesising algal symbionts breaks down. These recent events have been driven by unusually warm surface ocean temperatures and are a direct result of anthropogenically-driven global climate change. This talk will review how climate is already changing for coral reefs, why they are so sensitive to rapidly changing environmental conditions and the historical evidence for such changes as revealed in the annual skeletal records of certain long-lived massive corals. I will also consider what the future of these immensely valuable tropical ecosystems may look like given different trajectories of projected global warming and global and local actions that can contribute to their maintenance into the future.
Biography

Dr Janice Lough
Australian Institute of Marine Science, Australia

Janice Lough is a Senior Principal Research Scientist at the Australian Institute of Marine Science (AIMS, Townsville) and Adjunct Professorial Research Fellow and Partner Investigator with the ARC Centre of Excellence for Reef Studies, James Cook University. She is a climate scientist who has been publishing on issues related to climate change for over 30 years.

Janice has a BSc in Environmental Sciences from the University of East Anglia, Norwich, UK. She completed a PhD in 1982 at the Climatic Research Unit, University of East Anglia, on tropical Atlantic sea surface temperatures and climate in sub-Saharan Africa. She held an NSF-funded post-doctoral position at the Laboratory of Tree-Ring Research, University of Arizona, from 1982 to 1986. In 1986 she came to AIMS for a two-year postdoctoral position working with environmental records from corals and has been a research scientist at AIMS since 1988.

Current research activities focus on 1) obtaining annual proxy environmental and growth records from massive corals over the past several centuries; this places current changes in an historical context, and 2) assessing how climate is already changing for tropical marine ecosystems; climate change is not a future event, significant warming of the tropical oceans has already occurred with observable consequences for coral reefs.
Professor Jacqueline McGlade

General issues of science, society and policy

Biography

**Professor Jacqueline McGlade**

Professor Jacqueline McGlade is a leading figure in the world of knowledge and information systems to support sustainable development, ecology and conservation, pollution and health and resilience especially amongst indigenous peoples. Through her different appointments ranging from Chief Scientist and Director in the United Nations, to government agencies, research institutes and academia, and her collaborative research and work with international bodies, non-governmental organisations and communities around the world, she has made significant contributions to the science, society, policy interface. She has extensive field experience in Africa, south-east Asia, Central Asia, North America, Europe, the Caucasus, and the Arctic and has provided training and support to communities to map their lands, sacred sites and resources and participate in local, national and international fora. Her award winning films, television and radio series – Planet RE:think, One Degree Matters, Ocean Planet, Nature’s Numbers have received wide acclaim. She is also the author of more than 250 peer-reviewed articles, assessments, government reports and the author of several books including Advanced Theoretical Ecology and Large Marine Ecosystems of the Gulf of Guinea. She has designed and released into the global commons a wide array of innovative technologies and intelligence software.

Beyond her role in academia and the UN, Jacqueline is the mother of two daughters working in environment, international development and linguistics and a Maasai. In the village, where she lives, she is helping to build a sustainable future, by providing solar power, access to water, waste management, clean cook stoves, healthcare and women and children’s education. She is also creating local livelihoods in beekeeping, medicinal plant cultivation and environmental conservation.
New technologies plenary
Technologies for health

Human health is in danger due to environmental changes and cross infections from animals and plants. The ingenuity of man tries to keep up with current and future dangers through science and technology. 6/10 infections diseases and ¾ emerging infections have their source in animals. Life style changes and traffic accidents add further dangers to health. Some of the new technologies include diagnostics based on genetic approaches, including the sequencing of the organisms, identification of the susceptibility genes in man. CRISPER-Cas technologies have immense potential for vaccines, diagnostics and future therapeutics. Wearable technologies from the common ‘fit-bit’ to other sensors make monitoring of BP, pulse and O2 from the home to the hospital. Electroceuticals are another class of future therapeutics that are on the horizon. Antibiotic resistance is a current threat and technologies to diagnose and combat these are also underway using CRISPER as well as Hybrid molecules.
Biography

Professor Indira Nath

Indira Nath MD FRCPath DSc(hc) is Former Founder Head of Department of Biotechnology at the All India Institute of Medical Sciences. After retirement she continued at AIIMS as SN Bose Professor of the Indian National Science Academy, later as Dean of Medical School of AIMST, in Malaysia, Director of the UK Lepra Research Centre in Hyderabad and Raja RAMANNA Fellow and Emeritus Professor, National Institute of Pathology (ICMR), New Delhi, India. She is currently Chair of the Health and Wellbeing Programme of the International Council of Science (ICSU), Paris and Co-Chair of the Inter-Academy Council’s programme on Responsible Conduct in the Global Research Enterprise

She received an MBBS and MD from the All India Institute of Medical Sciences (AIIMS), New Delhi, and later served on the Faculty of AIIMS and started the first Biotechnology department in a medical school. She has made pioneering contributions to immunology research by her seminal work on cellular immune responses in human leprosy and a search for markers for viability of the leprosy bacillus which is not cultivable. She has also mentored many MBiotech, MD, and PhD students and made contributions to education, medical and science policies, and women scientists’ issues. She was a member of the Scientific Advisory Committee to Cabinet, Foreign Secretary INSA (1995 – 1997), council member (1992–1994 and 1998 – 2006) and vice president (2001 – 2003) of the Indian Academy of Sciences, Bangalore, and chairperson, Women Scientists Programme, DST (2003) and served on several national and international advisory committees.

She was conferred numerous awards, notably: Padmashri (1999), Chevalier Ordre National du Merite, France (2003), Silver Banner, Tuscany, Italy (2003), L'Oreal UNESCO Award for Women in Science (Asia Pacific) (2002), SS Bhatnagar Award (1983), and the Basanti Devi Amir Chand Award by ICMR (1994). She was elected fellow of the Indian National Science Academy, Delhi; National Academy of Sciences (India), Allahabad (1988); Indian Academy of Sciences, Bangalore (1990); National Academy of Medical Sciences (India) (1992); Royal College of Pathology (1992); and the Academy of Sciences for the Developing World (TWAS) (1995). She was conferred a DSc (hc) 2002, by Pierre and Marie Curie University, Paris, France.
Towards low carbon energy
Nanoscale modeling of low carbon energy storage materials

Climate change has prompted reduction in usage of fossil fuels in favour of low carbon energy sources, particularly renewables such as solar and wind. This is also an affordable option of expanding supply of much needed electricity in some developing countries of the Commonwealth. However, a major drawback is the intermittent nature of renewables, and limited ability of storing generated energy. Consequently, extensive studies on lithium ion batteries and beyond, are conducted to find and optimise materials for good performing, affordable and safe batteries. The 25th anniversary on commercialisation of lithium ion batteries was celebrated in 2016, where noteworthy achievements in electronics, transportation and stationary units were highlighted1. This provides an ideal opportunity for addressing goals of value addition to natural resources, especially in developing countries, whilst promoting usage of low carbon energy.

