# Program

<table>
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<tr>
<th>Time</th>
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<td>07:45 – 08:30 hr</td>
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| 08:30 – 08:45 hr | Opening and Welcome  
*Mr. Geoffry Smith, ILSI SEA Region, Singapore* |
| 08:45 – 09:20 hr | **KEYNOTE**  
*Chairperson: Prof. Choon Nam Ong, NERI, Singapore*  
Smart Data and Food Innovation: Potential Impact on Public Health Solutions  
*Dr. Ralph Graichen, A*STAR, Singapore* |
| 09:20 – 09:55 hr | An Evolutionary Perspective on Nutritional Science and Human Health: From Reductionism to System Approaches  
*Prof. Richard Head, The University of South Australia, Australia* |
| 09:55 – 10:10 hr | Q&A                                                                  |
| 10:10 – 10:30 hr | Tea Break                                                            |
| 10:30 – 10:55 hr | **SESSION 1**  
Transformation Technologies in Food Systems  
Applications in Food Manufacturing and Supply Chains  
*Chairperson: Dr. Diána Bánáti, ILSI Europe, Belgium*  
Technology Innovation: Trends that are Reshaping Life Science Research and Approaches to Food and Human Health  
*Dr. Chor San Khoo, ILSI North America, USA* |
| 10:55 – 11:25 hr | Innovations in Agriculture and Food and Implications for Nutrition and Precision Health  
*Dr. Christopher Downs/Prof. Lynne Cobiac, CSIRO, Australia* |
| 11:25 – 11:55 hr | New Agricultural Technologies for Sustainable Food Systems and Nutrition Improvement in ASEAN: Opportunities and Challenges  
*Prof. Paul Teng, NIE/NTU, Singapore* |
| 11:55 – 12:25 hr | Data Science and Analytics: Blockchain and its Application in the Food Supply Chain  
*Ms. Zelda Anthony, IBM ASEAN, Singapore* |
| 12:25 – 12:40 hr | Q&A                                                                  |
Program

12:40 – 13:45 hr  Lunch and Networking

SESSION 2
Reshaping Human Health Through Translational Science
Improved Nutrition, Biomedical Impact and Public Health Solutions
Chairperson: Prof. Lynne Cobiac, CSIRO Health and Biosecurity, Australia

13:45 – 14:15 hr  Harnessing Emerging Technologies in Nutrition and Biomedical Science for Public Health Improvement
Prof. Christiani Jeyakumar Henry, CNRC, A*STAR/NUHS, Singapore

14:15 – 14:45 hr  Advances in Antioxidant Research: Translation from Bench to Applications
Prof. Barry Halliwell, A*STAR/NUS, Singapore

14:45 – 15:15 hr  Potential of Genome Editing Tools in Agriculture, Preventative Health, and Diseases – Current and Future
Prof. Meng How Tan, Genome Institute of Singapore, A*STAR, Singapore

15:15 – 15:30 hr  Q&A

15:30 – 15:50 hr  Afternoon Refreshment Break

SESSION 3
Transformation Technologies in Food Safety
Improving Food Safety Assessment and Management
Chairperson: Dr. Junshi Chen, ILSI Focal Point China, China

15:50 – 16:20 hr  Applications of Next Generation and Whole Genome Sequencing (WGS): Opportunities and Challenges for Food Safety Management
Dr. Masami Takeuchi, FAO RAP, Thailand

16:20 – 16:50 hr  Novel Computational Approaches for Assessing the Allergenic Potential of Proteins for the Food Industry
Dr. Sebastian Maurer-Stroh, Bioinformatics Institute, A*STAR, Singapore

16:50 – 17:00 hr  Q&A

PANEL DISCUSSION
Multi-stakeholder Partnerships in the Application of New Technologies in the Food System
Chairperson: Dr. Ralph Graichen, A*STAR, Singapore

17:30 – 17:40 hr  Closing Remarks

Organizer

In collaboration with
About the Organizer

International Life Sciences Institute (ILSI) Southeast Asia Region

The International Life Sciences Institute (ILSI) is a non-profit, worldwide foundation based in Washington, DC, USA established in 1978 to advance the understanding of scientific issues relating to nutrition, food safety, toxicology, risk assessment and the environment. ILSI accomplishes its work through its branches and the ILSI Research Foundation.

Established in 1993, ILSI Southeast Asia Region facilitates and coordinates scientific programs, research and information dissemination in ASEAN, Australia, New Zealand and the Pacific Islands. Based in Singapore, ILSI Southeast Asia Region also oversees Country Offices and Committees in Australia, Indonesia, Malaysia, Philippines, Thailand and Vietnam.

By bringing together scientists from government, industry, academia and the public sector, ILSI seeks a balanced approach to solving problems of common concern for the health and well-being of the general public. ILSI receives financial support from the industry, government, and foundations.
About Our Collaborators

The **Agency for Science, Technology and Research (A*STAR)** is Singapore’s lead public sector agency that spearheads economic oriented research to advance scientific discovery and develop innovative technology. Through open innovation, we collaborate with our partners in both the public and private sectors to benefit society.

