

ABSTRACTS



**SINGAPOREAN  
RESEARCHERS  
GLOBAL SUMMIT**  
6-7 AUGUST 2019





# **Singaporean Researchers Global Summit**

August 6-7, 2019

Shaw Foundation Alumni House  
National University of Singapore

## **Abstract Book**

The Singaporean Researchers Global Summit is organised by the  
National University of Singapore

National University of Singapore  
21 Lower Kent Ridge Road  
Singapore 119077  
(W): nus.edu.sg  
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**NUS**  
National University  
of Singapore

## ORGANISING AND PROGRAMME COMMITTEE

The Singaporean Researchers Global Summit is organised by the National University of Singapore with support from the University Communications Office, Office of the Senior Deputy President and Provost, and Office of the Deputy President (Research and Technology).

### Programme Committee

**Ho Teck Hua**

Senior Deputy President and Provost, National University of Singapore (NUS)

**Ling San**

Provost and Vice President (Academic), Nanyang Technological University (NTU)

**Chua Nam Hai**

Chief Scientific Advisor, Wilmar

**Luke Ong**

Professor, Computer Science, University of Oxford

**Wong Chee Wei**

Professor, Electrical and Computer Engineering, University of California, Los Angeles (UCLA)

**Eugene Yeo**

Professor, Cellular and Molecular Medicine, University of California, San Diego (UCSD)

**Desney Tan**

General Manager, Microsoft Healthcare

**Brenda Yeoh**

Professor (Provost's Chair), Geography, National University of Singapore

**Peng Kah Whye**

Professor and Consultant, Department of Molecular Medicine, Mayo Clinic

## SUPPORTED BY

The Singaporean Researchers Global Summit Industry Night Reception is supported by the Economic Development Board Singapore, and EDBI Pte Ltd.

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## WELCOME MESSAGE

Dear Colleagues and friends,

It is a privilege to welcome you to the inaugural Singaporean Researchers Global Summit.

Today, Singapore's universities are renowned for their innovative interdisciplinary research, for providing students with holistic education, and for instilling entrepreneurial ambition in our graduates. NUS and NTU rank amongst the top in the world in areas of materials science, engineering, architecture and chemistry. Much of this success is due to the hard work of our researchers, and ongoing government and industry partnerships, which have paved the way for new avenues of research and provide unique platforms to test-bed sustainable, smart technologies that are revolutionising industries.

It is an exciting time to be a researcher. As we usher in a new era in Industry 4.0, we face changing workplaces, and industries that will be transformed by automation and smart technologies. Just as how the innovation and foresight of our predecessors have built Singapore into the global city it is today, so too will the good research we pursue now, positively impact and enhance life for future generations of Singaporeans.

It is most opportune that the inaugural Singaporean Researchers Global Summit is being held in the year of Singapore's bicentennial, and the week of our 54th National Day celebrations.

Over the next two days, we look forward to the valuable sharing of insights from academic and government leaders, and from Singaporean researchers working at home and abroad. An open dialogue session with Deputy Prime Minister Heng Swee Keat, and keynote talks from prominent academic leaders and researchers, will provide opportunities for you to be apprised on the research landscape and developments in Singapore. Finally, the site visits and industry night reception complement the formal programme and I hope you will get to catch up with old colleagues and make new acquaintances.

I wish you a fruitful and memorable Summit.

With best wishes

Professor Tan Eng Chye

NUS President

# INFORMATION FOR SPEAKERS AND ATTENDEES

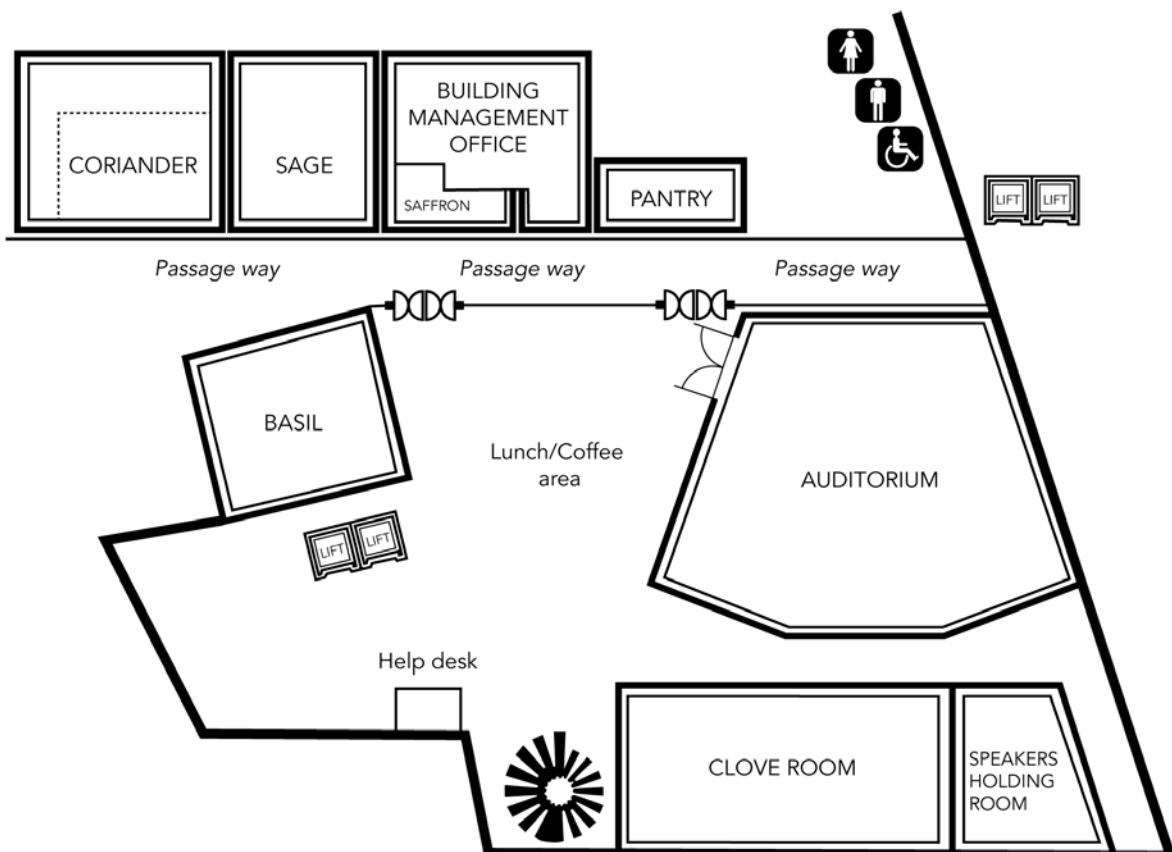
## THE VENUE

The Singaporean Researchers Global Summit will be held at the Kent Ridge campus of the National University of Singapore.

Shaw Foundation Alumni House  
11 Kent Ridge Drive  
Singapore 119244

Please refer to the floor plan for talk and poster locations.

## FLOOR PLAN (LEVEL 2)



## SOCIAL/NETWORKING PROGRAMME

### INDUSTRY NIGHT RECEPTION

Date: 6 August 2019

Venue: Regent Hotel (Level 1, Royal Pavilion Ballroom)

1 Cuscaden Rd, Singapore 249715

Time: 19:00 - 20:30

For those requiring transport to the venue, three shuttle buses are provided from the conference venue. **The first bus will depart at 17:45. The last bus will depart at 18:00 sharp.**

### SITE VISITS

Date: 07 August 2019

Five site visits will be held at the conclusion of the conference programme. **Participants are required to register for the site visit of their choice.** Registrations can be made during the conference, at the help desk, and is on a first-come-first-served basis. Participants must collect a site visit coupon for their registration to be considered valid. Each individual is allowed one coupon, for a single site visit only.

Site 1 - Capped at 30 participants	AI Singapore and the Institute for Health Innovation & Technology (iHealthtech) - NUS
Site 2 - Capped at 30 participants	WIL@NUS Corporate Lab and the Centre for Advanced 2D Materials - NUS
Site 3 - Capped at 40 participants	NTU Overview
Site 4 - Capped at 20 participants	Experimental Drug Development Centre (EDDC) - A*STAR
Site 5 - Capped at 20 participants	Advanced Remanufacturing and Technology Centre (ARTC) - A*STAR

Please note that shuttle buses will depart from the conference venue at **15:15 sharp.**

## INSTRUCTIONS FOR PARTICIPANTS:

### 1. Registration

The registration desk will be open during the following hours:

Tuesday, 06 August 2019	Level 1 Registration: 07:45 - 11:00
Tuesday, 06 August 2019	Level 2 Help Desk: 10:00 - 17:00
Wednesday, 07 August 2019	Level 2 Help Desk: 09:00 - 14:00

On arrival at the venue, please proceed to the registration desk to pick up your name badge, programme booklet and poster number if you are a poster presenter.



## WIFI ACCESS:

Free WiFi is available for all participants. To access WiFi, please follow these steps:

1. Select the network: NUS\_Guest
2. Click event login.
3. Enter the WiFi PIN code: AKKOSW

If you are not directed to the WiFi login page, please visit: [nusguest.nus.edu.sg](http://nusguest.nus.edu.sg)

## REQUEST TO PRESENTERS:

### INSTRUCTIONS FOR RESEARCH TALKS:

1. Time allocation for oral presentations:

**Keynote talks:** 30 minutes (25 minutes + 5 minutes for Q & A)

**Research talks:** 20 minutes each (15 minutes + 5 minutes for Q & A)

**Panel Discussion talks:** 10 minutes each. There will be no questions until the conclusion of each talk.

2. Please load your talks 10 minutes before the session commences
3. Please have a back-up of your talk on a thumb drive. Laptops will be available (Mac/Windows)
4. A timekeeper will indicate when you should conclude your talk.

### INSTRUCTIONS FOR POSTER PRESENTATIONS:

1. Please check the Poster Presenter Directory in this booklet for your poster number.
2. Please gather at the Coriander Room at 16:00 on Day 1.
3. Please be present by your posters during the poster session.
4. Posters are to be dismantled at the conclusion of the poster session on Day 1. Please note that any poster not removed by the stipulated time will be disposed of by the Secretariat.
5. There is no printing facility at the venue.

## **SITE VISITS - VENUE INFORMATION**

### **AI SINGAPORE**

AI Singapore (AISG) is a national AI programme launched by the National Research Foundation (NRF) to anchor deep national capabilities in Artificial Intelligence (AI) thereby creating social and economic impacts, grow the local talent, build an AI ecosystem, and put Singapore on the world map.