We have used high performance computing methods to simulate synthesis of metal oxide composites with complex nano-architectures2. Recently, we laid a framework for modelling composites of layered and spinel structures, reported amongst high capacity lithium-metal-oxide cathodes for lithium-ion batteries by Thackeray3, but with potential for performance enhancement. Our simulated microstructures were characterised and validated with high resolution transmission electron microscope images and X-ray diffractions results. The performance of such composites was predicted from mechanical properties which demonstrated, at a nanoscale, that electrochemical activity of batteries is sustained by maintaining open pathways for lithium ion transport during charging and discharging processes. This is mainly achievable in certain nano-architectures which confer long battery life, whilst enabling fast charge by providing access for electrolytes into voids and pores of battery electrodes.

References:
1. Z Ogumi et al, Electrochem Society Interface, Fall 2016, DOI: 10.1149/2.F04163if
Biography

Professor Phuti Ngoepe
University of Limpopo, South Africa

Professor Phuti Ngoepe obtained a PhD in Physics from the University of the Witwatersand. He has served the University of Limpopo for 40 years and is a Senior Professor in Physics, holds the South African Research Chair in Computational Modelling of Materials and is Director of Materials Modelling Centre, and has previously served as Dean of the Faculty of Science and Acting Deputy Vice-Chancellor. He is a Founder Member of the Academy of Science of South Africa and a recipient of the Order of Mapungubwe (Silver), awarded by the President of South Africa for excellent contributions to science. He was also recipient of NRF Presidential, Transformation of the Science Cohort and the National Science and Technology Forum TW Kambule NRF Research Awards. He has a broad network of collaborations; mainly from the UK. He has published widely in computational modelling on energy storage, mineral processing and alloy development and supervised many students in this area. He has presented several invited lectures at local and international conferences and served on organising and advisory committees. Lastly he has served on several Boards, mainly of Science Councils, and participated in many science strategy committees and reviews of government institutions and programmes.
Sustainable cities
Innovative platforms are critical for sharing knowledge and experience to solve complex urban problems: three case studies on cities, coasts and climate change

Innovative platforms are increasingly being recognised as critical for sharing knowledge and experience to solve complex urban problems including urban transport, the built environment, climate change and green infrastructure. I will present three examples connecting science, policy and the community by providing platforms for connecting and implementing more sustainable urban solutions. The first is the development of a national ‘climate ready cities’ policy information brief for Australian cities, the second is national award winning guidelines for coastal centres planning for climate change and the third is an innovative knowledge platform Canberra Urban & Regional Futures established 2010. I wish to share our research findings and the opportunities and lessons learned at the national, regional and local scale. I will also highlight possible wider application and the scope for partnerships with other commonwealth nations.
Biography

Professor Barbara Norman
University of Canberra, Australia

Professor Barbara Norman is the Foundation Chair of Urban and Regional Planning and Director of Canberra Urban and Regional Futures (CURF) at the University of Canberra. Professor Norman is Chair of the ACT Climate Change Council and a Visiting Fellow at the Australian National University. Barbara is a Life Fellow and past national president of the Planning Institute of Australia and a Life Honorary Member of the Royal Town Planning Institute (UK). Barbara’s qualifications include a Bachelor of Town & Regional Planning, Masters of Environmental Law and a PhD on sustainable coastal planning. She also has a substantial professional background having worked at all levels of government and run her own practice. Her current research and teaching interests include sustainable cities and regions, coastal planning, climate change adaptation and urban governance. Barbara was a contributing author to IPCC 5 WG 2 report on Impacts 2013. Professor Norman advises the public and private sector in Australia and has strong international linkages within Asia, Europe and the United States. Barbara was awarded an Australian Centenary Medal for her contribution to the community through urban and regional planning.
Emerging infectious diseases
The host transcriptome in infection

Analysis of the blood transcriptional response to infection has provided valuable information on immune factors contributing to disease progression. This approach has several advantages. Blood contains the effector cells of the immune system which traffic to and from the site of disease, facilitating the study of changes at inaccessible sites. Tuberculosis, caused by infection with Mycobacterium tuberculosis, is a major cause of morbidity and mortality worldwide. Efforts to control tuberculosis are hampered by difficulties with diagnosis, prevention and treatment. Most people infected with M. tuberculosis remain asymptomatic/latent with a 10% lifetime risk of developing active disease. We identified a blood transcript signature for active tuberculosis which correlated with the radiological extent of disease, was diminished upon successful treatment, and was absent in healthy individuals and the majority of those with latent tuberculosis. Identification of a meta-signature of active tuberculosis in 13 independent studies, by analysis of publicly available datasets, confirmed the robustness of this approach. The blood signature of tuberculosis is dominated by an interferon (IFN)-inducible gene profile, consisting of both IFNy and Type I IFNαβ signaling, suggesting a hitherto under-appreciated role of Type I IFNαβ signalling in the pathogenesis of tuberculosis. Our subsequent studies have defined mechanisms underlying the contribution of type I IFN to exacerbation of tuberculosis. Collectively, these studies provide strategies for the design and implementation of blood transcriptomic tools to support diagnostics and treatment monitoring of tuberculosis, and the development of potential therapeutics. The approach is similarly being applied to the study of other infectious diseases.

AOG and this work is/has been funded by the Francis Crick Institute, which receives its core funding from Cancer Research UK (FC001126), the UK Medical Research Council (FC001126), and the Wellcome Trust (FC001126), and previously the UK Medical Research Council (MR/U117565642/I) until April 2015, and by the European Research Council (294682- TB-PATH) until April 2017. AOG thanks all who have contributed and/or collaborated in this work throughout the years.
Biography

Professor Anne O’Garra FMedSci FRS
Head, Laboratory of Immunoregulation and Infection and Associate Research Director,
The Francis Crick Institute, UK

Anne O’Garra is currently a Group Leader, Head of Laboratory of Immunoregulation and Infection, and Associate Research Director at The Francis Crick Institute, London. After training at the MRC National Institute for Medical Research (NIMR), Mill Hill, she led a research group at the DNAX Research Institute (now Merck) in California. There she revealed molecular mechanisms for the induction and function of key immune responses, showing that the cytokine IL-12 induced the development of Th1 cells producing interferon-gamma, (IFN-γ) critical for control of intracellular pathogens. She went on to describe the immunosuppressive functions of interleukin-10 (IL-10) in regulating the immune response to prevent damage to the host, which has implications for control of inflammatory diseases and improved vaccination strategies. After 15 years O’Garra returned to the UK in 2001, and formed the Division of Immunoregulation at NIMR, to interface research in immunology and infectious diseases, continuing her research on the immune response to infection, with major emphasis on systems and transcriptomics approaches for study of the immune response in tuberculosis in both mouse models and in human disease. O’Garra is a member of many Scientific Advisory Boards to research institutions world-wide, on the Scientific Advisory Board and Board of Directors for the Keystone Conferences, and an Editor of the Journal of Experimental Medicine.
Sustainable cities
Research and public policy interfaces on sustainable cities