As a Science and Technology Organisation, A*STAR bridges the gap between academia and industry. Our research creates economic growth and jobs for Singapore and enhances lives by contributing to societal benefits such as improving outcomes in healthcare, urban living, and sustainability.

We play a key role in nurturing and developing a diversity of talent and leaders in our Agency and Research Institutes, the wider research community and industry. A*STAR oversees 18 biomedical sciences and physical sciences and engineering research entities primarily located in Biopolis and Fusionopolis. For more information on A*STAR, please visit [www.a-star.edu.sg](http://www.a-star.edu.sg)

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The **Commonwealth Scientific and Industrial Research Organisation (CSIRO)** is Australia’s premier national research organisation, and one of the largest and most diverse research agencies in the world.

We employ a team of more than 5,000 world-class scientists, engineers, technologists and economists to deliver solutions for some of the world’s most challenging problems and make a difference to the economy, society and the environment.

With more than 1,800 patents, we are Australia’s largest patent holder. This ever-increasing wealth of intellectual property is a vast source of commercial opportunity and has already resulted in more than 150 spin-off companies, with many more to come. We collaborate with 3,000 customers each year, including Australian government bodies; small, medium and large businesses; universities, and more than 150 international partners.

Our research develops innovative food processing technologies, creates new value-added foods, and improves lives with next generation health programs and technologies. Find out more about us at [www.csiro.au](http://www.csiro.au)
KEYNOTE

Chairperson: 
Prof. Choon Nam Ong, NUS Environmental Research Institute (NERI), Singapore
Prof. Choon Nam Ong is a Professor at the School of Public Health, National University of Singapore (NUS). He is also the Director of NUS Environmental Research Institute (NERI), Singapore. His main research interests are identification and validation of biomarkers for environmental exposure, diet and disease and molecular toxicology. For the past several years, he has developed a metabolomic platform to look into the relationship of environment and chronic diseases. Prof Ong is currently a member of the WHO Expert Panel, Guidelines for Drinking Water Quality. He is also an advisor to the Center for Disease Control and Prevention, China, and an Honorary Professor for the Chinese Academy of Science. And he also served as advisor of the National Water Research Institute, California, USA. He chaired the International Expert Panel on NEWater, Singapore. Prof Ong is a member of several editorial boards and has authored more than 330 scientific articles in international peer-reviewed journals with over 21,000 citations.
Smart Data and Food Innovation: Potential Impact on Public Health Solutions

Dr. Ralph Graichen, Biomedical Research Council, A*STAR, Singapore

Big Data is getting the next frontier for innovation in the food value chain. The sheer volume of data managed and generated every single day, which in itself is defining the term “Big Data”, is a global phenomenon. It is bringing considerable challenges to organizations - shortage of talent and infrastructure are only the beginning. On the other side, Big or rather “Smart” Data are already paying significant dividends for many industries and are now more and more readily applied in food science, food safety, and in securing the supply chain. What are Smart Data providing? They offer increased opportunities in better decision making, they help to uncover underlying trends (from consumer, to operational issues, to innovation). Correlations and relationships are emerging that would typically not be available in one dimensional, unstructured data sets. Smart data are not only valuable in the space of consumer insights and market trends. Smart data are now seen as a driver of growth and innovation, used to screen for new functionalities and novel features, help drive food security and safety. Potential applications and benefits are plentiful, but also a multitude of issues have to be addressed before being able to capture the full potential of smart data. Everything from data policies, collection and access, management and infrastructure needs to be addressed in the context of privacy, security, liability and intellectual property.

Dr. Ralph Graichen is currently Director, Food and Nutrition, Biomedical Research Council (BMRC) of the Agency for Science, Technology and Research (A*STAR), Singapore. In his current position with A*STAR, Ralph works with strategic partners to administer and develop new initiatives and programmes in the research areas of food and nutrition. He has a co-appointment as Adjunct Associate Professor with Nanyang Technological University, School of Chemical & Biomedical Engineering. He also sits on the advisory panel of the Food Innovation & Resource Centre, Singapore Polytechnic as well as multiple grant review committees. Dr. Graichen has over 12 years of experience in the local and global biomedical and nutrition industry. He was previously Research Operations Manager for Abbott Nutrition in Asia, establishing the R&D infrastructure and managing the research portfolio for Asia. Prior to joining Abbott Nutrition, Dr. Graichen was Research Director for ES Cell International, the first organization to provide clinical grade embryonic stem cell lines to the world’s research community (now a subsidiary of Bio Time Inc). Preceding ES Cell Dr. Graichen was part of the regional business development team at Roche Diagnostics Asia Pacific. Dr. Graichen graduated with a master in Biology from the Johannes Gutenberg University, Mainz, Germany and attained his PhD from the National University Singapore through the Institute of Molecular and Cell Biology. Dr. Graichen attended the Food System Leadership Institute, a program of the Association of Public and Land-Grant Universities (APLU) with support from the W.K. Kellogg Foundation.
An Evolutionary Perspective on Nutritional Science and Human Health: From Reductionism to System Approaches

Prof. Richard Head, University of South Australia/The University of Adelaide, Australia

Historically, humans have demonstrated remarkable inventive skills in and around the fundamentals of sustenance, mobility, shelter and communication. Food and nutrition have featured powerfully in that inventiveness over thousands of years. As a generalisation across areas of science and engineering, success has been the ability to achieve scale and concurrently to derive personalisation from complexity with sophistication.