The programme office brings together all Singapore-based research institutions and the vibrant ecosystem of AI start-ups and companies developing AI products to perform use-inspired research, grow the knowledge, create the tools, and develop the talent to power Singapore's AI efforts.

AISG is driven by a government-wide partnership comprising NRF, the Smart Nation and Digital Government Office (SNDGO), the Economic Development Board (EDB), the Infocomm Media Development Authority (IMDA), SGInnovate, and the Integrated Health Information Systems (IHiS).

### **NUS INSTITUTE FOR HEALTH INNOVATION AND TECHNOLOGY (IHEALTHTECH)**

iHealthtech seeks to address clinical needs through the development of innovative disruptive health technologies and to bring them from the bench to bedside, thus benefitting patients and the society. It does this through close interdisciplinary collaboration among scientists, engineers and clinicians as well as industrial partners and entrepreneurs.

Through its efforts, iHealthtech aims for better disease diagnosis, monitoring and treatment; improves health and longevity; and trains future leaders of the workforce in health technologies.

iHealthtech focuses on four research areas: Precision Medicine, Smart Sensors & Artificial Intelligence, Microbiome, and Mental Health & Ageing. In addition, iHealthtech has a dedicated translational arm, Healthtech Translation Hub (HATCH), to facilitate the translation of innovative technologies from lab to clinic and market.

### **WIL@NUS CORP LAB**

WIL@NUS Corporate Laboratory is a research partnership between the National University of Singapore and Wilmar International Limited and is hosted at the Yong Loo Lin School of Medicine, NUS.

The WIL@NUS Corporate Laboratory aims to leverage the expertise of Wilmar and NUS to: Identify food ingredients and food components capable of modulating glycemic control, lowering triglycerides and cholesterol as well as aid in healthy ageing. Develop efficient and cost-effective, bio-based methods for the production of industrial enzymes and biochemicals.

### **THE NUS CENTRE FOR ADVANCED 2D MATERIALS**

Established in 2010 within the National University of Singapore, the Graphene Research Centre (GRC) was created for the conception, characterization, theoretical modeling, and development of transformative technologies based on two-dimensional crystals, such as graphene.

Aimed at being a world leader in innovative and emergent materials science, with strong ties to the industry and academia, the centre directly contributes to the new generation of scientists and engineers who will have a permanent impact in the society and business enterprise landscape of Singapore, and worldwide.

## **NANYANG TECHNOLOGICAL UNIVERSITY - OVERVIEW**

A research-intensive public university, Nanyang Technological University, Singapore (NTU Singapore) has 33,000 undergraduate and postgraduate students in the colleges of Engineering, Business, Science, and Humanities, Arts and Social Sciences, and its Graduate College. NTU's Lee Kong Chian School of Medicine was established jointly with Imperial College London.

Known for research excellence and technological innovation, NTU leads the top Asian universities in normalised research citation impact (Clarivate Analytics' InCites 2018). In the 2019 Nature Index, NTU is placed 34th among the world's universities and first in Singapore.

NTU hosts two national research centres of excellence – the Earth Observatory of Singapore (EOS) and Singapore Centre for Environmental Life Sciences Engineering (SCELSE) – that are tackling important questions in environmental sustainability and public health.

NTU is also home to a number of world-class institutes. The National Institute of Education trains all teachers in Singapore, which is known for having one of the best education systems in the world. Other key institutes at NTU include the S Rajaratnam School of International Studies, the Nanyang Environment & Water Research Institute and the Energy Research Institute @ NTU.

## **THE EXPERIMENTAL DRUG DEVELOPMENT CENTRE (EDDC) A\*STAR**

The Experimental Drug Development Centre (EDDC) is a national platform for drug discovery and development to channel high potential drug candidates toward commercial and clinical outcomes. EDDC possesses a breadth of integrated capabilities suited to translate basic biomedical sciences into innovative medicines. Visitors will discover what it takes to create a successful drug from bench to bedside. The tour will conclude with a visit to the labs showcasing key technology platforms involved in drug discovery.

## **ADVANCED REMANUFACTURING AND TECHNOLOGY CENTRE (ARTC) A\*STAR**

The Advanced Remanufacturing and Technology Centre (ARTC) is a contemporary platform built upon strong public-private partnerships to translate research to industry applications. It is led by the Agency for Science, Technology and Research (A\*STAR), in partnership with the Nanyang Technological University (NTU).

The ARTC is located at Singapore's first eco-business park, JTC CleanTech Park, which is based at the Jurong Innovation District. The centre provides a collaborative platform which brings together industry players, public sector research institutes and academia to bridge technological gaps in the adoption of advanced manufacturing and remanufacturing processes.

A world-renowned industry-led centre of excellence for advanced manufacturing and remanufacturing technologies, processes and systems, the ARTC aims to bridge the gap from research to industry applications for advanced manufacturing and remanufacturing for cross-sectorial industries across the supply chain.

# SUMMIT PROGRAMME

## **SINGAPOREAN RESEARCHERS GLOBAL SUMMIT**

AUGUST 2019

**Tuesday, 6 August 2019**

07:45 - 08:30	Registration		
08:30 - 09:00	Welcome address	Professor TAN Eng Chye NUS President	
09:00 - 09:45	Dialogue with Deputy Prime Minister Heng Swee Keat Moderated by Prof Tan Eng Chye, NUS		
09:45 - 10:15	<b>Tea break</b>		
10:15 - 11:15	<b>Panel Discussion Research Landscape and Opportunities in Science, Technology, Engineering and Mathematics (STEM)</b>	Chaired by Prof LING San (NTU)  Panellists: Prof LOW Teck Seng (NRF), Mr QUEK Gim Pew (MINDEF), Mr Frederick CHEW (A*STAR)	
11:15-12:15	<b>Panel Discussion Research Landscape and Opportunities in Humanities and Social Sciences (HSS)</b>	Chaired by Prof HO Teck Hua (NUS)  Panellists: Mr Peter HO (SSRC), Prof CHAN Heng Chee (SUTD), Prof Brenda YEOH (NUS)	
12:15 - 13:30	<b>Lunch</b>		
13:30 - 14:00	<b>Keynote Talk - Social science, social relevance and social responsibility</b> Prof Lily KONG (SMU)		
14:00 - 15:00	<b>CORIANDER ROOM</b>	<b>CLOVE ROOM</b>	<b>AUDITORIUM</b>
	<b>Physical Sciences and Engineering Research Talks</b>	<b>Life Sciences Research Talks</b>	<b>HSS Research Talks</b>
	Prof Mohan KANKANHALLI (NUS) Prof Ricky ANG Lay Kee (SUTD) Asst Prof Benjamin TEE (NUS)	Prof NG Huck Hui (A*STAR) Assoc Prof CHNG Shu Sin (NUS) Assoc Prof Karen CRASTA (NTU)	Prof Audrey YUE (NUS) Prof Melvyn TEO (SMU) Prof LIM Sun Sun (SUTD)
15:00 - 15:30	<b>Keynote Talk - Life sciences research</b> Prof Eugene YEO (UCSD)		
15:30 - 16:30	<b>Panel Discussion Research Landscape and Opportunities in Industry and Government</b>	Chaired by Dr Desney TAN (Microsoft)  Panellists: Mr CHNG Kai Fong (EDB), Mr Steve LEONARD (SG Innovate), Mr CHAN Cheow Hoe (GovTech)	
16:30 - 18:00	<b>Afternoon Tea and Poster Session - CORIANDER ROOM</b>		
19:00 - 20:30	<b>Industry Night Reception - Sponsored by EDB Singapore and EDBI</b> Guest-of-Honour: Minister Ong Ye Kung Location: Regent Hotel (Royal Pavilion Ballroom)		

**Wednesday, 7 August 2019**

08:30 - 09:00 Registration

	<b>CLOVE ROOM</b>	<b>AUDITORIUM</b>	<b>CORIANDER ROOM</b>
	<b>Panel Discussion Drug Development</b>	<b>Panel Discussion Smart Nation</b>	<b>Panel Discussion Social Inequality</b>
	<i>Chaired by:</i> Prof PENG Kah Whye (Mayo Clinic)	<i>Chaired by:</i> Prof LUI Pao Chuen (NRF)	<i>Chaired by:</i> Prof TAN Tai Yong (NUS)
9:00 - 10:00	Panellists: Dr Angela LIM (Merck) Prof HONG Wanjin (A*STAR) Prof CHNG Wee Joo (NUS) Dr Damian O'CONNELL (A*STAR)	Panellists: Mr TAN Kok Yam (SNDGO), Mr TAN Kiat How (IMDA), Mr CHAN Hian Lim (DSO)	Panellists: Prof Joseph LIOW (NTU) Assoc Prof TEO You Yenn (NTU) Assoc Prof THANG Leng Leng (NUS)

10:00 - 10:30 **Tea Break**

10:30 - 11:00 **Keynote Talk - Quantum Science and Engineering: Measurements at the Precision Frontiers**  
*Prof WONG Chee Wei (UCLA)*

11:00 - 12:00	<b>Panel Discussion Experiences of Returning Singaporean Scientists</b>	Chaired by: Prof CHUA Nam Hai (NUS)  Panellists: Prof Aaron THEAN (NUS) Prof Andrew LIM (NUS) Prof PEH Li-Shiuan (NUS)
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12:00 - 13:30 **Lunch**

	<b>CORIANDER ROOM</b>	<b>CLOVE ROOM</b>
	<b>Mentors' Sharing Session - STEM</b>	<b>Mentors' Sharing Session - HSS</b>
13:30 - 14:30	Prof PHOON Kok Kwang (NUS) Assoc Prof Sourav S. BHOWMICK (NTU) Prof LIM Ee Peng (SMU)	Prof Ivan PNG (NUS) Prof Robbie GOH (NUS) Prof May Oo LWIN (NTU)

14:30 - 15:00 **Closing Remarks**  
*Prof Luke ONG (University of Oxford)*

15:00 - 18:00	<b>Site Visits</b>	Site 1: AI Singapore and iHealthtech (NUS) Site 2: WIL@NUS Corporate Lab and Centre for Advanced 2D Materials (CA2DM) Site 3: NTU Overview Campus Tour Site 4: Experimental Drug Development Centre (EDDC) - A*STAR Site 5: Advanced Remanufacturing and Technology Centre (ARTC) - A*STAR
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# KEYNOTE AND SPEAKER ABSTRACTS

**SINGAPOREAN RESEARCHERS  
GLOBAL SUMMIT**

AUGUST 2019

## SOCIAL SCIENCE, SOCIAL RELEVANCE AND SOCIAL RESPONSIBILITY

Lily KONG

President and Lee Kong Chian Chair Professor of Social Sciences, Singapore Management University

In this address, I make the case that the long-term future of social sciences turns largely on connecting the research agenda to the local, national and global communities that we are a part of, in ways that make a difference to these communities. While it clearly remains of great importance to address other academics and engage in debate with one another to maintain rigor in argument and evidence base, our discourses must ultimately be meaningful to those we choose to study, whose lives and experiences we examine, and for whom our research should make some difference. In this regard, we bear a responsibility as social scientists to be socially relevant and socially responsible.