Sustainable cities cannot be achieved without a strong public sector commitment to enact governance institutions and systems that can facilitate an ongoing exchange between researchers, the state and various interested parties. One of the ongoing problems with public policy discourses on sustainable development is that it favours a consensus-based model of deliberation and decision-making. This creates a political/policy context that avoids irresolvable differences in favour of so-called low hanging (policy) fruits that effectively serves to legitimize the status quo in the name of sustainable development. This phenomenon is particularly problematic in very poor and highly unequal societies such as the South Asian and African members of the Commonwealth. Over the last decade, I have been involved in designing and operationalising various kinds of research/public policy interfaces on sustainable cities that range from the city level, i.e. Cape Town; to the national scale – South Africa; and sub-Saharan Africa. With the benefit of hindsight, I now prefer to think of these as proto-innovation systems for defining and advancing sustainable urban development policies and epistemic communities. My research and experimentation in this domain achieved significant global policy impact when we could craft the norm-setting approach to urban governance and sustainable development as encapsulated in the flagship development report of United Cities and Local Government: Co-creating the urban future. The agenda of metropolises, cities and territories. The paper will summarise the core argument of this publication set against a brief elaboration of the urban science research/policy approaches at various scales of urban development policy formulation.
Biography

Professor Edgar Pieterse
African Centre for Cities, University of Cape Town, South Africa

Professor Edgar Pieterse is an urban scholar, writer, curator and creative agent whose interests include the theory and practice of policy discourses and interventions to make the African city more just, open and vibrant. He holds the South African Research Chair in Urban Policy at the University of Cape Town and is director of the African Centre for Cities. Formerly a special policy advisor to the premier of the Western Cape, he is the author of City Futures: Confronting the Crisis of Urban Development (2008), New Urban Futures: Inhabiting Dissonant Times (in press); and co-editor of: Africa's Urban Revolution (2014) and Rogue Urbanism: Emergent African Cities (2013). He is a member of the Research Advisory Committees of: the Gauteng City-region Observatory, Indian Institute of Human Settlements and LSE Cities. He is co-lead author of the Urban Chapter for the International Panel on Social Progress.
Professor CNR Rao FRS

Plenary session
Science and the Commonwealth

It is truly wonderful that the Royal Society has taken such interest in science in the commonwealth. I feel proud to be a member of this great academy of science. The Conference has addressed topics of great importance to humankind including energy, infectious diseases, oceans and so on. It has also devoted attention to issues of science policy. The beauty and complexity of the commonwealth is that it has countries from several continents with wide variations in GDP and development. There is also little that is common amongst the commonwealth countries in two most crucial areas – science and education. Even the emerging countries in the commonwealth do not have institutions and infrastructure comparable to those in the advanced countries. The problems of the LDCs are severe. Let us not forget that in many of the member countries, poverty is severe while at the same time they have high aspirations to progress and prosper. Most of the developing countries invest little in S&T and the best of them is still to invest 1% of the GDP. The contribution of most of the developing countries to scientific research is negligible, and even the best of them contributes 1% to the top 1% of scientific research. Clearly, there is much that we can do to help through cooperation and collaboration. The Royal Society is ideally suited to be the agent of transformation, being the only academy associated with many countries and continents. Some of the things that we have to accomplish require little money, but demand human generosity and concern for fellow beings. I believe that equity in education and science is essential for the members of the commonwealth to feel that they are full-fledged participants, empowered by knowledge and know-how. Such equity may indeed eliminate if not minimize the threat of terrorism. I plan to discuss some ways of working together for science in the commonwealth, with the Royal Society acting as the catalyst and the promoter. It will be great to see the Royal Society emerge as the science academy of the commonwealth. The pride that I have being a member of this great society will be enhanced immensely when this happens.
Biography

Professor CNR Rao FRS
National Research Professor and Linus Pauling Research Professor at the Jawaharlal Nehru Centre for Advanced Scientific Research, India

CNR Rao (born 1934) obtained his PhD degree from Purdue University, DSc degree from the University of Mysore. He is the National Research Professor and Linus Pauling Research Professor at the Jawaharlal Nehru Centre for Advanced Scientific Research and Honorary Professor at the Indian Institute of Science (both at Bangalore). His research interests are mainly in the chemistry of materials. He is a fellow of the Royal Society, London, and member of the Chinese, French, Russian, Japan, Pontifical as well as other academies. He is the recipient of the Einstein Gold Medal of UNESCO, the Hughes and Royal Medals of the Royal Society, the August Wilhelm von Hofmann medal of the German Chemical Society, the Dan David Prize and Trieste Science Prize for materials research and the first India Science Prize. He has published over 1500 research papers and authored or edited 50 books. He is the recipient of Bharat Ratna (Jewel of India), the highest civilian honour of India.
Social and policy implications of new technologies
Gaining and maintaining social licence

Social licence occurs when community acceptance is gained and maintained for the use of data. Social licence is needed to gain and maintain trust for specific uses of data.

The Data Futures Partnership Working Group in New Zealand have been exploring the public attitudes towards data collection and use. The Partnership have engaged with the public to explore the benefits and risks the public perceive for specific uses of health, education and IOT data. The Partnership are developing guidelines for obtaining social licence.

Social licence can be gained when
1. people understand the purpose and value of the data use
2. Are informed of the use of the data
3. Are clear about the control and security of the data
4. Trust the agencies involved and
5. Where there is transparency around the data use
Biography

Dame Diane Robertson DNZM
Chair, Data Futures Partnership, New Zealand

Dame Diane is Chair of the Data Futures Partnership – an independent ministerial advisory body charged with championing data innovation and engaging with New Zealanders to explore their concerns about data use.

She is the former City Missioner at the Auckland City Mission. Diane was responsible for the collection and analysis of data gathered for the Auckland City Mission’s Family 100 research project, which has become one of New Zealand’s leading authorities on families living in poverty.

Diane is a successful social sector entrepreneur, giving her a unique combination of strong business and financial skills with strong social sector credentials. Her passion is to deliver better outcomes for New Zealanders through the development of sound policies informed by qualitative and quantitative data.
Professor Janet Rossant FRSC FRS

Plenary session
Embryos, stem cells and ethical concerns

Embryonic stem cell research is founded in our understanding of the development of the mammalian blastocyst, when the pluripotent embryo progenitors are set aside from the cells that make the placenta. Research on the underlying mechanisms of these early cell decisions in the mouse has informed the derivation of human stem cell lines with pluripotent properties. Human embryonic stem (hES) cell research has become a major international venture, with Commonwealth countries, including the UK, Canada, Australia and Singapore, playing leadership roles in the International Stem Cell Initiative. HES cells can differentiate into many different cell types with the potential to treat serious degenerative diseases. The first clinical trials with hES-derived products are now underway. However, hES cells were ethically controversial, because of their derivation from human early embryos. The ability to generate induced pluripotent stem (iPS) cells directly from adult human cells has limited these ethical concerns. Patient-specific iPS cells can be used to study disease in the petri dish, develop screens for novel drug therapies and eventually provide replacement cell types for regenerative therapies. However, recent scientific advances have reignited ethical debate about the appropriate limits on human embryo research and applications. New studies have raised the possibility of extending culture of human embryos past the blastocyst stage, making human-animal chimeras, and CRISPR-Cas9 gene editing of the human germline. I will discuss the science of embryonic development and stem cells and the need for ongoing international debate related to human embryo and stem cell research and the limits of gene editing.
Biography

Professor Janet Rossant FRSC FRS
Senior Scientist, Developmental and Stem Cell Biology, The Hospital for Sick Children
University Professor, University of Toronto, Canada