In nutritional sciences, we see an evolution of scientific method with a similar emerging pattern. In nutrition and particularly in nutritional deficiency states, the molecular characterisation of the single bioactive and the demonstration of efficacy has been a fundamental contributor to our knowledge and wellbeing. The emergence of an understanding of the pleiotropic properties of many nutrients, their potential influence on, and with, the genome, epigenome, transcriptome, proteome, metabolome, and microbiome, together with dietary behaviour and lifestyle, has stimulated Complex Systems thinking in this area.

The challenge will involve further evolution of the scientific method to meet an individual need for personalisation, clarity and convenience from this scale and complexity, with the appropriate sophistication. Examples of this transition in nutrition and other areas undergoing similar change will be discussed.

Professor Richard Head is a Pharmacologist and is currently Emeritus Professor in the Division of Health Sciences, University of South Australia, Affiliate Professor in the Discipline of Pharmacology, The University of Adelaide, and Honorary CSIRO Fellow. Previously he was the interim Director of the Future Industries Institute at the University of South Australia, the Deputy Vice Chancellor & Vice President: Research and Innovation for the University of South Australia with a substantive position as the Director of the Sansom Institute for Health Research, Division of Health Sciences also at the University of South Australia. Formerly, Prof. Head was the Director of CSIRO’s Preventative Health National Flagship and Chief of CSIRO’s Division of Health Sciences and Nutrition, and prior to that Chief of CSIRO’s Division of Human Nutrition. He served as Professor of Pharmacology and Toxicology at West Virginia University Medical Centre, as Research Fellow with the Department of Medicine at the University of Melbourne and Postdoctoral Fellow at the Roche Institute of Molecular Biology, USA. Prof. Head provided leadership in integrating CSIRO’s fundamental and applied research in human health into Australian health R&D. He is known for operating in translational health on a national scale with multidisciplinary programs. He was the recipient of the CSIRO Medal for Lifetime Achievement, the CSIRO Business Excellence Award and the US National Institutes of Health (NIH) Career Development Award. Prof. Head has a unique background and skill base in pharmacology and nutrition. He is a Member of numerous professional organisations and has extensive experience in research and research management.
SESSION 1
Transformation Technologies in Food Systems
Applications in Food Manufacturing and Supply Chains

Chairperson:
Dr. Diana Banati, ILSI Europe, Belgium
CHAIRPERSON

Prof. Dr. Diána Bánáti is the Executive and Scientific Director of the International Life Sciences Institute, Europe (ILSI Europe) and Professor of the University of Debrecen, Hungary. Currently, she is elected Fellow of the International Academy of Food Science and Technology (IAFoST) and a member of Academia Europaea. She is also member of several Scientific Advisory Committees. Prof. Bánáti has also organised and chaired countless national and international conferences and was extensively involved in national and international R&D programmes and EU research projects (FP6, FP7, H2020). Following her graduation in Food Science and Technology (MSc) in Budapest, Hungary, Prof. Bánáti earned in rapid succession further university degrees (MA in Law, MA in Teaching, CSc, PhD). She became the youngest ever Director General of the internationally-recognized Central Food Research Institute. In addition, she acted as a Ministerial Commissioner for food safety and international scientific research cooperation. In her impressively distinguished career, a particularly important landmark was her election to the prestigious functions of Vice-Chair and – with her re-election – of Chair of the Management Board of EFSA, the European Food Safety Authority (2006-2012).
Technology Innovation: Trends that are Reshaping Life Sciences Research and Approaches to Food and Human Health

Dr. Chor San Khoo, International Life Sciences Institute (ILSI) North America, USA

Convergence is gaining popularity as a new approach to address complex cross disciplinary problems in health. Often defined as the integration of the life sciences, physical sciences, mathematics, engineering, and information technology, convergence (research or science) has emerged as a strategic cost effective, and efficient way to develop potential medical, technological, manufacturing and processing breakthroughs.

Recently, convergence approach has led to the proliferation of a new field of “biologically-inspired engineering,” an offspring of unification between the applied and physical sciences, engineering, computational and data sciences, which is accelerating development of novel and precise technology/tools for exploring biological systems and mechanisms. Often, convergence results in unexpected and synergistic transformations. The integration of Big Data, AI, computational sciences, sensor advancement, systems biology, cellular genomics, and nano- and material technologies has opened new doors for combination technologies targeted to customized applications. Examples of such breakthroughs include imaging and photonic tools (optogenetics); data science/mathematical modelling, physiological wearables and digital sensors; stem cells; bioengineered synthetic organs; microdevices (organs on chips) etc. Many of these are currently applied in research related to brain research, aging, organ regeneration, immunotherapy, and drug discovery.

In the food and nutrition fields, convergence approach has yet to be fully applied. The novel tools and technologies emerging from bioinspired research and combination technology breakthroughs need to be explored for opportunistic applications in food and nutrition. This presentation will share additional highlights from ILSI North America Emerging Science Reports.