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### *Biography*

Professor Kong is the fifth President of the Singapore Management University, and the first Singaporean to lead the 19-year old university. She is also the first Singaporean woman to head a university in Singapore.

Professor Kong graduated from NUS with a Bachelor of Arts (First Class Honours) in Geography and a Master of Arts. She earned her PhD in Geography at University College London.

Professor Kong is internationally known for her research on social and cultural change in cities, and has studied topics ranging from religion to cultural policy, creative economy, urban heritage and conservation, smart cities and more. She has won research and book awards from the Association of American Geographers and the Singapore National Book Development Council respectively. She has also been conferred the Outstanding Researcher Award and Teaching Excellence Award by the National University of Singapore.

Prof Kong's recent books include *Arts, Culture and the Making of Global Cities: Creating New Urban Landscapes in Asia* (with Ching C-H and Chou T-L, 2015); *Food, Foodways and Foodscapes: Culture, Community and Consumption in Postcolonial Singapore* (with Vineeta Sinha, 2015); and *Religion and Space: Competition, Conflict and Violence in the Contemporary World* (with Orlando Woods, 2016).



## HUMAN-IMPERCEPTIBLE PRIVACY PROTECTION AGAINST MACHINES

Mohan KANKANHALLI

Dean, School of Computing and Provost's Chair Professor of Computer Science, National University of Singapore

We will start with an overview of research in NUS Computing and the NUS Centre for Research in Privacy Technologies. Privacy concerns with social media have recently been under the spotlight. With advances in machine learning, the threat of privacy leakage is shifting from humans to machines. Due to big data, computer algorithms often act as a first-step filter for privacy breaches, by automatically selecting content with sensitive information, such as photos that contain faces or vehicle license plate. We will present a novel algorithm to protect the sensitive attributes against machines, while keeping the changes imperceptible to humans.

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### *Biography*

Professor Mohan Kankanhalli is the Dean of NUS School of Computing where he is the Provost's Chair Professor of Computer Science. Before becoming the Dean in 2016, He was the NUS Vice Provost (Graduate Education) during 2014-2016 and Associate Provost (Graduate Education) during 2011-2013. Earlier, he was the Vice-Dean for Academic Affairs & Graduate Studies at the NUS School of Computing during 2008-2010 and Vice-Dean for Research during 2001-2007.

Prof Kankanhalli obtained his BTech (Electrical Engineering) from the Indian Institute of Technology, Kharagpur, in 1986 and his MS and PhD (Computer and Systems Engineering) from the Rensselaer Polytechnic Institute in 1988 and 1990, respectively. He was a researcher at the Institute of Systems Science at NUS from 1990-1997. He then became a faculty member at the Department of Electrical Engineering of the Indian Institute of Science, Bangalore during 1997-1998 after which he joined NUS again. He visited the University of California at Berkeley from Jan-Jun 2004 and University College London during Jan-Apr 2013.

Prof Kankanhalli's research interests are in Multimedia Computing, Information Security and Privacy, Image/Video Processing and Social Media Analysis. He has made many contributions in the area of multimedia content processing – image and video understanding, data fusion, visual saliency as well as in multimedia security – content authentication and privacy, multi-camera surveillance. He is actively involved in the Multimedia Systems research community and was the Director of Conferences for ACM SIG Multimedia during 2009-2013. He is on the editorial boards of several journals including ACM Transactions on Multimedia Computing, Communications and Applications, Springer Multimedia Systems, IEEE Multimedia, Pattern Recognition, and Journal on Big Data.

He directs N-CRiPT (NUS Centre for Research in Privacy Technologies) which conducts research on privacy on structured as well as unstructured (multimedia, sensors, IoT) data. N-CRiPT looks at privacy at both individual and organizational levels along the entire data life cycle. He is personally involved in privacy research related to images, video and social media as well as privacy risk management. N-CRiPT, which has been funded by Singapore's National Research Foundation, works with many industry, government and academic partners. He earlier directed the SeSaMe (Sensor-enhanced Social Media) Centre during 2012-2018. SeSaMe did fundamental exploration of social cyber-physical systems with applications in social sensing, sensor analytics and smart systems.

Prof Kankanhalli is a Fellow of the Institute of Electrical and Electronics Engineers.

## SCALING LAWS FOR DEVICE PHYSICS AND ENGINEERING

Ricky ANG Lay Kee

Head of Science and Mathematics Cluster, Singapore University of Technology and Design

In this presentation, I will share some physics-based scaling laws in specific topics related to physics and engineering in my research areas to illustrate the importance of getting the physics correct for the design of novel-materials based devices. Such analytical scaling laws or models can provide useful insights to complement powerful computational simulation and experimental verification. Recent results in using fractional calculus developed by mathematicians to model some complicated and non-perfect devices will be discussed. Finally, I will briefly introduce some related research areas of the Singapore University of Technology and Design (SUTD) and its unique engineering pedagogy.

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### *Biography*

Lay Kee (Ricky) Ang received his BS in 1994 from the Department of Nuclear Engineering, National Tsing Hua University, Taiwan. His MS and PhD (1996, 1999), were from the Department of Nuclear Engineering and Radiological Science (NERS), University of Michigan, Ann Arbor, USA, where NERS is the top #1 nuclear engineering graduate program in USA. After his PhD, he was awarded the LANL director postdoctoral fellowship (1999-2001) to work in the Applied Physics Division of the Los Alamos National Laboratory (LANL). He is currently the Head of Science and Mathematics Cluster under the Singapore University of Technology and Design (SUTD), and also the Ng Teng Fong chair Professor under the SUTD-ZJU (Zhejiang University) IDEA (Innovation, Design and Entrepreneurship Alliance). Before joining SUTD, he was with the Nanyang Technological University (2002-11). His research interests are in the formulation of basic scaling laws for device physics, focusing on novel materials, nano-structures, and application of fractional calculus. His research has been funded by both Singapore and USA (AFOSR and ONR). He is an IEEE Distinguished Lecturer in the Nuclear and Plasma Science (NPSS) Chapter (only 1 from Asia institution). He was awarded a Public Administration Medal (Bronze) in 2017.

## ADVANCES IN EMBODIED ARTIFICIAL INTELLIGENCE SYSTEMS VIA ELECTRONIC SKINS

Benjamin TEE

President's Assistant Professor, National University of Singapore

We are in an increasingly connected living environment where humans, smart devices and robots live in synergy together. Continued development of physical sensory systems with embedded intelligence will augment human abilities, and aid in applications as health diagnostics, surgery and predictive health analytics. In my talk, I will discuss materials design and strain engineering techniques to develop skin-like materials with stretchability, sensitivity and unique mechanical properties, such as self-healing. In addition, I will also discuss our recent progress in developing new scalable electronic skin platform technologies for more tactile-aware and perceptive systems. It is envisioned that such electronic skins can be useful in future distributed conformable electronic skins, neuro-prosthetic devices and wearable exo-suits in the increasingly digital and AI era.

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### *Biography*

Dr. Benjamin C.K. Tee is appointed President's Assistant Professor in Materials Science and Engineering Department at the National University of Singapore. He won the Singapore National Research Foundation Fellowship (2017). He obtained his PhD at Stanford University, and was a Singapore-Stanford Biodesign Global Innovation Postdoctoral Fellow in 2014. He has developed and patented several award-winning electronic skin sensor technologies. He was named the prestigious MIT TR35 Innovator (Global) in 2015 and he won the Singapore Young Scientist Award in 2016. His research group aims to develop technologies at the intersection of materials science, mechanics, electronics and biology, with a focus on sensitive electronic skins that has tremendous potential to advance global healthcare technologies in an increasingly Artificial Intelligence (AI) era.

[www.benjamintee.com](http://www.benjamintee.com)

## THE FRONTIER OF CREATING MINI-ORGANS IN THE LABORATORY

NG Huck Hui

Deputy Executive Director, Biomedical Research Council, Agency for Science Technology and Research (A\*STAR)

One of the greatest limitations in understanding human diseases is the lack of in vitro models that can recapitulate features and functions of human organs. The human organs are comprised of multiple cell-types forming a unique architecture. To develop new understanding of human diseases, our laboratory generates in vitro organoid systems using novel culture methodologies. With our collaborators in Singapore, we have succeeded in generating brain organoids for Parkinson's disease research. These brain organoids are new tools for us to study Parkinson's diseases and to accelerate drug discovery.

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### *Biography*

Professor Ng Huck Hui is the Deputy Executive Director of the Biomedical Research Council, under the Agency for Science, Technology and Research. Prof Ng is renowned in the field of stem cells, where he leads a research laboratory on gene regulation and how they relate to cell biology. Prof Ng has held several administrative positions. He was the Executive Director of the Genome Institute of Singapore and the Executive Director of the A\*STAR Graduate Academy.

Prior to joining A\*STAR, Professor Ng was a postdoctoral fellow with Harvard Medical School under the prestigious Damon Runyon-Walter Winchell Postdoctoral Fellowship. In 2016, Professor Ng was elected to be an Associate Member of the European Molecular Biology Organization, making him the only associate member to be based in Singapore. Professor Ng has received numerous local and international honours and awards, including the Young Scientist Award in 2004, Singapore Youth Award in 2005, National Science Award in 2007, Junior Chamber International (JCI) The Outstanding Young Persons Singapore Awards in 2009, Singapore Youth Award (Commendation Medal) in 2010, President's Science Award (Team Award) in 2011 and President's Science Award (Team Award) in 2018.