Janet Rossant, CC, PhD, FRSC, FRS, is Senior Scientist and Chief of Research Emeritus at the Hospital for Sick Children in Toronto and President and Scientific Director of the Gairdner Foundation. She is an internationally recognised developmental and stem cell biologist, exploring the origins of stem cells in the early embryo and their applications to understanding and treating human disease. She led the research institute at the Hospital for Sick Children from 2005 to 2015. She has received many honours and recognition for her work, including four honorary degrees, and election to the Royal Societies of London and Canada, and the National Academy of Sciences, USA.
One of the areas involving intense activities to improve photovoltaic efficiency involves making use of ferroelectric materials, as it offers the possibility of splitting the photo-excited electron-hole pair with the help of the internal polar field. There are two distinct classes of systems where this concept has been invoked in recent times, leading to a great deal of excitement in the community. One class of materials is based on organic-inorganic hybrid methyl ammonium (MA) lead halides (MAPbX3, with X = I, Br, and Cl) compounds that have led to extraordinary efficiencies of > 20% in conjunction with many other attractive features, such as solution processability. An intensely debated issue in this field concerns the ability of permanent dipoles on MA units to give rise to polar fields, either in the normal state (as in the case of any ferroelectric material) or in the photo-excited state, contributing to its spectacular photovoltaic properties. The other class of materials are based on well-known inorganic ferroelectric materials; unfortunately, most such materials have large bandgaps, thereby not being able to harvest a major part of the solar spectrum. Our own efforts in these areas rely on investigating physical properties of hybrid materials with a host of techniques that are differently sensitive to polar nature of any given material, probing time-scales from the static down to a few hundred femto-seconds, both without and in presence of photo-excitation to address the outstanding issue of polar fields in this case. Our results conclusively establish the absence of any significant polar field in MAPbX3, In the case of all inorganic materials, we show how solid state chemistry can be used to reduce the bandgap of ferroelectric materials significantly while retaining their ferroelectric properties, making these more suitable for solar light harvesting applications.
Biography

Professor D D Sarma
Indian Institute of Science, India

D D Sarma obtained a PhD Degree in 1982 from Indian Institute of Science (IISc), Bangalore. He worked in Kernforschungsanlage, Jülich, Germany, as a Visiting Scientist during 1984 – 1986. Since 1986, he has been a faculty member at Solid State and Structural Chemistry Unit of IISc. His current research interest spans the science of strongly correlated electron systems, primarily based on transition metal compounds, and semiconductor nanocrystals using a wide range of experimental as well as theoretical tools. He has published more than 400 scientific papers and holds several patents. He is a Fellow of Indian Academy of Sciences, Indian National Science Academy, The National Academy of Sciences India, Indian National Academy of Engineering, The World Academy of Sciences (TWAS) and American Physical Society. He has received a large number of national and international awards and recognitions, including multiple Honoris Causa Doctorate degrees.
Sir David Spiegelhalter OBE FRS

Plenary session
Communicating science through the media: what could possibly go wrong?

Scientists are increasingly encouraged to use media to communicate the outcomes of their research, whether it’s through social media, blogging, print, radio or TV, as well as providing an authoritative voice concerning issues of societal concern. This can be an enjoyable and rewarding activity, but brings challenges. There are claims we live in a ‘post-truth’ society in which emotional responses matter more than careful consideration of evidence, and the way in which some science is portrayed can seem to support this, with the risk that exaggerated stories of the dangers of everyday activities will increase public scepticism. I will also talk about personal experiences, some good and some spectacularly bad, and suggest ways of improving the way that scientific and statistical evidence is discussed and used in the public forum.
Biography

Sir David Spiegelhalter OBE FRS
Winton Professor for the Public Understanding of Risk, Centre for Mathematical Sciences, University of Cambridge, UK

David Spiegelhalter is a statistician who has pioneered the modelling of risk in medical contexts. He has brought statistical methodology into the heart of clinical performance monitoring and has worked extensively to improve general understanding of mathematical uncertainty.

David’s statistical work has also resulted in major innovations in artificial intelligence. His primary contribution to this field was the development of the Lauritzen-Spiegelhalter algorithm, which broadened the scope of machine learning to include exact probabilistic reasoning.

An expert on medical statistics, David has played a leading role in a number of public inquiries and was part of the Joint British Societies team that developed revised guidelines for cardiovascular care. He is also a popular and respected communicator of scientific concepts and has written numerous books and newspaper articles explaining the nature of risk, uncertainty and statistics.
Dr Ussif Rashid Sumaila

Future of the oceans
An interdisciplinary economic approach to a thriving future ocean

The Singapore water story began some 60 years ago. For reasons such as infrastructure inadequacies, water was scarce and this may seem ironical on a tropical island which receives much rainfall. Then as Singapore developed there was need to ensure water supply could keep pace with demand and that there is water security. This a brief discussion on the journey Singapore embarked on towards water sustainability. The journey included fresh perspectives on land used as water catchments, education to better ensure a sense of ownership towards waterbodies, minimising loss and wastage, and deployment of ‘new’ technologies to produce more freshwater such as membranes in desalination and reclaiming water from used water. In the midst of deploying such technologies, the fact Singapore imports energy looms large as this then impacts on water production costs. Reducing energy needs and recovering energy are issues addressed by ongoing R&D on issues such as carbon capture and enhanced anaerobic digestion.
Biography

Dr Ussif Rashid Sumaila
Professor and Director of the Fisheries Economics Research Unit,
University of British Columbia, Canada

Dr Sumaila is Professor and Director of the Fisheries Economics Research Unit at the University of British Columbia. He received his PhD from Bergen University, Norway, and holds a BSc with honors from Ahmadu Bello University, Nigeria. Dr Sumaila is deeply interested in how economics, through integration with ecology and other disciplines, can be used to help ensure that ocean resources are sustainably managed for the benefit of both current and future generations. His key recent contributions include 1) applying game theory to fisheries; 2) rethinking the nature of the discount rates applied in marine resource valuations, and formulating a highly original alternative, ie, ‘intergeneration discount rates’; 3) understanding the nature, amounts and effects of government subsidies on global fisheries; 4) estimating the multiple benefits that would be obtained globally by rebuilding fish stocks and setting up marine reserves, including conceiving of the High Seas as a large marine reserve. Sumaila has authored over 200 journal articles; which have appeared in prestigious journals such as Nature, Science, Nature Climate Change, Ecological Economics, and the Journal of Environmental Economics & Management. Dr Sumaila is winner of the 2017 Peter Benchley Ocean Award in the Excellence in Science category; the 2016 UBC Killam Faculty Research Prize; the 2013 American Fisheries Society Excellence in Public Outreach, the Stanford Leopold Leadership Fellowship and the Pew Marine Fellowship. He was named a Hokkaido University Ambassador in 2016. His work is highly regarded by policy makers at the highest levels, resulting in invitations to give talks at the United Nations, the White House, the US Congress, the European Parliament, the African Union, the British House of Lords, and the Canadian Parliament.
Emerging Infectious diseases
Emerging and disappearing Infectious diseases
Progress towards the global elimination of trachoma

Trachoma is an ancient, blinding eye infection caused by Chlamydia trachomatis. Repeated episodes of conjunctivitis cause prolonged inflammation leading to scarring of the upper eyelid and inturned eyelashes that cause blindness. Although most infection occurs in young children, blindness usually develops in older adults. Blindness results from 150 – 200 episodes of re-infection.