Dr. Chor San Khoo is currently Senior Science Fellow at the North America Branch of the International Life Sciences Institute (ILSI) in Washington DC, USA, where she serves as science advisor to the institute’s executive director and its scientific programs. Her responsibilities include leading the horizon science and technology trends tracking and authoring the ILSI NA Emerging Science Trends: Insights and Implications and the Emerging Science Signals reports. These reports identify emerging issues and opportunities of importance and relevance to the food and nutrition communities. Dr. Khoo is a co-editor-in-chief of the Frontiers in Nutrition and Food Science Technology Journal. Dr. Khoo was formerly Vice President of Research and Development at the Campbell Soup Company, leading the Global Nutrition and Health Department with responsibility for setting global vision and strategies for internal and external collaborative research and partnerships. She led Campbell’s initiatives on salt and health policy; and was involved in the development of salt reduction technologies, and research on salt taste mechanism. Dr. Khoo has published and presented in many areas of nutrition, and holds six patents on food meal programs for management of at-risk populations. Dr. Khoo received a Bachelor of Science, Chemistry from the University of Oregon, USA, and a PhD in Nutrition Science from Iowa State University, USA, with minors in Biochemistry and Physiology. She completed her post-doctoral research training at the University of California, Davis, USA.
Innovations in Agriculture and Food and Implications for Nutrition and Precision Health

Dr. Christopher Downs, CSIRO Agriculture and Food, Australia
Prof. Lynne Cobiac, CSIRO Health and Biosecurity, Australia

Today we face the challenge of how to sustainably feed the global population that is projected to increase to nearly 10 billion people by 2030. This will be accompanied by an increasingly aging demographic profile, a concomitant elevated health burden from diet and lifestyle related chronic diseases and likely impacts on food production from climate change and other environmental challenges. We are seeing a growing demand from consumers across many different countries for foods with demonstrated health benefits, coupled with the digital explosion of data from populations relating to the internet of things and monitoring health, genetics, eating and other lifestyle behaviours. In combination these trends create the opportunity for a tailored (in real time) sustainable dietary approach as part of a proactive and precise health framework that aims to keep individuals healthy for as long as possible.

Plant-based foods are likely to be both sustainable and healthy due to the presence of a number of plant constituents (both naturally occurring and from enhanced breeding programs) that are associated with decreasing the risk of chronic diseases. We will provide an overview of CSIRO’s new developments in elite grains and other crops, including consideration of new technologies and the likely impacts on nutritional profiles under a range of possible climate change scenarios. We will present some innovative processing technologies which can further modify nutritional profiles and physical functionality of new and existing grains. We will discuss how inappropriate food/nutrition/diet is a major risk factor contributing to the burden of chronic diseases and how it is also a major determinant of how healthy our gut microbiome is.

When planning for producing food in the future, all of these factors need to be integrated into one trans-disciplinary framework which includes industry, government and research partnerships. CSIRO’s newly announced Precision Health Future science platform is one such approach.
Dr. Christopher Downs is Research Director – Food at CSIRO Agriculture and Food, Brisbane, Australia. Dr. Downs leads delivery of CSIRO’s science and innovation outcomes in food, food ingredients and beverages. Key research areas include: Food Safety, Food Stability, Food Structure and Sensory and Food Transformation. Dr. Downs has experience working with the meat, dairy, seafood and horticulture sectors in Australia and New Zealand. He has previously held executive positions in Food Science Australia, CSIRO Food and Nutritional Sciences, CSIRO Animal, Food and Health Sciences and the NZ Institute for Crop & Food Research, with responsibilities including; capability development, science strategy and leadership, investment portfolio leadership, business development and commercialisation. His previous directorships include companies involved in innovation and commercialisation in the seafood and biomaterials sectors. Dr. Downs is currently a Director of one of New Zealand’s Crown Research Institutes, the Australian Institute for Food Science and Technology (AIFST) and the Institute for Food Technologists (IFT) in the USA.

Professor Lynne Cobiac is the Science Director of CSIRO’s Health and Biosecurity, a multidisciplinary science portfolio that focuses on preventing biosecurity threats, minimising the burden of disease and improving efficiency of the health system. Prof. Cobiac is a Professorial Research Fellow at Flinders University and working with Flinders. She is also active in developing and implementing the National Food and Nutrition Research Development and Technology Transfer Strategy through chairing a working group on the nexus between food, nutrition and health. Prof. Cobiac was previously the Director (2012-2014) of the former CSIRO Preventative Health Research Flagship which comprised of multidisciplinary teams from CSIRO and other leading research institutions, working across science boundaries to address the challenge of reducing the impact of chronic disease in an ageing population. Prof. Cobiac has a background in nutritional biochemistry and research coupled with an Advanced Master of Business Administration (MBA), Corporate Director’s training and business management experience.
New Agricultural Technologies for Sustainable AgriFood Systems in ASEAN: Challenges and Opportunities