## BACTERIAL LIPID TRAFFICKING AND OUTER MEMBRANE HOMEOSTASIS

CHNG Shu Sin

Assistant Head (Research and Education), National University of Singapore

Gram-negative bacteria can survive in harsh environments in part because of the presence of the outer membrane (OM), which comprises lipopolysaccharides (LPS) and phospholipids (PLs) in the outer and inner leaflets, respectively. This asymmetric distribution of lipids renders the OM a very effective permeability barrier against toxic compounds, including bile salts and hydrophobic antibiotics. To build a stable OM with the requisite lipid asymmetry, the transport and assembly of LPS, PLs and OM proteins into the OM must be coordinated. While assembly pathways for LPS and OM proteins have been well-characterized, the processes by which PLs are transported to and from the OM, and their coordination with these other systems, are much less understood. In this seminar, I will describe our work in understanding and characterizing two retrograde PL transport systems in *Escherichia coli*, and discuss how these systems function in maintaining lipid homeostasis in the OM.

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### *Biography*

Shu-Sin Chng completed his Ph.D. degree in Chemistry and Chemical Biology at Harvard University in 2010, working with Professor Daniel Kahne on understanding the mechanisms of lipopolysaccharide transport and assembly in Gram-negative bacteria. After a short postdoctoral stint at the Harvard Medical School with Professor Jonathan Beckwith, Shu-Sin returned to the National University of Singapore (NUS) in August 2011 as an Assistant Professor in the Department of Chemistry, and has recently been promoted to Associate Professor with tenure (July 2018). His research group is interested in elucidating the mechanisms of inter-membrane lipid trafficking in Gram-negative bacteria and mycobacteria, and in identifying novel protein targets in these bacteria for the development of new antibiotics. For his work, Shu-Sin has received the 2018 NUS Faculty of Science Young Scientist Award, and has been featured in the 2019 "Future of Biochemistry" special issue in *Biochemistry*. He is also the recipient of the 2019 Walter Shaw Young Investigator Award in Lipid Research, a recognition conferred by the American Society of Biochemistry and Molecular Biology. Beyond research, Shu-Sin is a passionate educator who adopts an active learning classroom approach in these courses, and has won multiple NUS Annual Teaching Excellence Awards, including the Honour Roll.

## AGE IS JUST A NUMBER BUT IT MATTERS: HOW THE AGED TUMOUR MICROENVIRONMENT EXACERBATES PARACRINE RESPONSE TO CHEMOTHERAPY

Karen CRASTA

Principal Investigator and Nanyang Associate Professor Lee Kong Chian School of Medicine (LKC Medicine), Nanyang Technological University (NTU)

Singaporeans have the longest life expectancy in the world. Unfortunately, twilight years spent in poor health is also on the rise. Aging is known to be the biggest risk factor for most chronic diseases. This talk will focus on breast cancer as a “test case” for studying the impact of the aged stromal milieu on disease progression and therapeutic resistance. I will describe the molecular and cellular impact on gene expression, cell non-autonomous-driven inflammation and response to chemotherapy. It is hoped the study will aid tackle tumour progression and chemoresistance in the elderly population, and offer insights for age-related diseases.

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### *Biography*

Karen Crasta is an Associate Professor in Molecular and Cell Biology at the Lee Kong Chian School of Medicine, Nanyang Technological University (NTU), with joint appointment at NTU School of Biological Sciences and A\*STAR Institute of Molecular Biology (IMCB). Prior to joining NTU, Karen held research positions at the Dana-Farber Cancer Institute, Harvard and A\*STAR IMCB. She has a long-standing interest in how mitotic errors contribute to cancer and her postdoctoral stint contributed seminal work linking whole-chromosome missegregation to chromosomal fragmentation via tiny structures known as micronuclei. She currently leads a team studying the effects of aging on cancer metastasis and therapeutic resistance. Karen holds a BSc Honours and PhD from the National University of Singapore (NUS). She has been awarded the HHMI Research Associate Fellowship (USA), the A\*STAR International Fellowship, the prestigious National Research Foundation Fellowship and the Elite Nanyang Assistant Professorship.

## COMMUNICATIVE CITIES IN ASIA

Audrey YUE

Professor and Head, Department of Communications and New Media, National University of Singapore

Globalization, migration and new media technologies have contributed to changes in the city by altering the spaces of urban communities and practices of aesthetic, interpersonal, mediated and public communication. To address the need for new methods and tools that will best facilitate change management in the city and among its communities, this paper outlines a research platform based on the concept of the communicative city. This platform introduces urban communication as an intervention to the shortcomings of current city

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### *Biography*

Audrey Yue is Professor of Media, Culture and Critical Theory, Head of Department of Communications and New Media, and Convenor of the Cultural Studies in Asia PhD Programme at the National University of Singapore, and Honorary Professorial Fellow at the University of Melbourne. Her research covers the fields of Sinophone media cultures; cultural policy and development, and; queer Asian studies. She has published 8 scholarly books and 96 refereed journal articles and book chapters including *Promoting Sustainable Living* (2015); *Sinophone Cinemas* (2014); *Transnational Australian Cinema* (2013) and *Queer Singapore* (2012). Her recent essays appear in *International Journal of Communications*; *Inter-Asia Cultural Studies*, *Urban Studies* and *International Journal of Cultural Policy*. She is Editorial Board Member of *International Journal of Communication*; *Sexualities*; *Feminist Media Studies*; *International Journal of Chinese Cinemas* and *Cultural Studies Review*. She has received more than AUD\$6m in competitive research grants, and is currently completing three Australian Research Council funded projects on arts participation in the smart city; young people and multiculturalism, and; Asian media flows in Australia. Previously at the University of Melbourne (1998-2017), she was recipient of three international and university-wide teaching excellence awards, and has supervised to completion 25 PhD theses as Principle Supervisor.

## DO ALPHA MALES DELIVER ALPHA? FACIAL STRUCTURE AND HEDGE FUNDS

Melvyn TEO

Lee Kong Chian Professor of Finance, Singapore Management University

Facial structure as encapsulated by facial width-to-height ratio (fWHR) maps onto masculine behaviors in males and may positively relate to testosterone. We find that high-fWHR hedge fund managers underperform low-fWHR hedge fund managers by 5.16% per year after adjusting for risk. Moreover, funds with high-fWHR managers exhibit higher operational risk, are susceptible to fire sales, and fail more often. Yet, by marketing their funds more intensively, high-fWHR managers garner more inflows and harvest greater fee revenues. The results are robust to adjustments for sample selection, sensation seeking, and manager race, and suggest that investors should eschew masculine managers.

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### *Biography*

Melvyn Teo is Lee Kong Chian Professor of Finance and Deputy Dean for Faculty and Research at the Lee Kong Chian School of Business, Singapore Management University. His research focuses on alpha generation, principal-agent problems, information asymmetry, and behavioural finance in the context of the hedge fund industry. He has published in leading academic journals such as the *Journal of Finance*, the *Journal of Financial Economics*, the *Review of Financial Studies*, and the *Management Science*.

An award-winning researcher, Melvyn is the recipient of the Jack Treynor Prize by the Q Group, which recognizes superior academic working papers with potential applications in the fields of investment management and financial markets. His research has been extensively profiled by the popular press including Bloomberg, CNBC, CNN Money, Institutional Investor, The Economist and The Wall Street Journal. Melvyn received a BA in Economics and Mathematics from Cornell University and a MA and PhD in Economics from Harvard University.



## ON WICKED PROBLEMS & CREATIVE SOLUTIONS: THE PERILS AND PROMISE OF INTERDISCIPLINARITY

LIM Sun Sun

Head, Humanities, Arts and Social Sciences, Singapore University of Technology and Design

From fake news to climate change, social inequality to religious extremism, the world is beset with wicked problems that cannot be resolved through the perspective of any one discipline. In a rapidly digitalising world, the influence of technology pervades virtually every realm of our existence. Social issues are deeply imbricated with technological problems that may arise through accident or by design. Humanities and social science academics can therefore ill afford to overlook the technological in their study of the social. To best grasp technological issues while also shaping technological trajectories, humanists and social scientists should work alongside colleagues in STEM to forge interdisciplinary teams with multi-perspectival approaches. I will discuss the opportunities and challenges that inhere in interdisciplinary research while taking into account the dominant structures, practices and priorities undergirding academia today.

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### *Biography*

Professor Lim Sun Sun is Professor of Communication and Technology and Head of Cluster (Dean) of Humanities, Arts and Social Sciences at the Singapore University of Technology and Design. She was with the National University of Singapore from 2003 to 2016, where she served as Associate Professor at the Department of Communications and New Media from 2010 to 2016, and Assistant Dean (Research) at the Faculty of Arts & Social Sciences from 2014 to 2016. She has researched extensively on the social implications of technology domestication, authoring more than 70, articles, book chapters and books. Her latest books include *Transcendent Parenting: Raising Children in the Mobile Age* (Oxford University Press, 2019) and *Mobile Communication and the Family - Asian Experiences in Technology Domestication* (Springer, 2016). She serves on the editorial boards of ten journals and has contributed actively to public bodies including the Media Literacy Council and the National Internet Advisory Committee. She is currently serving as a Nominated Member of Parliament of the 13th Parliament of Singapore. She offers her expert opinion in opinion-editorials and interviews across a wide spectrum of print, broadcast and online media. She has won eight awards for excellent teaching at both university and faculty level.

For more information, see [www.sunsunlim.com](http://www.sunsunlim.com).

## LIFE SCIENCES RESEARCH

Eugene YEO

Professor of Cellular and Molecular Medicine University of California San Diego (UCSD); National University of Singapore

I will discuss our journey studying a basic class of molecule (RNA) by developing technologies that have led to new biotech entities creating services and products for the biomedical research community and gene therapy for severe neurological disease.

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### *Biography*

Dr. Gene Yeo is an expert in the areas of RNA biology and therapeutics, computational biology, genomics and neurological diseases.

Gene is a Professor of Cellular and Molecular Medicine at the University of California, San Diego (UCSD). Dr. Yeo has a BSc in Chemical Engineering and a BA in Economics from the University of Illinois, Urbana-Champaign, a Ph.D. in Computational Neuroscience from Massachusetts Institute of Technology and an MBA from the UCSD Rady School of Management. Dr. Yeo's research interest is in understanding and manipulating RNA processing in development and disease using induced pluripotent stem cell and murine models. His lab demonstrated in vivo RNA targeting with CRISPR/Cas proteins with proof of concept in repeat expansion disorders. His lab developed enhanced CLIP for the purposes of large-scale mapping of protein-RNA interactions. His lab is an active participant in RNA genomics technology and therapeutics development. Dr. Yeo is on the Editorial Boards of the journals Cell Reports and Cell Research. Dr. Yeo is a recipient of Alfred P Sloan Fellowship in recognition of his work in computational molecular biology (2011), the inaugural Early Career Award from the International RNA Society (2017), a recipient of the Lee Kuan Yew Graduate Scholarship (2000), National Research Foundation Visiting Investigatorship Award (2017), a Blavatnik National Finalist (2018) and Xconomy Award Finalist (2019). Gene is a co-founder of several biotech companies including Locana, Eclipse Bioinnovations, Enzerna and Proteona. Gene serves or had served on the scientific advisory boards of the Allen Institute of Immunology, Locana, Eclipse Bioinnovations, Proteona, Aquinnah, LGC, Nugen and Ribometrix. Dr. Yeo is a Visiting Professor at the National University of Singapore. Gene was a sword of honor recipient in the Republic of Singapore Navy.