In 1997, the World Health Organization (WHO) initiated the Global Elimination of Trachoma by the year 2020 (GET2020) using the SAFE Strategy (surgery for inturned eyelashes, antibiotic treatment, facial cleanliness and environmental improvement) to eliminate trachoma. Then 54 countries had endemic trachoma. Following a huge global effort three countries now have elimination of trachoma and seven others are awaiting verification. The Diamond Jubilee Trust was established in 2013 to recognise the Queen. It has supported trachoma programs in five African Commonwealth countries, Kenya, Mozambique, Malawi, Nigeria and Uganda, four Pacific Island countries, Fiji, Kiribati, Solomon Islands and Vanuatu, and Australia. In parallel, DFID has provided over 60 million pounds to support the global mapping of trachoma and other trachoma activities in seven other African countries.

Australia is the only developed country to still have trachoma, although considerable progress has been made over the last eight years with particular attention paid to health promotion to reduce transmission with improved facial cleanliness.

Overall, there is good progress in eliminating this blinding scourge and trachoma is projected to be eliminated in 75% of the countries by 2020 and in the remaining by around 2025.
Biography

Professor Hugh Taylor
Harold Mitchell Professor of Indigenous Eye Health, University of Melbourne, Australia

Melbourne Laureate Professor Hugh Taylor is the Harold Mitchell Professor of Indigenous Eye Health at the University of Melbourne. He was Head of the Department of Ophthalmology at the University of Melbourne and the Founding Director of the Centre for Eye Research Australia from 1990 to 2007. Prior to that, he was a Professor of Ophthalmology at the Wilmer Institute at the Johns Hopkins University in Baltimore with joint appointments in the Departments of Epidemiology and International Health.

Professor Taylor’s current work focuses on Aboriginal eye health. He has led the efforts to eliminate trachoma in Australia and developed *The Roadmap to Close the Gap for Vision*, a blueprint to provide sustainable eye-care services to Indigenous Australians. He has worked with WHO in different roles for over 30 years.

He has written 36 books and reports and more than 700 scientific papers. He has received multiple international awards and prizes and is a Fellow of the Australian Academy of Health and Medical Sciences. In 2001, he was made a Companion in the Order of Australia.

Professor Taylor is the President of the International Council of Ophthalmology, Deputy Chairman of Vision 2020 Australia and was Vice President of the International Agency for the Prevention of Blindness. He is also a Member of the Expert Advisory Panel of The Queen Elizabeth Diamond Jubilee Trust.
Social and Policy implications of new technologies
Social and policy implications of new technologies in agricultural biotechnology

The toolkit available to scientists working in agricultural biotechnology has been given a boost due to the advent of CRISPR technology. Although much of the work has concentrated on animal science, crop research has also been impacted. To date the emphasis has been on the removal of genes with harmful effects. A good example is the development of a non-browning mushroom. The response of society and regulatory authorities have, predictably, varied. In some, this case is viewed as not requiring any regulation. However, the issue becomes more complicated when considering examples in which genes are added. As flanking DNA, which normally accompanies conventional genetic engineering techniques, is not present in the product it is more difficult to detect that DNA has been inserted. These and other issues around the social acceptance and regulatory aspects of modern agricultural biotechnology will be discussed. The potential impact on agriculture in developing countries will be emphasised.
Biography

Professor Jennifer Thomson
University of Cape Town, South Africa

Jennifer Thomson (PhD Rhodes) is Emeritus Professor in the Department of Molecular and Cell Biology at the University of Cape Town. She held a post-doctoral fellowship at Harvard, was Associate Professor in Genetics at the University of the Witwatersrand, visiting scientist at MIT, and Director of the Laboratory for Molecular and Cell Biology for the CSIR, before becoming Head of the Department of Microbiology at UCT in 1988. She won the L’Oreal/UNESCO prize for Women in Science for Africa in 2004 and has an Honorary Doctorate from the Sorbonne University. Her research field is the development of genetically modified maize resistant to the African endemic maize streak virus and tolerant to drought. She has published three books on Genetically Modified Organisms: Genes for Africa, Seeds for the Future, and Food for Africa, and is a frequent speaker at international meetings, including the World Economic Forum and the United Nations. She is a member of the board (previously Chair) of the African Agricultural Technology Foundation (AATF), based in Nairobi and Vice-Chair of ISAAA (International Service for the Acquisition of AgriBiotech Applications). She serves on the National Advisory Council on Innovation of the South African Minister of Science and Technology. She is the President of the Organisation for Women in Science for the Developing World (OWSD) and chairs the South African chapter.
Emerging infectious diseases
Strengthening research collaboration among Commonwealth countries

Emerging infectious diseases continue to expose national and global unpreparedness for prevention and control of disease outbreaks. The widespread transmission of Ebola Virus Diseases (EVD) in Guinea, Liberia and Sierra Leone, and subsequent exportation to 7 other countries, highlight the significant threat of emerging diseases to global health security. Three of the ten countries which recorded at least one EVD case are members of the Commonwealth group of nations. During the period between 1940 and 1960, Britain, through the Medical Research Councils, spearheaded intense research collaboration in medicine and agriculture among countries that now make up the Commonwealth of Nations. During this period, as an example, workers in the Ugandan research center isolated several new viruses – Chikungunya, West Nile and Zika – that are now emerging and causing public health emergencies of global concern. However, soon after 1960, research collaboration activities waned, between Britain and independent African countries, except for the Gambia, where there was an active Medical Research Council Unit in Fajara. On the other hand, French speaking African countries and France have maintained active research collaboration through the network of the Institut Pasteur laboratories. The Commonwealth of Nations will benefit tremendously from a renewed and intensified research collaboration, especially on emerging infectious diseases. However, such collaboration must be based on equity contribution of human and financial resources by participating countries, so as to engender mutual respect and benefit.
Biography

**Professor Oyewale Tomori**

Oyewale Tomori, is the immediate past President of the Nigerian Academy of Science with experience in virology, disease prevention and control. He was at the University of Ibadan until 1994, as a Professor of Virology, and later served as the pioneer Vice Chancellor of the Redeemer’s University in Nigeria from 2004 – 2011. From 1994 – 2004, he was the Virologist for the WHO Africa Region, establishing the African Regional Polio Laboratory Network. Dr Tomori has appreciable knowledge of arbovirus and viral hemorrhagic fever infections: Lassa Fever, Yellow Fever, and Ebola Viral Disease. In 1981, he was recognised by the US CDC for contribution to Lassa Fever research. In 2002, he received the Nigerian National Order of Merit, (NNOM), the country’s highest award for academic and intellectual attainment and national development. In 2016, he was honoured by the African Society for Laboratory Medicine with the Lifetime Award for making made a positive impact on public health, through outstanding contributions to, and leadership in laboratory medicine. Dr. Tomori has served/continues to serve on numerous advisory committees, including: WHO Africa Regional Polio Certification Committee, WHO Group of Experts on Yellow Fever Disease, Chairman WHO Yellow Fever Emergency Committee on International Health Regulations (IHR) and World Bank Working Group on Financing Preparedness and Response. He is a member of the 2016 Class of the US National Academy of Medicine. He holds the DVM and PhD degrees of the Ahmadu Bello University and the University of Ibadan, respectively. He has >140 publications in the areas of his expertise.
Sir Mark Walport FMedSci FRS

General issues of science, society and policy

Innovation: Managing risk, not avoiding it

We badly need innovation around the world to deal with the challenges posed by ageing populations, scarce resources, infectious diseases of humans and other species and the need to reduce carbon emissions. But innovation requires change, and any change has within it the potential for both benefit and harm. If we fail to manage risk proportionately we can miss out on major potential benefits, or suffer needlessly. Discussions should be founded around specific possible uses of a technology, their respective alternatives, and the costs of inaction as well as action. We need to reframe the debate about risk: in any public debate science is not the only lens being used, but evidence and rigour are essential.