Prof. Paul Teng, NIE International/Nanyang Technological University, Singapore

The ASEAN region is a dynamic economic region of over 600 million consumers and is also an important source for some of the world’s key agrifood produce such as rice, palm oil, black pepper, pineapple and shrimp. Yet it remains a region of contradictions as many of its member countries are highly vulnerable to disruptions in their agriculture and food supply chains while experiencing rapid economic growth. United Nations estimates put the number of food insecure persons in ASEAN at about one out of ten, concurrent with a problem of over-nutrition (overweight and obesity) among the growing urban middle-class population. The “nutrition transition” is most visible now in urban areas of Southeast Asia, driven partly by rising household incomes and access to food items from outside the region. Arable land in the ASEAN region is about 16% of total land area, but arable land per capita is only 0.12 ha, one of the lowest in the world. At the same time that rapid urbanization is occurring within ASEAN, which is already over 51% urban, loss of productive cropland mainly due to urbanization is estimated to average 3% per year. The ASEAN region is also among the most prone to severe weather events such as tropical cyclones, and climate change projections put many countries in the region as high in future climate vulnerability with respect to temperature and precipitation.

Against this backdrop, sustaining agrifood systems in ASEAN will depend on increasing current agricultural productive capacity with natural resource conservation, and increase agricultural productivity and total food production in consonance with population growth and changing diet demands. These challenges require that investments in science and technology, backed by infrastructure and human resources be made. The essential technologies include bio-based technologies and biotechnology (to narrow crop yield gaps, improve food safety, reduce losses and waste, adapt to climate change and improve food nutritive value), physical technologies for improving productivity and efficiency (such as new nanotech-based applications), mechanical technologies (such as drones and environmental sensors to improve crop management), and digital knowledge technologies (such as integrated systems for Knowledge Intensive Agriculture, models and mobile devices. New rice varieties such as those which tolerate short term submergence from excessive rainfall, and new maize varieties such as those engineered to resist the Asian corn-borer, have proven popular with farmers to tolerate climate change and pests, respectively. But a new generation of new plant breeding technologies and mobile digital devices is available to accelerate crop improvement and management. The benefits to be derived from the so-called “4th Industrial Revolution” will have to be tapped in concert with advances in the biotechnology arena all of which collectively make up “agtech”. For ASEAN to fully utilize the opportunities to increase productivity sustainably and meet the goals of biodiversity and natural resource conservation, the region needs a pragmatic approach to formulate evidence-based, supportive policy and regulations. A financing ecosystem to shorten the time from “proof of concept” to adoption further needs to be in place, with modern “fintech”, and supported by multi-stakeholder partnerships (MSPs).
Professor Paul Teng is Managing Director of NIE International Pte. Ltd., a subsidiary of Nanyang Technological University (NTU), Adjunct Senior Fellow, Centre for Non-Traditional Security Studies, S. Rajaratnam School of International Studies, NTU Singapore; Adjunct Professor, Murdoch University, Australia, and Senior Fellow, Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Philippines. He is internationally recognized for his expertise in food security, commercialization and biosafety of crop biotechnology, agrotechnology innovations and bio-entrepreneurship, and sustainable development. He has over thirty years of experience in agri-food issues from positions in international organizations (the International Rice Research Institute, Worldfish Centre), U.S. universities (University of Minnesota, University of Hawaii) and the private sector. Prof. Teng has won numerous awards for his work such as the Eriksson Prize in Plant Pathology (Royal Swedish Academy of Science), an Honorary Doctor of Science (from Murdoch University, Australia) and is a Fellow of the American Phytopathological Society, and The World Academy of Sciences (TWAS). He is Immediate Past-Chair, Genetic Modification Advisory Committee, Singapore and is also currently Chairman, International Service for the Acquisition of Agri-biotech Applications (ISAAA). He has published/ co-published eight books and over 200 technical papers. His latest book, co-authored with Manda Foo is titled “Food Matters – Issues in food and food security”.

Data Science and Analytics: Blockchain and its Application in the Food Supply

Ms. Zelda Anthony, IBM ASEAN, Singapore

This session will cover what Blockchain is; the key concepts, and why Blockchain is relevant for the food supply chain. Real world examples of where Blockchain is being applied today to the food supply chain will be given, with the aim of providing significant benefits to end consumers and to the participants in the food supply chain.

Zelda Anthony is IBM’s Head of Blockchain, ASEAN, based in Singapore. She is responsible for developing IBM’s blockchain business in the ASEAN region including understanding the key blockchain trends and opportunities and how they can benefit IBM’s customers across all industries, developing IBM’s blockchain strategy for the region and building an ecosystem with partners and Fintechs. Prior to the Blockchain leadership role, Ms. Anthony was Head of Payments for APAC at IBM and prior to that she spent 7 years at SWIFT where she held roles including Head of Compliance products APAC, Head of ASEAN, Head of New Customers APAC and Head of Oceania.
SESSION 2
Reshaping Human Health Through Translational Science
Improved Nutrition, Biomedical Impact and Public Health Solutions

Chairperson:
Prof. Lynne Cobiac, CSIRO Health and Biosecurity, Australia
**CHAIRPERSON**