## Keynote Talk

## QUANTUM SCIENCE AND ENGINEERING: MEASUREMENTS AT THE PRECISION FRONTIERS

WONG Chee Wei

Professor, Electrical and Computer Engineering, University of California, Los Angeles (UCLA)

Quantum science and engineering has made remarkable advances in the past few years, driven by recent discoveries in materials, physical understanding, long coherence, high-purity entanglement, and algorithms. Through controlling coherence and entanglement, new frontiers in computation, communication and sensing have recently been revisited. In computation, 72-qubit processors are implemented, led by industry with commercially-available systems. In communication, unbreakable communications at 55 Mb/s over 50-km have been achieved. In sensing, qubits provide unprecedented resolution in fields and force sensing, towards quantum limits.

This talk reviews the state-of-the-art, and how we the community can contribute to advance the technology and commercialization possibilities.

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### *Biography*

Prof. WONG Chee Wei examines precision, quantum, and ultrafast optical measurements in mesoscopic systems. He currently serves as the Tannas Professor of Engineering at the University of California at Los Angeles and, prior, a tenured Professor at Columbia University. He is elected Fellow of multiple societies, and is recipient of NIH Trailblazer Award, DARPA Young Faculty Award, NSF CAREER Award, Google Faculty Award and 3M Faculty Award among others. He received the Doctorate of Science in 2003 and Masters of Science in 2001, both from Massachusetts Institute of Technology. From 1996 to 1999, he completed his double degree, B.Sc. with highest distinction and B.A. with highest distinction, both from University of California at Berkeley.

His work has appeared in 330+ journals and conferences, including Nature, Science and Physical Review series. He delivered 110+ plenary and invited talks at universities and industry, published 4 book chapters, and been awarded 19 patents and 13 provisional patents. He is currently working with 20 scientists and PhD students, and has supervised 38 scientists, more than half now in their own professorships at world-leading institutions. He has sat on 80 PhD thesis committees. In his spare time, he enjoys playing the piano, running and snowboarding.

## MENTORS' SHARING SESSION – SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM TRACK)

PHOON Kok Kwang

Distinguished Professor, Civil and Environmental Engineering, and Vice Provost (Academic Personnel), National University of Singapore

There is no unique pathway to a fulfilling and successful career in academia. There is a tenure track pointing to a broad direction of travel, but everything else is very much a personal journey. It is useful to think long term and reflect on the basis of one's distinctive reputation at a mature stage (what would I be known for), be clear about the focus of one's scholarship (what part of the work makes me tick?), and to organise your personal development pathway as early as possible (how do I spend my time?).

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### *Biography*

Professor Phoon Kok Kwang is Vice Provost (Academic Personnel) at the National University of Singapore, and is presently a Distinguished Professor.

In his capacity as Vice Provost, Prof Phoon works with the Provost in academic personnel matters including recruitment and development, benchmarking and resource allocation.

A graduate of the National University of Singapore and Cornell University, Prof Phoon is a geotechnical engineer and has been a faculty member in the NUS Department of Civil & Environmental Engineering since 1995. He was the Head of Department of Civil and Environmental Engineering between 2013 and 2015.

Prof Phoon's expertise lies in risk and reliability in geotechnical engineering. He is a recipient of numerous awards, including the ASCE Norman Medal (2005), the NUS Outstanding Researcher Award (2010), Annual Teaching Excellence Award (ATEA) (2011 and 2012), and the Humboldt Research Award (2017).

## LEARNING TO SAY NO!

Sourav S. BHOWMICK

Associate Professor, School of Computer Science and Engineering, Nanyang Technological University

Quality research is risky business. The path leading to a successful academic research career is certainly not a bed of roses. An aspiring researcher may often have to make hard choices that have profound impact on his/her scientific career. In this talk, I will share with the audience important issues that a young researcher may face in academia at the beginning of his/her career. Specifically, I will emphasise on the importance of learning to say no in order to say yes to academic and research issues that really matter.

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### *Biography*

Sourav S Bhowmick is an Associate Professor in the School of Computer Science and Engineering (SCSE), Nanyang Technological University. He leads the data management research group (DANTE) in SCSE. His research areas include data management, human-data interaction, data analytics, computational social science and network biology. He has published many papers in top-tier venues such as VLDB, SIGMOD, WWW, SIGIR, ACM MM, Bioinformatics, Biophysical Journal, and VLDB Journal. He has received Best Paper Awards at ACM CIKM 2004 and ACM BCB 2011 for papers related to evolution mining and biological network summarization, respectively. His work on influence maximization was nominated for the best paper award in ACM SIGMOD 2015. Sourav has served as a program chair/co-chair, area chair, keynote and tutorial speaker for several international conferences and workshops. He is a co-recipient of the VLDB Service Award in 2018 from the VLDB Endowment for his contribution in designing an efficient PVLDB proceedings management framework. Recently, he has co-authored books on "Summarizing Biological Networks" and "Human Interaction with Graphs", which are published by Springer-Verlag (May 2017) and Morgan & Claypool (August 2018) publishers, respectively. He believes that "learning to say no" has played a big part in his career.

## ACADEMIC RESEARCH IN SINGAPORE

LIM Ee Peng

Lee Kong Chian Professor of Information Systems and Director, Living Analytics Research Centre, Singapore Management University

In this talk, I will share my personal experience conducting research in Singapore's universities. This includes applications for research grants, supervision of PhD students, and establishment of research centres. While Singapore universities offer abundant opportunities to do good research and teaching, there are also some challenges which one should be aware of. Through this sharing, I hope to give the audience some idea how to begin their research career in Singapore's universities.

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### *Biography*

Dr Lim Ee Peng is the Lee Kong Chian Professor with the School of Information Systems at the Singapore Management University (SMU). He is also the Director of Living Analytics Research Centre in SMU, a National Research Foundation (NRF) supported research centre focusing developing personalized and participatory analytics capabilities for smart city and smart nation relevant applications. Dr Lim received his PhD degree from University of Minnesota and Bachelor degree from National University of Singapore. Prior to SMU, he was on the faculty of Nanyang Technological University for 14 years. Between 2002 and 2003, he was a visiting professor of The Chinese University of Hong Kong. His research expertise covers social media mining, social/urban data analytics, and information retrieval. He has published more than 90 international journal papers and 280 conference papers, many of them appeared at top ACM and IEEE journals and conference venues. He had served on the ACM Publications Board, and the editorial boards of top computer science journals including ACM Transactions on Information Systems, IEEE Transactions on Knowledge and Data Engineering, and IEEE Intelligent Systems. He is the recipient of the Distinguished Contribution Award at the 2019 Pacific Asia Conference on Knowledge Discovery and Data Mining (PAKDD). He currently serves on the Singapore's Social Science Research Council, and Research Advisory Panel of Prime Minister's Office.

## SINGAPORE: LABORATORY FOR APPLIED AND POLICY RESEARCH

Ivan PNG

Distinguished Professor, National University of Singapore

Why Singapore is attractive to social sciences scholars as a site for applied and policy research: novel policies, access to data, and welcoming of field studies and experiments.

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### *Biography*

Dr Png is Distinguished Professor in the NUS Business School and Department of Economics at the National University of Singapore. He studies the economics of productivity and innovation, and is the Principal Investigator of a \$4.75 million project, SPIRE (Service Productivity and Innovation Research), funded by the Social Sciences Research Council, Singapore, 2017-22. He is the author of *Managerial Economics*, which has been published in multiple editions. For leisure, he plays tennis with colleagues and the violin (both badly).

## ACADEMIC EXCELLENCE: TRAITS AND PRACTICES

Robbie GOH

Dean, Faculty of Arts and social Sciences, National University of Singapore

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### *Biography*

Robbie B. H. Goh is Professor in the Department of English Language and Literature, National University of Singapore (NUS). He has a B.A. Honours (first class, direct honours) and M.A. from NUS, and a Ph.D from the University of Chicago. He received a number of academic prizes and scholarships, including the NUS Overseas Graduate Scholarship to pursue his Ph.D, and a Fulbright fellowship in 1998. He works in Indian Anglophone Literature, Christianity in Asia, and Cultural Studies, and is the author/co-author of 4 books and the editor/co-editor of 8 books, and has also published more than 90 articles and book chapters. A passionate educator, he has won 7 teaching awards at the Faculty and University levels. He has been involved in a wide range of committee and leadership roles in NUS, including as Head of the Department of English Language and Literature, Vice-Dean of the Faculty of Arts and Social Sciences (FASS), and currently as Dean of FASS. Outside of the university he has served as board member and Second Vice-President of the Metropolitan YMCA, as Chair of his church executive committee, as council member of the English Language Institute of Singapore, and on various MOE and NAC committees.



## MENTOR SHARING

May Oo LWIN

Associate Dean (Special Projects), College of Humanities, Arts & Social Sciences; Director, University Scholars Programme, Nanyang Technological University

This session will share experiences in Singapore academia with insights on research, teaching and mentorship, service, plus trials and opportunities in the Singapore context.

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### *Biography*

May Lwin is a Professor at the Wee Kim Wee School of Communication and Information and a Professor (Joint) with the Lee Kong Chian School of Medicine, Nanyang Technological University (NTU). May is an Associate Dean for the College of Humanities, Arts & Social Sciences and the Director of NTU's University Scholars Programme. She also holds an honorary appointment of Asia Scholar Professor at the University of Melbourne, Australia.

Professor Lwin's expertise is in health and strategic communication. Her projects involve the development and assessment of health communication based on psychosocial theories to motivate health behaviors targeting specific populations. She has successfully developed and launched mobile-based health systems, such as Mobuzz, a social media surveillance for tackling dengue, and FluMob for influenza tracking in hospitals. Professor Lwin has advanced several instruments to examine public health responses. Her projects on digital technology use in promoting physical activity, wellness and nutrition education amongst children and families have been piloted in primary and secondary schools in Singapore.