Biography

Sir Mark Walport FMedSci FRS
Chief Scientific Adviser to HM Government and Head of the Government Office for Science, UK

Sir Mark is the Chief Scientific Adviser to HM Government and Head of the Government Office for Science. Previously, Sir Mark was Director of the Wellcome Trust. Before joining the Trust he was Professor of Medicine and Head of the Division of Medicine at Imperial College London.

He is Co-Chair of the Prime Minister’s Council for Science and Technology and has been a member since 2004. He received a knighthood in the 2009 New Year Honours List for services to medical research and was elected as Fellow of The Royal Society in 2011.
Professor Stephanie Waterman

Future of the oceans
Send in the robots: Using an ocean drone to map Arctic Ocean mixing rates

The distributions of heat, salt, nutrients and chemicals in the oceans are critical to ocean transports, climate variations, and the health of marine ecosystems. Understanding how and at what rate mixing of these properties occurs is fundamental to our understanding of how the oceans work, and crucial for the development of accurate ocean models and robust climate change predictions.

The Arctic Ocean is a rapidly changing environment that is tightly linked to changes in the Earth's climate. As such it is a place where understanding mixing rates and mechanisms is especially important. Historically the Arctic Ocean interior has been quiet, and heat contained in subsurface waters has been sequestered from contact with the surface by strong stratification and weak mixing rates. However, as more ice melts and the ocean is increasingly exposed to winds at the surface, we expect the Arctic Ocean to become increasingly turbulent. There exists the potential for accompanying increased mixing rates to become sufficient to mix the Arctic Ocean's deep heat upward. This would warm surface waters, accelerate the rate of ice melt, and increase turbulent energies further.

For a number of reasons, measurements of ocean mixing to date are strikingly sparse in space and time. This is especially true in the Arctic. Based on the measurements that do exist, it is clear that we are still far from developing a complete picture of Arctic Ocean mixing rates. In this talk, I will describe my research group’s efforts to help address the critical need for more data in this remote and harsh environment by exploiting recent advances in ocean observing technology, specifically in autonomous drone-like platforms and the sensors they carry. As is typical, looking at the ocean at this new level of detail has revealed a wealth of complexity and small-scale structure in need of characterization and understanding. Despite this, the unique view that these measurements has revealed has advanced our understanding of ocean mixing in this region in important ways. I'll review the key lessons learned thus far, and outline the most pressing questions remaining.
Biography

**Professor Stephanie Waterman**  
**University of British Columbia, Canada**

Stephanie Waterman is a physical oceanographer who uses observations and theoretical studies to better understand the dynamics of the ocean circulation. She studies the multi-scale processes responsible for the transfer of energy and variability in ocean properties between ocean motions of different scales, as well as small-scale turbulent dissipation and mixing responsible for the ultimate removal of energy and variance from the circulation and ocean property budgets. A good understanding of these processes is critical to our ability to accurately represent the role of the ocean in climate models. She has participated in observational campaigns in the Atlantic, Pacific, Southern and Arctic Oceans, spending well over a hundred days at sea. More recently, she and her research group have engaged in making state-of-the-art observations of oceanic turbulence from autonomous ocean drones. By doing so, in 2015 her group collected the densest set of turbulence measurements in the Arctic Ocean to date, allowing for the first statistical demonstration of the natural variability of turbulence in this region. Her work has gained international recognition, attracting significant research awards including the CNC-SCOR Early Career Ocean Scientist Award (2016), the Sloan Research Fellowship in Ocean Science (2015), and the ARC Discovery Early Career Researcher Award (2012).
Sustainable cities
The Singapore water story

The Singapore water story began some 60 years ago. For reasons such as infrastructure inadequacies, water was scarce and this may seem ironical on a tropical island which receives much rainfall. Then as Singapore developed there was need to ensure water supply could keep pace with demand and that there is water security. This a brief discussion on the journey Singapore embarked on towards water sustainability. The journey included fresh perspectives on land used as water catchments, education to better ensure a sense of ownership towards waterbodies, minimising loss and wastage, and deployment of ‘new’ technologies to produce more freshwater such as membranes in desalination and reclaiming water from used water. In the midst of deploying such technologies, the fact Singapore imports energy looms large as this then impacts on water production costs. Reducing energy needs and recovering energy are issues addressed by ongoing R&D on issues such as carbon capture and enhanced anaerobic digestion.
Biography

Professor NG Wun Jern
Executive Director, Nanyang Environment & Water Research Institute (NEWRI)

Professor Ng founded and is Executive Director at the Nanyang Environment & Water Research Institute. NEWRI, a globally ranked environmental engineering research organization, covers technology development, de-risking, education, industry and community interface, and full-scale applications. Capabilities include modeling and visualization, membranes, biotechnology, chemistry and materials, and sludge and solid waste management, with laboratory to large-scale demonstration facilities.

Ng’s research in water, wastewater and waste management focuses on quality, treatment science, and technology development. His some 500 publications include journal papers, presentations, chapters and monographs, reports, trade secrets, and patents. IPs commercialised include the aeSBR, anSBR, aeMSBR, Hybridan, Anfil, deep shaft aerator, flocculator, anaerobic digestion technologies, and phytohormone applications.

Ng has extensive industry involvement, having implemented his research outcomes in some 130 full-scale wastewater treatment facilities – the largest having 1.2million ep capacity. Ng was Chairman at an international consulting firm and continues to serve as Chairman in his spin-off companies.

Ng leads NEWRI’s philanthropic efforts and works with communities with need for better sanitation and water in Indonesia, Myanmar, Laos, Sri Lanka, India, and Bhutan. Completed projects include bank filtration water supply, lake clean-up, and wastewater treatment.
Student session
The US Energy Information Administration has predicted that global energy demand will increase from 549 quadrillion Btu in 2012 to 815 quadrillion Btu by the year 2040\(^1\). Accordingly, several sources of energy are being harnessed to meet the growing demand, including but not limited to: combustible fuels, nuclear, geothermal, wind and solar. The abundance, sustainability and overall green nature of solar energy makes it an attractive source of electricity.

Plastic based solar cells offer a more flexible, easily processed, lightweight and tunable technology for electricity generation compared to the silicon based solar cells\(^2\). Nonetheless polymers typically used as electron donor materials in plastic solar cells suffer from polydispersity and end group variation which can lead to poor reproducibility between batches. The use of organic small molecules (such as acceptor coupled 3,4-ethylenedioxythiophene, EDOT molecules)\(^3\) for plastic solar cells can avoid this issue as they have well-defined, monodisperse structures compared to the polymer counterpart\(^4\).