Prof. Lynne Cobiac is the Science Director of CSIRO’s Health and Biosecurity, a multidisciplinary science portfolio that focuses on preventing biosecurity threats, minimising the burden of disease and improving efficiency of the health system. Prof. Cobiac is a Professorial Research Fellow at Flinders University and working with Flinders. She is also active in developing and implementing the National Food and Nutrition Research Development and Technology Transfer Strategy through chairing a working group on the nexus between food, nutrition and health. Prof. Cobiac was previously the Director (2012-2014) of the former CSIRO Preventative Health Research Flagship which comprised of multidisciplinary teams from CSIRO and other leading research institutions, working across science boundaries to address the challenge of reducing the impact of chronic disease in an ageing population. Prof. Cobiac has a background in nutritional biochemistry and research coupled with an Advanced Master of Business Administration (MBA), Corporate Director’s training and business management experience.
Harnessing Emerging Technologies in Nutrition and Biomedical Sciences for Public Health Improvement

Prof. Christiani Jeyakumar Henry, Clinical Nutrition Research Centre, A*STAR/NUHS Singapore

We are in the midst of a global food revolution – a revolution driven by consumer demand for “healthy foods”. Nutrition and health have taken center stage in our lives – no time in human history has food manufacturing been driven by nutrition as we are witnessing today. In response, food manufacturers have evolved several strategies to develop foods with specific health benefits and by harnessing emerging technologies to develop foods with functional attributes. The strategies used by industry to develop healthy foods include (i) innovative food processing technologies (ii) isolation of novel food ingredients from plants (iii) development of new food ingredients. An early example of a food ingredient with health benefit includes the extraction of beta-glucan from oats/barley to lower blood lipids and cholesterol. An additional example is the extraction of phytosterol from legumes and nuts to also lower cholesterol. New sweeteners such as isomaltulose and allulose are examples of new food ingredients as a substitute for sugar. Ironically, in our quest to identify and isolate novel ingredients from Mother Nature, we have ignored or neglected a vast reservoir of food resources – the tropical plants. Disruptive food technology will enable us to manipulate the structure of food in a unique way in order to develop a range of foods with novel health benefits. With increasing demand for proteins, alternative sources of protein will also become a major focus of research. Finally, the marriage of the nutrient profile of an individual with food selections in the supermarket aisle will enable all individuals to consume foods that are specifically tailored for their overall health and well-being. The 21st century may be seen as the century when disruptive food technology will impact significantly on human nutrition.

Professor Christiani Jeyakumar Henry is Director of the Clinical Nutrition Research Centre and Deputy Executive Director of the Singapore Institute for Clinical Sciences (SICS) A*STAR where he spearheads the translation of nutrition research into food applications, acting as a consultant to global food companies on aspects of food product development with special reference to nutrition. He is a Fellow of the UK Institute for Food Science and Technology and is a Registered Public Health Nutritionist. Prior to working at the SICS, Prof. Henry was the Head of Food Sciences and Nutrition at Oxford Brookes University, UK, and was instrumental in the development and launch of the UK’s first dedicated Functional Food Centre, in his role as Director. Prof. Henry has served on several committees including the UK Committee on Medical Aspects of Food and Nutrition Policy (COMA) panel on Novel Foods, Board member of the UK Food Standards Agency (FSA) and was a member of the General Advisory Committee on Science of the FSA. He was a member of the recent Joint FAO/WHO consultation on fats and fatty acids in human nutrition and has acted as a consultant to FAO, WHO and UNICEF. His major research interests are in energy regulation, functional foods, obesity, glycaemic index, energy and protein metabolism and nutrition in the elderly. Prof. Henry has published over 270 papers and presented over 380 lectures around the world and is Editor-in-Chief of the journal ‘Advances in Food and Nutrition Research’. He was awarded the British Nutrition Foundation prize in 2010 for his outstanding contribution to nutrition and was made a Fellow of the International Academy of Food Scientists and Technologists in 2012. Prof. Henry was the recipient of the Most Inspiring Mentor Award from A*STAR Singapore in 2017.
Advances in Antioxidant Research: Translation from Bench to Applications

Prof. Barry Halliwell, A*STAR/National University of Singapore, Singapore

Oxygen free radicals and related “reactive oxygen species” are fundamental to survival; they help drive evolution yet the damage that they can do (“oxidative damage”) is involved in most, if not all, human diseases and in ageing itself. As a result, there has been a huge advertising and popularisation of antioxidant and other supplements. Unfortunately, clinical trials have shown, with some exceptions, a general lack of effectiveness of supplements of such “classical” antioxidants as ascorbate, vitamin E and β-carotene in decreasing risk or severity of human disease. There are multiple reasons for this, one being that these antioxidants are often ineffective in decreasing levels of oxidative damage in humans. So how then can we minimize oxidative damage in the human body? Strategies will be discussed.

Much of my research now focuses on ergothioneine, a diet-derived antioxidant that is avidly retained by the human body and particularly accumulated at sites of tissue injury, where it may help to diminish tissue damage. We have conducted a detailed study of how ergothioneine behaves when administered to humans or mice. Ergothioneine is made by fungi and some bacteria, although the list of those able to make it grows daily. Data on the potential relevance of ergothioneine to human neurodegenerative diseases, and other conditions will be presented.