Professor Lwin has received a number of awards, including the Rafflesian Award, the Ogilvy Foundation Award, the Fulbright ASEAN Scholar Award, and most recently, the 2019 Outstanding Applied Researcher Award from the International Communication Association (ICA).

## CLOSING REMARKS

Luke ONG

Professor of Computer Science, University of Oxford

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### *Biography*

Luke Ong is Professor of Computer Science and Head of Programming Languages Research, Department of Computer Science, University of Oxford; and Fellow of Merton College. He works in programming languages, verification, semantics of computation, and logic and algorithms. Ong has made pioneering contributions to game semantics; he has played a leading role in the development of higher-order model checking. His current research interests include statistical probabilistic programming for Bayesian machine learning and differentiable programming; specification and synthesis of programs; analysis of concurrent and distributed systems; and verification of cryptographic and consensus protocols. Ong was a joint winner of the

2017 ACM / EATCS Alonzo Church Award for Outstanding Contributions to Logic and Computation. He is a former General Chair of ACM/IEEE Symposium on Logic in Computer Science (LICS), and Vice Chair of the ACM Special Interest Group in Logic and Computation (SIGLOG).

# PANELLIST BIOGRAPHIES

## **SINGAPOREAN RESEARCHERS GLOBAL SUMMIT**

AUGUST 2019

### **LING San - Panel Chair**

Provost and Vice President (Academic) and President's Chair in Mathematical Sciences, Nanyang Technological University

Professor Ling is Provost and Vice President (Academic) at Nanyang Technological University (NTU), Singapore. Currently the President's Chair in Mathematical Sciences, he joined NTU Singapore in 2005 as the Founding Head of Division of Mathematical Sciences in the School of Physical & Mathematical Sciences (SPMS), after 13 years at the National University of Singapore. He has previously been Chair of SPMS and Dean, College of Science, at NTU Singapore.

Professor Ling obtained his BA and MA in Mathematics from the University of Cambridge, and PhD in Mathematics from the University of California, Berkeley. The honours he has received include: the Singapore National Science Award (Team) in 2003, Public Administration Medal (Silver) by the President of the Republic of Singapore (2013), and Fellowship of the Singapore National Academy of Science (2014). He has also been a visiting scholar at institutions such as UC Berkeley, INRIA, the Technion and Hanyang University.

Professor Ling's research interests are in applications of algebra and number theory to coding theory and cryptography. He has published about 190 papers, 2 textbooks and edited several conference proceedings. Professor Ling has also served on several professional bodies, and as a reviewer for research funding agencies in several countries.

### **LOW Teck Seng**

Chief Executive Officer, National Research Foundation

Prof Low Teck Seng is the Chief Executive Officer of the National Research Foundation (NRF), Prime Minister's Office. The NRF sets the national direction for research and development (R&D) by developing policies, plans and strategies for research, innovation and enterprise.

Prof Low has been actively involved in the Research and Development (R&D) landscape in Singapore. Prior to joining NRF in July 2012, Prof Low served as the Managing Director of the Agency for Science, Technology and Research. As A\*STAR's Managing Director, Prof Low oversaw A\*STAR's strategic priorities of driving innovative research and developing scientific talent to support Singapore's economic and industry development goals.

Prof Low was instrumental in setting up the Magnetics Technology Centre in NUS in 1992 where he helped to spearhead world class R&D in data storage technologies. It became the Data Storage Institute (DSI) of today, the foremost research centre in data storage technologies in the world focusing on technologies for data storage and data management.

After leadership roles in the education sector as Dean of Engineering at the National University of Singapore (1998 to 2001) and as the founding Principal of Republic Polytechnic (2002-2008), Prof Low joined A\*STAR as the Deputy Managing Director (Research) in April 2009 to synergise the work of A\*STAR's Science and Engineering Research Council (SERC) and the Biomedical Research Council. He took on the additional role of Executive Director of SERC in February 2010 to lead SERC into the next decade and shape the future of science and engineering research in Singapore.

Prof Low is a Senior Advisor to President, Nanyang Technological University and a tenured Professor with National University of Singapore.

*Panel Discussion - Research Landscape and Opportunities in Science, Technology, Engineering and Mathematics*

## **QUEK Gim Pew**

Chief Defense Scientist and Future Systems and Technology Architect, Ministry of Defence (MINDEF)

Mr Quek Gim Pew is currently the Chief Defence Scientist of the Singapore Ministry of Defence (MINDEF).

He graduated from the National University of Singapore with a Bachelor of Engineering (1st Class Hons) in Electrical Engineering in 1981, and a Master of Science (Distinction) in Electrical Engineering from the Naval Postgraduate School, USA in 1986.

In his career, he has held various appointments in the defence and technology community including Director of R&D at the Ministry of Defence and the Deputy Chief Executive (Technology) DSTA. He was the Chief Executive Officer of DSO from 1 Feb 2004 to 30 June 2016.

He sits on various boards of organizations, institutions and directorship of companies. He is a member of the A\*STAR Board and Executive Committee, the Defence Science and Technology Agency Board (DSTA), DSO National Laboratories, Singapore Technologies Engineering Ltd Board and the National Supercomputing Centre Steering Committee.

He chairs the Temasek Laboratories at NUS, NTU & SUTD, the Temasek Defence Systems Institute in NUS, the NCL (National Cybersecurity R&D Lab) and the Centre for Quantum Technologies.

He is a Fellow of the Academy of Engineering, Singapore, a Member of the Institute of Leadership in the NUS Faculty of Engineering and an Adjunct Professor in the NUS Department of Electrical and Computer Engineering.

Mr Quek was presented the Defence Technology Prize (Individual) in 1992. He was also conferred the Public Administration Medal (Gold) in 2007 and the NUS Distinguished Engineering Alumni Award in 2014.

## **Frederick CHEW**

Chief Executive Officer, Agency for Science Technology and Research (A\*STAR)

Mr Frederick Chew is the Chief Executive Officer of A\*STAR, Singapore's lead public sector agency that spearheads economic oriented research to advance science and develop innovative technology to further economic growth and improve lives.

Helming the science and technology agency of over 4,100 research staff, he drives the implementation of A\*STAR's strategies, initiatives, and programmes, and the building of A\*STAR's organisational capabilities. He works to share A\*STAR's mission and vision with public and private sector stakeholders, and to strengthen collaboration with partners across the research, innovation and enterprise ecosystem.

He was previously the Deputy Secretary (Technology) at the Ministry of Defence (MINDEF). In this role, he was instrumental in optimising the Defence Technology ecosystem, in particular strengthening MINDEF's partnership with industry.

He also held various key positions in MINDEF and the Singapore Armed Forces (SAF), including Director of Joint Operations, Commander of Maritime Security Task Force/Maritime Security Command and Head of Naval Plans.

He holds a Master of Engineering (First Class Honours) from the Imperial College of Science, Technology and Medicine and a Master of Science in Management from Stanford University. He is an SAF Overseas Scholar, a recipient of the Lee Kuan Yew Scholarship and Fulbright Award.

## **HO Teck Hua - Panel Chair**

Senior Deputy President and Provost, National University of Singapore

Teck is the senior deputy president and provost at the National University of Singapore, where he is Tan Chin Tuan Centennial Professor. He is also the executive chairman of AI Singapore and chairman of the Singapore Data Science Consortium.

Teck is a prominent behavioural scientist, with a PhD in decision sciences from the Wharton School of the University of Pennsylvania. In 2011, he was appointed as vice president (research strategy) at NUS, and became director of the NUS Centre for Behavioural Economics. In 2015, he became deputy president (research and technology). Prior to this, Teck was the William Halford Jr Family Professor of Marketing at the University of California, Berkeley's Haas School of Business.

Teck has had significant articles on behavioural economics, management science, and marketing published in refereed journals. He was the first non-US citizen to be editor-in-chief of Management Science, the venerable flagship journal of the Institute for Operations Research and the Management Sciences, and one of the top journals for research in management.

At the Haas School of Business, Teck received the 2015 Williamson Award, the School's highest faculty award, named in honour of Oliver Williamson, the recipient of the 2009 Nobel Memorial Prize in Economic Sciences.

## **Peter HO**

Senior Advisor, Centre for Strategic Futures

Peter Ho is the Senior Advisor to the Centre for Strategic Futures, and a Senior Fellow at the Civil Service College.

He is also 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, Chairman of the National Supercomputing Centre Steering Committee, and Chairman of the Governing Council of the Campus for Research Excellence and Technological Enterprise. He is a member of the Board of Trustees of the National University of Singapore, and a board member of the National Research Foundation, a member of the Board of Governors of the S Rajaratnam School of International Studies, and of the Lee Kuan Yew School of Public Policy.

When he retired from the Singapore Administrative Service in 2010, he was Head, Civil Service, concurrent with his other appointments of Permanent Secretary (Foreign Affairs), Permanent Secretary (National Security & Intelligence Coordination), and Permanent Secretary (Special Duties) in the Prime Minister's Office. Before that, he was Permanent Secretary (Defence).

*Panel Discussion - Research Landscape and Opportunities in Humanities and Social Sciences (HSS)***CHAN Heng Chee**

Chairman Lee Kuan Yew Centre For Innovative Cities, Singapore University of Technology and Design

Professor Chan Heng Chee is Ambassador-at-Large with the Singapore Foreign Ministry. She chairs the Lee Kuan Yew Centre for Innovative Cities in the Singapore University of Technology and Design. She is Chairman of the National Arts Council, a Member of the Presidential Council for Minority Rights.

Professor Chan is the Deputy Chairman of the Social Science Research Council and a member of the Advisory Council on the Ethical Use of Artificial Intelligence ("AI") and Data, Ministry of Communications and Information.

Professor Chan is a Member of the Board of Trustees of the National University of Singapore and a Member of the Yale-NUS Governing Board.

She was elected the Global Co-Chair of the Asia Society in December 2017 and a Council Member of the Asia Society Policy Institute.

Professor Chan received a number of awards including The Public Administration Medal (Gold); The Meritorious Service Medal; The Distinguished Service Order; Honorary Degrees of Doctor of Letters from the University of Newcastle, Australia and the University of Buckingham United Kingdom; and an Honorary Degree of Doctor of Laws from the University of Warwick, United Kingdom.