The work presented here involves synthesis and characterisation of novel organic small molecules, as well as the fabrication of solar cell devices using the molecules as electron donors for electricity generation.

It is anticipated that, the research shall contribute to the provision of greener, sustainable and inexpensive electricity for the future generation.

Reference


B Y Antwi\(^1,2\), R G D Taylor\(^2\), J Cameron\(^2\), N Findlay\(^2\), R B Owoare\(^1\), R Kingsford-Adaboh\(^1\) and P J Skabara\(^2\).

2. University of Strathclyde, Glasgow, UK.
Biography

Boniface Yeboah Antwi is a chemistry PhD candidate at the University of Ghana, Legon, Accra, Ghana (2013 – present). His thesis area is centred on the synthesis and physical characterisation of novel materials for organic photovoltaics, as well as the fabrication and optimisation of these devices. This work is supported by the Royal Society–Leverhulme Africa capacity building award under the supervision of Professor R Kingsford-Adaboh (University of Ghana) and Professor P J Skabara (University of Strathclyde, Glasgow, UK). He recently published some of his results in the journal RSC Advances (DOI: 10.1039/C6RA22897F). Additionally, Boniface has made presentations of his work at international conferences organised in Africa and the UK. These include oral presentations at the RSC-Pan African Chemistry Network International conference on Materials Chemistry, Kumasi, Ghana, (3 October 2016), the Ghana Academy of Arts and Sciences one day science communication workshop, Accra, Ghana, (27 October 2015) and the Technology Transfer workshop, Ghana Telecom University, Accra, Ghana, (12 March 2014).
Evan Brenton-Rule

Invasive species: new management?

Invasive species are one of the problems of an increasingly interconnected world. Here I will discuss results from my PhD, demonstrating that: (1) Invasive species can have unexpected and unseen impacts on their recipient environments; and (2) That social indicators, such as political stability and rule of law, can be used to predict invasive species risk associated with internationally traded commodities.

Biography

Evan is a PhD student at Victoria University of Wellington, New Zealand. He has undergraduate degrees in biology and law. Broadly, his interests lie in the application of science to global problems. In his PhD he uses tools from molecular biology to try and better inform legal regulation of invasive species. Outside of academia Evan works in developing nations in the Pacific, helping to build resilience in the area of biosecurity.
Michael Gallaugher

Clustering and classification of clickstream data with applications in anti-terrorism

Clustering and classification deals with finding and analyzing underlying groups in heterogeneous data. Clickstream data, one of the various types of ‘big data’, looks at an internet user’s search patterns. One application of the clustering and classification of clickstream data is anti-terrorism. With the rise of various terrorist groups, analyzing a person’s internet search patterns could potentially help prevent an attack. However, raising a flag each time a person visits a certain website would raise too many flags, and therefore the sequence of searches and the amount of time spent on a website would have to be considered, as well as other potential covariates.

Biography

Michael Gallaugher is currently a first year doctoral candidate in statistics at McMaster University working under the supervision of Dr Paul D McNicholas, Canada Research Chair in Computational Statistics. Michael holds a Vanier Canada Graduate Scholarship from the Natural Science and Engineering Research Council of Canada, and his research is in the area of clustering and classification which analyzes underlying homogenous group structures in data, with a focus on mixture model-based approaches. Outside of his studies, Michael is an accomplished pianist and violinist.
Andree Hartanto

The Relationship between video game and cognition: clarifying the misconceptions

Recent surveys have shown significant increases in the prevalence of video gaming in children and young adults. Despite its prevalence, however, there are currently many misconceptions among general public regarding the consequences of video gaming. For example, there is a popular belief among parents and teachers that playing video game can cause lower cognitive functioning. To challenge the misconception, I will present two of my recent research that examine the effect of video gaming on executive functions and academic achievement in children and young adults. Possible implications will also be discussed.

Biography

Andree Hartanto is a third-year PhD candidate from Singapore Management University who currently works on media psychology. He conducts experimental study to examine the consequences of using new media and technological devices on our emotion and cognition. His research has been published in several psychology journals, such as Cortex, Cognition, AP&P (Attention, Perception, and Psychophysics), Computer in Human Behaviours, Journal of Psycholinguistic Research, and Frontiers in Psychology. He is the recipient of the Postgraduate Research Scholarship and Presidential Research Fellowship from Ministry of Education Singapore.
Organics in Ice Cores: Newly identified emissions from the terrestrial biosphere, trapped in polar ice, may reveal clues to past climates.

My project focuses on searching for atmospheric particles which become trapped within layers of ice in polar regions as the ancient snow fell. Ice cores (vertical, cylindrical ice sections) drilled from these ice masses are, in simple terms, a time capsule of these atmospheric samples. The particles trapped within help us understand the past climate states of the Earth up to the last 800,000 years. Specifically I am interested in particles that come originally from trees and plants, which may teach us about past regional temperatures and biosphere composition over at least the last few hundreds to thousands of years.

Biography

Amy King is a PhD student working jointly with the British Antarctic Survey and University of Cambridge, United Kingdom. Growing up with a passion for the natural world, Amy spent time studying geology, marine science, and climate in both the United Kingdom and Australia. Realising how lucky she is to be able to spend her life researching something she loves, as well as the potential impacts of her field of research, Amy also likes to communicate her science wherever possible to different audiences through outreach activities. She recently returned from her first ever ice coring expedition in the Sub-Antarctic!
Islands in the ice: Expansion and increasing connectivity of Antarctic ice-free areas under climate change

Though constituting <1% of the continent, Antarctic ice-free areas are home to over 99% of the continent's terrestrial biodiversity, including penguins, lichens, moss, tardigrades and nematodes. Despite global interest in climate change impacts, very little research has focused on understanding how ice-free areas and associated Antarctic biodiversity will be impacted by climate change. We demonstrate that total ice-free area across the continent could expand by nearly 25% by the end of the century, with substantial expansion and coalescence of ice-free areas in the Antarctic Peninsula. The increasing connectivity and expansion of habitat could provide new opportunities for both native and non-native species.

Biography

Jasmine is a conservation scientist and spatial ecologist in the final year of her PhD, based at the University of Queensland, CSIRO and the Australian Antarctic Division. Her research focuses on conserving terrestrial Antarctic biodiversity in the face of multiple threats, including climate change, human activity and invasive species. She is passionate about using robust science to form evidence-based policy and help species and ecosystems cope with climate change, and she is aiming to pursue a career in Antarctic science and conservation.
Selma Lendelvo

Factors influencing the establishment of translocated ungulates in the community-based conservancies in Namibia

Wildlife translocation has been practiced worldwide for decades as a management tool that promoted biodiversity conservation, increased the survival rates of species and also made sustainable exploitation possible. Recent translocations in Namibia involved the movement of wildlife from protected areas into Community-based Natural Resources Management (CBNRM) approaches. The habitat factors appeared to be favourable to both the species but the negative outcomes of the eland could be alluded to the human disturbances which should have contributed to high dispersal levels in avoiding disturbances. This is a unique and rare experience that can be share world-wide to design translocation programs to protect our wildlife in various suitable ways.