Professor Barry Halliwell is Chairman, Biomedical Research Council (BMRC), Agency for Science, Technology and Research (A*STAR), and Senior Advisor to the President, National University of Singapore (NUS). An internationally-acclaimed biochemist, Prof. Halliwell is known especially for his seminal work on the role of free radicals and antioxidants in biological systems. His research focuses on the role of free radicals and antioxidants in ageing and in human disease, particularly neurodegenerative diseases. His interest in identifying the most important antioxidants in the human diet and in developing novel antioxidants has critical bearing on treating diseases and perhaps ageing itself. Prof. Halliwell was a faculty member with King’s College London from 1974 - 2000 and held a prestigious Lister Institute Research fellowship. From 1995 -1999, he was a Visiting Research Professor with the University of California, Davis, School of Medicine, Divisions of Cardiology and Pulmonary/Critical Care Medicine. Prof. Halliwell was a Visiting Professor of Biochemistry to NUS from 1998 to 2000, Head of NUS’ Biochemistry Department from 2000 to 2007 and Deputy Director, Office of Life Sciences from 2001 to 2003. From 2003 to September 2008, he was the founding Executive Director of the NUS Graduate School of Integrative Sciences and Engineering. From Mar 2006 to May 2015, he was the Deputy President (Research and Technology) at NUS, driving the NUS research agenda. Thomson Reuters lists Prof. Halliwell as one of the world’s most highly-cited researchers in Biology and Biochemistry, with a Hirsch Index of 151. His book Free Radicals in Biology and Medicine published by Oxford University Press, and now in its fifth edition, is regarded worldwide as an authoritative text in the field. Among multiple awards, he received the “Lifetime Achievement Award” by the Society for Free Radical Biology and Medicine in the USA for overall sustained research excellence. Prof. Halliwell graduated from Oxford University with B.A. (1st class) and D. Phil degrees. He also holds a D.S. degree from the University of London.
Potential of Genome Editing Tools in Agriculture, Preventative Health, and Diseases: Current and Future

Prof. Meng How Tan, A*STAR Genome Institute of Singapore, Singapore

The 21st century is an exciting time for biomedical scientists and bioengineers. With the advancement of deep sequencing technologies, the blueprint of human life, together with thousands of other genomes, have been laid out starting from the beginning of this century. The wide availability of such big data is helping us to better understand our own development and diseases and enabling novel biotechnological innovations. However, we are witnessing yet another revolution in recent years with the rapid development of powerful genome engineering technologies, in particular CRISPR (clustered regularly interspaced short palindromic repeats)-Cas systems. While sequencing allows us to read the genome, CRISPR-Cas empowers us to write and redesign the underlying DNA. In this talk, I will discuss the development and applications of CRISPR-Cas systems as novel tools for sculpting the complex genomes of plants and animals, including human. I will outline the challenges that the technology is currently facing, describe some solutions to solve the problems, and share my thoughts on how the agriculture and healthcare industries may be disrupted in the future.

Professor Meng How Tan is currently Senior Research Scientist in the Genome Institute of Singapore at Agency for Science, Technology and Research (A*STAR), as well as Assistant Professor in the School of Chemical and Biomedical Engineering at Nanyang Technological University (NTU), Singapore. Prof. Tan was a recipient of the Overseas Merit Scholarship from the Singapore Government, the National Science Scholarship (Ph.D.) from A*STAR, and the Donald Wills Douglas Fellowship from Caltech. Currently, his laboratory is interested in understanding how biological information hardwired in the genome of living cells can be permanently or transiently altered at both the DNA and RNA levels. Prior to setting up his laboratory in Singapore, Prof. Tan received a B.S. degree in mechanical engineering and a B.A. degree in economics from University of California, Berkeley, USA, a M.S. degree in aeronautics from California Institute of Technology (Caltech), USA, a M.S. degree in biomedical engineering from NTU, Singapore, and a Ph.D. in developmental biology from Stanford University, USA. He also performed postdoctoral research on genomics and stem cells with Jin Billy Li, Mylene Yao, and Wing Hung Wong at Stanford University, USA.
SESSION 3
Transformation Technologies in Food Safety
Improving Food Safety Assessment and Management

Chairperson:
Dr. Junshi Chen, ILSI China, China
Dr. Junshi Chen is Chair of the Chinese National Expert Committee for Food Safety Risk Assessment and the Vice-Chair of the National Food Safety Standard Reviewing Committee. Internationally, he serves as the chairperson of the Codex Committee on Food Additives (CCFA) (2007-2017), UN co-convener of the AMR Inter-Agency Coordination Group (IACG), member of the WHO Food Safety Expert Panel, and Director of ILSI (International Life Sciences Institute) Focal Point in China. Dr. Chen has engaged in nutrition and food safety research for more than 50 years at the Institute of Nutrition and Food Safety, Chinese Center for Disease Control and Prevention (the former Chinese Academy of Preventive Medicine), Beijing. He has been Senior Research Professor at the China National Center for Food Safety Risk Assessment since 2011. Dr. Chen has conducted large epidemiological studies on diet, nutrition and chronic diseases, in collaboration with Dr. T. Colin Campbell, Cornell University, USA, and Prof. Richard Peto, University of Oxford, UK, since 1983. From the late 1980’s, Dr. Chen conducted a series of studies on the protective effects of tea on cancer, including laboratory studies and human intervention trials. He is a member of the expert panel responsible for writing the 1997 WCRF/AICR report “Food, Nutrition and the Prevention of Cancer: A Global Perspective”. Dr. Chen’s research interests focus on nutrition epidemiology as well as food safety surveillance and risk assessment in the following areas: food safety risk assessment and risk communication; food toxicology; epidemiological studies on diet, nutrition and chronic diseases; food fortification; and Total Diet Studies in China. Dr. Chen graduated from Beijing Medical College, China.
Next Generation and Whole Genome Sequencing: Opportunities and Challenges for Food Safety Management