**Brenda YEOH**

Director, Humanities and Social Sciences Research, Office of the Deputy President (Research and Technology), National University of Singapore

Professor Brenda Yeoh is Raffles Professor of Social Sciences in the Department of Geography, as well as the Director of Humanities and Social Science Research (DHSSR) in the Office of Deputy President (Research & Technology). She also leads the Asian Migration Cluster at ARI, NUS. She completed her BA at Cambridge University and her DPhil at Oxford University. Her research interests include the politics of space in colonial and postcolonial cities, and she also has considerable experience working on a wide range of migration research in Asia, including key themes such as cosmopolitanism and highly skilled talent migration; gender, social reproduction and care migration; migration, national identity and citizenship issues; globalising universities and international student mobilities; and cultural politics, family dynamics and international marriage migrants. She has published widely on these topics. She serves on several public committees and boards including the Urban Redevelopment Authority (URA) Board; URA Architectural Heritage Awards (AHA) Assessment Committee; Center for Aging, Research and Education (CARE); National Council on Problem Gambling (NCPG) and currently chairs the Heritage Advisory Panel (HAP), National Heritage Board. In 2015, she was awarded the Public Administration Medal (Silver) and received the Friend of MSF Award from the Ministry of Social and Family Development in 2017.

### **Desney TAN - Panel Chair**

General Manager, Microsoft Healthcare

Desney Tan is General Manager of Microsoft Healthcare, where he is responsible for Microsoft's clinical solutions, medical devices, and life science agenda. He also holds an affiliate faculty appointment in the Department of Computer Science and Engineering at the University of Washington. As an applied researcher, Desney's work has shipped in various versions of Windows and Office, the Microsoft Handwriting Recognition Engine, Xbox Kinect, and the Microsoft Band. Desney received his Bachelor of Science from the University of Notre Dame, after which he spent a couple of years as a Combat Engineering officer in the Singapore Armed Forces. He later returned to Carnegie Mellon University, where he earned his PhD in Computer Science. Desney was honored as one of MIT Technology Review's 2007 Young Innovators Under 35 for work on brain-computer interfaces and a 2012 Kavli Fellow by the US National Academy of Sciences. He was named one of SciFi Channel's Young Visionaries at TED 2009, as well as Forbes' Revolutionaries: Radical Thinkers and their World-Changing Ideas for work on Whole Body Computing. Desney has over 100 peer-reviewed publications receiving over 13000 citations, more than 80 granted patents, and has been covered widely by the popular press. Desney is also an avid angel investor, and enjoys spending time with his wife Angela and two kids Ayden and Zachary.

### **CHNG Kai Fong**

Executive Director, Singapore Economic Development Board

Mr Chng was appointed Managing Director of the Singapore Economic Development Board (EDB) on 1 October 2017.

He was the Principal Private Secretary (PPS) to the Prime Minister (PM) from 1 September 2014 to 30 September 2017.

Before his appointment as PPS to the PM, Mr Chng served various roles in the Public Service. He was Director of Communications Group at the Prime Minister's Office, where he oversaw strategic communications and coordinated communications strategy across Government agencies. He was also Director of Resource Industry at the Ministry of Trade and Industry, where he coordinated the Government's efforts to drive productivity growth, and Director of the Institute of Public Sector Leadership, which runs leadership development programmes for public sector leaders. Mr Chng also served in the Ministry of Home Affairs, and the Ministry of Communications and Information. Mr Chng was also seconded from 2008 to 2010 as a Senior Management Consultant to Shell in its Downstream Strategy Division.

Mr Chng graduated from the University of Cambridge with a Master in Engineering in 2001, specialising in signal processing. In 2011, Mr Chng was awarded the Lee Kuan Yew Scholarship. He is also a Sloan Fellow with a Master of Science in Management from Stanford University's Graduate School of Business.



*Panel Discussion - Research Landscape and Opportunities in Industry and Government***Steve LEONARD**

Founding CEO, SGIInnovate

Mr Steve Leonard is a technology-industry leader with a wide range of experience, having played key roles in building several global companies in areas such as Software, Hardware and Services. Although born in the US, Mr Leonard considers himself a member of the larger global community, having lived and worked outside the US for more than 25 years.

In his current role as the Founding Chief Executive Officer of SGIInnovate – a private limited company wholly owned by the Singapore Government – Mr Leonard has been chartered to lead an organisation that builds ‘deep-tech’ companies. Capitalising on the science and technology research for which Singapore has gained a global reputation, Mr Leonard’s team works with local and international partners, including universities, venture capitalists, and major corporations to help technical founders imagine, start and scale globally-relevant early-stage technology companies from Singapore.

Mr Leonard serves on the advisory boards of a range of universities and organisations in Singapore. Mr Leonard also serves as an Independent Non-Executive Director at Singapore Post Ltd (SingPost), a global leader in e-commerce logistics; and AsiaSat, a Hong Kong Stock Exchange-listed commercial operator of communication spacecraft.

**CHAN Cheow Hoe**

Deputy Chief Executive, Government Technology Agency

Mr Chan Cheow Hoe is the Government Chief Digital Technology Officer (GCDTO) of the Smart Nation and Digital Government Office (SNDGO). He is also concurrently the Deputy Chief Executive of the Government Technology Agency of Singapore (GovTech).

As the GCDTO, Cheow Hoe oversees the development of the Government’s digital infrastructure and digital technology capability, as well as talent development in information and communication technology and smart systems (ICT&SS). He will also oversee the development of platforms to enable resource sharing and interoperability across Government, so as to drive the development and delivery of innovative government digital services for citizens and businesses.

In his role as Deputy Chief Executive, GovTech, he oversees multi-disciplinary teams that develop and manage key government’s digital products such as the National Digital Identity.

Cheow Hoe has more than two decades of extensive experience both in the public and private sectors, with a strong track record in leading digital transformation changes in organisations and the government.

Prior to joining GovTech, Cheow Hoe held senior appointments in international banks and consulting companies in the areas of technology, operations, finance and business.

Cheow Hoe graduated from the National University of Singapore, and obtained his masters from Wharton School.

*Panel Discussion - Drug Development*

**PENG Kah Whye - Panel Chair**

Professor and Consultant, Mayo Clinic, USA

Dr. Peng is Professor of Oncology in the Department of Molecular Medicine at Mayo Clinic Rochester Minnesota (USA, and Director of the Virus and Gene Therapy Toxicology/Pharmacology Laboratory which supports the translation of novel viral, gene and cell based therapeutics from bench to Phase I clinical trials. She obtained her BSc (Hons, First Class) and MSc degrees from the School of Biological Sciences at the University of Singapore and PhD degree in gene therapy at the Center for Protein Engineering, University of Cambridge, UK in 1997. Her laboratory at Mayo Clinic develops tumor targeted oncolytic viruses for cancer therapy and noninvasive cell and virus tracking technologies. She has more than 100 publications, serves on NIH grant review panels, and is a Council member of the International Society of Cell and Gene Therapy, the American Society of Cell and Gene Therapy Translational Science and Product Development Committee member. She is a cofounder and Chief Operating Officer of Imanis Life Sciences, a reporter gene imaging company, and cofounder and Chief Technical Officer of Vyriad, a clinical stage biotech developing oncolytic viruses as cancer therapeutics.

**Angela LIM**

Director, EMD SERONO R&D Institute, Inc. / MERCK KGaA Darmstadt, Germany

Angela L. Lim is currently a Director at EMD Serono R&D Institute, the US-based Healthcare division of Merck KGaA, Germany. With 20 years of experience in biologic drug design and process development, she currently heads the Operations and Project teams in the PCS department where she is responsible for supporting all R&D discovery programs in the immunoncology, oncology and immunology therapeutic areas. During her tenure at EMD Serono, she led efforts that helped advanced numerous drugs that are currently in various stages of clinical testing, including the anti-PDL1 antibody Avelumab. Before EMD Serono, she was project leader of the Group B Streptococcus Vaccine Antigen project at BioChem Pharma, where she was responsible for recombinant vaccine design and process development. Dr. Lim received her Ph.D. from Northeastern University, Boston, studying structure and function of CPS protein, and completed her postdoctoral work at the Brigham and Women's Hospital, Harvard Medical School working on Regulators of G-protein signaling.

**HONG Wanjin**

Executive Director, Institute of Molecular and Cell Biology (IMCB), Agency for Science Technology and Research (A\*STAR)

Prof Wanjin HONG graduated from Xiamen University in 1982 and was one of a few hundred Chinese students chosen for further graduate training in the United States via the CUSBEA (China–United States Biochemistry Examination and Application) program. He received his PhD from the State University of New York (SUNY Buffalo), and was a postdoctoral fellow there before he joined the Institute of Molecular and Cell Biology (IMCB) in Singapore as a PI in 1989 and he became Singaporean in 1992. He became the Executive Director of IMCB at A\*STAR (Agency for Science, Technology and Research) in 2011. He is also a Professor at the National University of Singapore (NUS) and an Honorable Professor at Xiamen University and The University of Queensland in Australia. He was the recipient of Singapore's National Science Award (now President's Science Award) in 1999. He also received Singapore's government Public Administration Medal (Silver) in 2014. He serves as the Editor-in-Chief of Bioscience Reports, Associate Editor of Cell & Bioscience, and is on the editorial board of TRAFFIC. His publications have close to 20,000 total citations with a H-index of 76.

*Panel Discussion - Drug Development***CHNG Wee Joo**

Group Director, NUHS Research Office, National University Health System

Professor Wee Joo Chng is the Director of the National University Cancer Institute of Singapore (NCIS) at the National University Health System, Singapore (NUHS). He is also the Group Director of Research Office at the NUHS, Vice-Dean of Research and Provost's Chair Professor at the Yong Loo Lin School of Medicine as well as the Deputy Director and a Senior Principal Investigator at the Cancer Science Institute (CSI), Singapore, National University of Singapore (NUS).

He is a member of many international professional committees, such as American Society of Haematology Scientific Committee on Plasma Cell Neoplasia, the International Myeloma Working Group and the Asian Myeloma Network. He is also involved in a number of Grant Review Committees, Conference Organising Committee, Advisory Boards and Steering Committees of Global Clinical Trials. He has authored more than 200 publications in many reputed journals, and actively participates in clinical trials and has delivered talks in many national and international conferences. He has won multiple awards for his research both locally and internationally including the National Medical Excellence Outstanding Clinician Scientist Award, the National Medical Research Council Senior Translational Research (STaR) Award, The NUS Young Researcher Award, and the Celgene Future Leaders in Haematology Award.

**Damian O'CONNELL**

CEO, Experimental Drug Development Centre, Agency for Science, Technology and Research (A\*STAR)

Most recently Dr. Damian O'Connell was Senior Vice President, Drug Discovery – Global Head of Clinical Sciences, Bayer Pharma AG, Berlin – Germany. Clinical Sciences (CS) is a global function within Bayer (based in Germany, US, Japan, China) with responsibility for the first use of drug products in humans up to Proof of Concept, as well as all clinical pharmacological components of NDAs.