Biography

Selma Lendelvo is currently a researcher and PhD student at the University of Namibia. She has a BSc (Botany and Zoology) from UNAM, and an MSc in Natural Resources Management and Sustainable Agriculture from Norwegian University of Life Sciences. Selma has been working with the University of Namibia for the past 15 years and has worked various research programmes on aspects of livelihoods, land reform, socio-ecological and community based-natural resources management in Namibia and neighboring countries. Lendelvo is part of the Namibian partnership promoting community-based conservation and ensuring its contribution to the welfare of the local people through research and capacity building.
Luke Mizzi

Auxetic mechanical metamaterials in skin grafting

Mechanical metamaterials are systems whose anomalous mechanical properties depend primarily on the geometry rather than their intrinsic material composition. These systems include auxetics, which are materials which possess the counter-intuitive property of a negative Poisson’s ratio (i.e. they expand laterally when stretched). This property makes them ideal for use in niche applications in the biomedical field such as skin grafting. In typical skin grafting operations, a piece of skin is removed from a healthy part of the body, perforated, stretched and transplanted onto the damaged area. However, currently used skin graft perforation techniques, although adequate for the many situations, are not very efficient since the perforation patterning used does not significantly increase the potential expansion of the graft. In our work, we propose novel auxetic metamaterial-based skin grafts which have the potential to expand many times their original dimensions and could provide a more efficient and viable alternative to the current methods used.
Characterising variation in the Sirex-Amylostereum-Deladenus symbioses using genomic data

Understanding diversity in invasive pest populations is crucial for effective biological control programs. The Sirex-Amylostereum-Deladenus symbioses represent an ideal invasive pest and biological control system to study the impact of diversity. In this study we characterised mitochondrial genomes of different strains of invasive populations of the pest Sirex noctilio to augment microsatellite and standard barcoding markers. For the symbiotic fungus, Amylostereum areolatum, we developed and used microsatellite markers, in addition to mitochondrial genome data. For the biocontrol agent, Deladenus siricidicola, population genetic data was compared to variation in key fitness traits that could affect biological control programs.

Biography

Osmond Mlonyeni is a PhD candidate in Genetics at the Forestry and Agricultural Biotechnology Institute (FABI) at the University of Pretoria (UP). He has published in international peer-reviewed journals and presented at national and international conferences. The latest conference presented at was the International Congress of Entomology in Florida, USA, 25 – 30 September 2016. Osmond has also served at various leadership levels of student-led organisations and management committees within the University of Pretoria.
Vrinda Mukundan

Photochemical modeling of the ionosphere of the Saturnian moon Titan

Collisions of solar ultraviolet photons and photoelectrons with the neutral atoms and molecules present in the atmosphere can cause many pertinent chemical and physical processes. In Titan, the Saturnian moon, when sunlight hits the major neutral constituents nitrogen and methane, the molecules are broken up whose subsequent reactions with the background neutrals cause the production of higher order hydrocarbons, ions and free electrons. I work on developing a one dimensional photochemical model to calculate the density profiles of ions and free electrons and thereby understand the complex chemistry scheme in the ionosphere of Titan.

Biography

Born and brought up in Kerala, India, Vrinda went on to pursue her post graduate studies in Physics MG university, Kerala and Christ University, Bangalore. In 2014, she joined Space Physics Laboratory, Vikram Sarabhai Space Centre, Indian Space Research Organisation(ISRO) in Trivandrum for Phd under the guidance of Dr Anil Bhardwaj. Vrinda’s research interests include the study of planetary atmospheres, specifically the modeling of photochemistry in order to understand the physics and chemistry of upper atmospheric regions. Currently she focuses on the atmosphere of the Saturnian moon Titan with the aim of understanding the chemistry schemes that causes the formation of hydrocarbon ions and free electrons in the atmosphere of the satellite.
Phylicia Ricketts

The objective of my research was to investigate the impact of maternal fish intake on placental mercury concentrations for pregnant women living in Jamaica and Trinidad & Tobago. A selected group of pregnant women were interviewed on their fish intake and other possible sources of mercury exposure. Maternal residence and neonatal anthropometric data were also recorded. Several analytical techniques were used to determine mercury concentration in the placentas. The results showed that those pregnant women who regularly ate oceanic pelagic fish reported higher placental mercury concentrations than those who regularly ate reef finfish. It was also found that mothers living near bauxite mining reported higher placenta mercury concentrations. Due to the overall low levels of placenta mercury concentrations, it was difficult to determine any significant effects on neonate anthropometry. The results from this study clearly showed an influence of maternal fish intake preferences on prenatal mercury exposure and thus a recommendation for a fish consumption advisory for pregnant women is necessary for public health purposes.

Biography

Phylicia Ricketts uses basic concepts in physics to investigate critical issues regarding human health and the environment. She believes that multidisciplinary research is relevant for solving many problems. She won the Best Poster award at the Women in Nuclear 22nd Annual global conference. Her poster was titled Non-destructive characterization of elements in human placenta using energy dispersive x-ray fluorescence and gamma spectroscopy. She has since published several papers on mercury concentration levels in human placenta and its impact on maternal and prenatal health in Jamaica and in Trinidad & Tobago.

Phylicia has also received several training and fellowship awards funded by the International Atomic Energy Agency (IAEA).

Phylicia holds a BSc in Medical Physics and Bio-engineering from the University of the West Indies, Mona. She is currently pursuing a PhD in Applied Physics. She also plays the clarinet in the UWI classical ensemble.
Extreme events in the Southwest Pacific are mostly related to tropical cyclone, drought and floods that have dramatic impacts on socio-economic development for the island countries. Monthly and annual rainfall totals measured at stations at Pekoa and Sola airport on Santo and Vanua Lava Island, respectively in northern Vanuatu, and at Lata airport on Santa Cruz Island in the eastern Solomon Islands. The rainfall record for northern Vanuatu and eastern Solomon Islands span from 1971 – 2012 and 1975 – 2012, respectively. Previous literature found positive correlation between monthly and annual rainfall anomalies with monthly and annual variations in the Southern Oscillation Index (SOI). We investigate the relationship between the SOI and the precipitation records, at various leads and lags, to explore the potential for using this large-scale climate index as a monthly to seasonal rainfall prediction tool. The highest correlation between SOI and the total rainfall occurs when the SOI leads the rainfall by five and seven months in northern Vanuatu and four months in the eastern Solomon Islands. In particular, this relationship appears to be particularly robust for the wet season rainfall months of November – April.

Biography

Graduated from the University of the South Pacific (USP), Bachelor of Science in Environmental Science (BSc). Worked as weather observer and forecaster at the Vanuatu meteorology. Also worked as climate officer, before pursued further postgraduate studies at the University of Auckland (UoA), New Zealand. Graduated from UoA, Graduate diploma in Science (GdipSci), Postgraduate Diploma in Science in Environmental Science (PGdipSci), and Master of Science in Environmental Science (MSc). Master research topic is; Relationship between the Southern Oscillation and Rainfall in the Vanuatu region of the Southwest Pacific. Currently pursuing PhD study at USP, Suva, Fiji, and research topic focus on improving rainfall predictions in the Solomon Islands, Vanuatu, Fiji, Tonga and Tuvalu in the southwest Pacific.
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