Dr. Masami Takeuchi, Food and Agriculture Organization of the United Nations (FAO), Thailand

Food safety is a global concern and the current estimated global burden of foodborne disease from microbiological food safety problems and the related social and economic costs remain unacceptably high. Some newly emerging tools that can be useful in managing such food safety problems have become increasingly sophisticated. However, challenges remain in outbreak investigations, in linking illness to particular foods and ensuring the appropriate products are recalled. Genome sequencing is one such tool that offers great potential for various food safety regulatory activities including food inspection, outbreak detection/investigation and studies on antimicrobial resistance (AMR). Such benefits would significantly contribute to protecting public health and food security as it eventually saves lives and prevents economic losses and food waste from incorrect or imprecise implications of wrong products and commodities. However, while several industrialized countries have been moving forward with genome sequencing for food safety management, its application, particularly in developing and transitional countries is limited. Overcoming the challenges and ensuring that countries can reap the benefits of genome sequencing technology means that all parties need to be involved in the dialogue regarding its use in food safety management. FAO developed a technical paper on the applications of Whole Genome Sequencing in food safety management (FAO, 2016, [http://tiny.cc/WGS-TP](http://tiny.cc/WGS-TP)) and convened a global meeting bringing 175 participants from 50 countries to the table, half of which were developing countries ([http://tiny.cc/FAO-TM](http://tiny.cc/FAO-TM)). While recognizing concrete advantages of the technology, concerns around liability and accountability that are legally binding, in respect of relevant data, were raised and the need for legal basis for harmonized and accredited typing methods was highlighted. FAO continues to contribute to address the needs and concerns that developing countries may face regarding the technology.

Dr. Masami Takeuchi is a Food Safety Officer at the Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific (FAORAP) in Bangkok, Thailand. Dr. Takeuchi provides food safety advice to FAO Members, as well as the Codex Alimentarius Commission, including risk assessment activities and safety assessment of food/feed derived from new technologies including biotechnologies. She also advises FAO Members on applications and development of innovative technologies (i.e. genome sequencing) for better food safety management. She is the manager of the global database on safety assessment results of foods derived from GMOs, entitled ‘FAO GM Foods Platform’. Dr. Takeuchi continues to lead global FAO activities, including those related to new and emerging technologies, while she takes up various regional and national initiatives on food safety to assist countries in the Asia-Pacific region for their food safety capacity development. Dr. Takeuchi holds a Ph.D. in food science and human nutrition from Washington State University, USA.
Novel Computational Approaches for Assessing the Allergenic Potential of Proteins for the Food Industry

Dr. Sebastian Maurer-Stroh, A*STAR Bioinformatics Institute, Singapore

Food allergies caused by proteins are globally on the rise while at the same time novel or alternative protein sources enter the market and need to be tested for safety. Previous FAO/WHO guidelines for computational assessment of allergenic potential of proteins based on single hexamer peptide hits and linear sequence window identity thresholds produce a large number of false positives. The number of identified allergens in databases over the last decade has dramatically increased the chances of random hits of hexamers to the extent that, following the rules from 2001, up to 90% of all HUMAN proteins would be classified as potential allergens in 2017 due to random peptide hits. At the same time, true similarity in protein sequence and structure between allergens and non-allergens introduces yet another challenge to similarity-based methods for classifying allergenic proteins. We revisited sequence and 3D structure features of known allergens in order to derive and test enhanced prediction methods. We propose an adjusted hexamer hit approach for a 6-fold reduction of false positives as well as switching from the linear sequence window similarity to B-cell epitope-like 3D surface similarity using a newly created database of 713 structural models representing predicted structures for 76% of all known allergens. Using a benchmark set of known allergens and likely non-allergens sharing the same structural fold, we show that the 3D epitope similarity method increased accuracy of classification by 2-fold compared to the classical linear window approach. Testing for allergenic potential of proteins using our novel computational workflow early in food production planning and product development can dramatically reduce costs and risks for food companies.

Dr. Sebastian Maurer-Stroh is senior principal investigator in the A*STAR Bioinformatics Institute (BII), Singapore. With more than 125 publications in the field and an h-index of 44, he is known for developing computational tools for protein sequence and structure analysis and contributing to virus surveillance and disease outbreaks analyses in Singapore and the global WHO influenza surveillance network. He also has a strong track record for industry collaborations ranging from local SMEs to large multinationals on sequence analysis and a major research programme on prediction of allergenicity potential of proteins. Dr. Maurer-Stroh’s protein function analysis skills also support the A*STAR Biotransformation Innovation Platform positioned at the academic-private interface.