Dr. O'Connell previously held senior positions within Pfizer Research & Development, Parke Davis, Elan Pharmaceuticals and Neurex. Dr. O'Connell has both MD & PhD degrees from the National University of Ireland, has been a Medical Faculty member of the University of Virginia Health Sciences Center as well as a member of the Clinical Pharmacology & Therapeutics Department at the University College Cork, Ireland where he was a Professor of Clinical Research. He started his career in the Industry in 1998.

Dr. O'Connell is a Member of the Faculty of Pharmaceutical Medicine; Fellow of The Royal Society of Medicine; Fellow of The Royal Academy of Medicine (Ireland); Member of the British Pharmacological Society; Member of the Drug Safety Executive Council (DSEC); Member American Society for Clinical Pharmacology and Therapeutics; Member American College of Clinical Pharmacology; Member of American Society of Pharmacometrics; Member of the Irish Association of Pharmacologists; Member of the Irish Cardiac Society; and Member of the British Hypertension Society.

### **LUI Pao Chuen - Panel Chair**

Advisor, National Research Foundation

Professor Lui Pao Chuen retired in 2008 after serving 41 years in the SAF and MINDEF and 22 years as Chief Defence Scientist. He is adviser to the National Research Foundation, Prime Minister's Office, six Ministries and Government Agencies and to President NUS and President NTU. He serves on the board of twelve research institutes and corporations. In 2002 Prof Lui received the National Science & Technology Medal "For his outstanding leadership in the build up of science and technology capability for the nation and its exploitation for major systems of national impact". In 2009 he received the rare Pioneer Award of International Council on Systems Engineering (INCOSE) "for dedicating his life to systems thinking and application, resulting in both an unparalleled impact in Singapore, and advances in the development of systems engineering around the world." In 2011 he was conferred an Honorary Fellow of the ASEAN Federation of Engineering Organizations and the Institute of Physics of Singapore President Medal. In 2014 he received the IES the Lifetime Engineering Achievement Award.

### **TAN Kok Yam**

Deputy Secretary (Smart Nation & Digital Gov)

Mr Tan Kok Yam is the Head of the Smart Nation Programme Office in the Prime Minister's Office. In this role, he coordinates the Singapore Government's plans, and engagements with the public and private sectors to use information technology in a concerted, integrated manner to achieve maximum positive impact to citizens.

Prior to his current post, Mr Tan served in a number of other Ministries within the Singapore Public Service. As the Director of Manpower in the Ministry of Defence, he was in charge of both the human resource and national service policies of the Singapore Armed Forces. He also served previously in the Ministry of National Development and the Ministry of Education, dealing with public housing and higher education policies respectively.

Mr Tan is an engineer by training, having graduated from the University College London in 1997 with a Bachelor in Electrical and Electronic Engineering and a Master of Science in Telecommunications. He also completed the 1-year Sloan Program at the Stanford Graduate School of Business as a Fulbright Scholar.

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*Panel Discussion - Smart Nation*

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**TAN Kiat How**

Chief Executive, Info-Media Development Authority (IMDA)

Mr Tan was appointed Chief Executive of the Info-communications Media Development Authority (IMDA) and Commissioner of the Personal Data Protection Commission (PDPC) in Jan 2017.

Prior to joining IMDA, Mr Tan was the Deputy Secretary (Cyber and Technology) at the Ministry of Communications and Information (MCI), where he was involved in refining the national cybersecurity strategy with the Cyber Security Agency (CSA).

Mr Tan was also previously from the former Infocomm Development Authority of Singapore (IDA), where he helped to develop the Intelligent Nation 2015 plan and implemented the Next Generation Nationwide Broadband Network. He also served at the Ministry of Finance and the Pioneer Generation Office.

Mr Tan graduated from Stanford University with an M.Sc in Management and was a Mason Fellow at Harvard University, John F. Kennedy School of Government. He also has a B.A. in Computer Engineering and a B.A. in Economics from the University of Illinois, where he graduated summa cum laude.

Mr Tan currently sits on the boards of Government Technology Agency (GovTech) and Land Transport Authority (LTA).

**CHAN Hian Lim**

Deputy Chief Executive Officer (Technology), DSO National Laboratories, Singapore

Mr Chan Hian Lim, Deputy Chief Executive Officer (Technology), DSO National Laboratories, was instrumental in the development of advanced radar systems and concepts for the past 2 decades. He is also active in building satellite research capabilities at DSO in partnerships with NUS, NTU, EDB OSTIn and ST Engineering. Today, in this new role as Deputy CEO, he oversees the Future Technology planning and development. His recent focus areas include Quantum Engineering, Advanced Electronics, Space technology, AI and Advanced Materials and Manufacturing. To advance some of the nascent technologies that are Dual Use, he drives collaborations with partners like NRF, ASTAR, EDB, and universities. He assists the CEO in overseeing the R&D investment portfolio and transition outcomes at the three MINDEF Temasek Laboratories at NTU, NUS and SUTD. Mr Chan was awarded the Defence Technology Prize in 2016 for his Individual Engineering contributions. He completed the Advanced Management Program (AMP) at Harvard Business School in 2014. He is Board Directors at ST Engineering Satellite Systems Pte Ltd and the three Temasek Laboratories.

### **TAN Tai Yong - Panel Chair**

President and Professor of Humanities (History) at Yale-NUS College.

Prior to becoming president, President Tan served as the College's Executive Vice President (Academic Affairs) overseeing the academic and co-curricular aspects of the liberal arts experience at Yale-NUS College, including all faculty matters and academic affairs. President Tan was previously the Vice-Provost (Student Life) at the National University, in charge of student matters and residential living. He served as Dean of the Faculty of Arts and Social Sciences and was concurrently Director of the Institute of South Asian Studies. An active member of the community, President Tan serves on numerous boards of various organisations. These include the National Heritage Board, the Indian Heritage Centre's Advisory Board, the Board of Trustees of ISEAS-the Yusof Ishak Institute and the Management Board of the Institute of South Asian Studies. He is also the Honorary Chairman of the National Museum of Singapore and a member of the Singapore Bicentennial Advisory Panel.

### **Joseph LIOW**

Tan Kah Kee Chair in Comparative and International Politics, Nanyang Technological University (NTU)

Joseph Chinyong Liow is Dean of College of Humanities, Arts, and Social Sciences, Nanyang Technological University, Singapore, where he is also Tan Kah Kee Chair in Comparative and International Politics, and Professor and former Dean at the S. Rajaratnam School of International Studies. He held the inaugural Lee Kuan Yew Chair in Southeast Asia Studies at the Brookings Institution, Washington DC, where he was also a Senior Fellow in the Foreign Policy Program.

Joseph's research interests encompass Muslim politics and social movements in Southeast Asia and the geopolitics and geoeconomics of the Asia-Pacific region.

Joseph is the author, co-author, or editor of 14 books. His most recent single-authored books are *Ambivalent Engagement: The United States and Regional Security in Southeast Asia after the Cold War* (Brookings 2017), *Religion and Nationalism in Southeast Asia* (Cambridge University Press, 2016) and *Dictionary of the Modern Politics of Southeast Asia*, fourth edition (Routledge, 2014). A regular columnist for the *Straits Times*, his commentaries on international affairs have also appeared in *New York Times*, *Foreign Affairs*, *Foreign Policy*, *National Interest*, *Nikkei Asian Review*, and the *Wall Street Journal*. He has testified to the United States Congress, and been invited to deliver a special closed door briefing to the ASEAN Defence Minister's Meeting. In addition to scholarship and policy analysis, Joseph has also consulted for a wide range of MNCs including Shell, BHP Billiton, Chevron, Japan Bank for International Cooperation, Total, and Statoil. He sits on the board of several peer-reviewed academic and policy journals and the Social Science Research Council (Singapore), is Singapore's representative on the advisory board of the ASEAN Institute of Peace and Reconciliation (formed under the auspices of the ASEAN Charter), and on the Experts and Eminent Persons Group of the ASEAN Regional Forum.

Joseph Liow holds a PhD in International Relations from the London School of Economics and Political Science, an MSc in Strategic Studies from the Nanyang Technological University, and a BA (Hons) in Political Science from the University of Madison-Wisconsin. He is currently working on two book manuscripts: the fifth edition of *Dictionary of the Modern Politics of Southeast Asia*, and a comparative study of Muslim political movements in Malaysia and Indonesia.

*Panel Discussion - Social Inequality*

**TEO You Yenn**

Provost's Chair in Sociology, Nanyang Technological University

TEO You Yenn received her PhD in Sociology from the University of California at Berkeley. She is Associate Professor and Provost's Chair in Sociology at Nanyang Technological University, Singapore. Her work has been published in journals such as *Economy and Society*, *Signs*, *Social Politics*, and *Development and Change*. She is the author of *Neoliberal Morality in Singapore: How family policies make state and society* (Routledge, 2011). She is recipient of NTU's Nanyang Education Award (2013) and the American Sociological Association Sex and Gender Section's Feminist Scholar Activist Award (2016). In 2018, for her contribution to igniting a national conversation on poverty and inequality with the book *This is What Inequality Looks Like* (Ethos Books, 2018), she was named a Finalist in the Straits Times Singaporean of the Year Award.

**THANG Leng Leng**

Associate Professor, Department of Japanese Studies, National University of Singapore

Thang Leng Leng graduated with PhD in Anthropology from the University of Illinois at Urbana-Champaign. She is a socio-cultural anthropologist with research interests on ageing, intergenerational approaches and relationships, gender, family and migration. She publishes widely in her areas of expertise and is co-Editor-in-chief of the *Journal of Intergenerational Relationships* (by Taylor and Francis). She is also active in the community, serving as chair of Fei Yue Family Service Centre and council member of Singapore Gerontological Society, among others. She is Associate Professor and Head of the Department of Japanese Studies, co-director of Next Age Institute and former deputy director of the Centre for Family and Population Research at Faculty of Arts and Social Sciences, NUS. She is also honorary fellow of the College of Alice and Peter Tan in University Town, NUS.

### **CHUA Nam Hai - Panel Chair**

Chief Scientific Officer, Wilmar

Nam-Hai Chua is Andrew W. Mellon Professor and was Head of Plant Molecular Biology,

The Rockefeller University till Sept 2018. He is also Chief Scientific Advisor, Wilmar International Limited, Deputy Chairman, Temasek Life Sciences Laboratory and Distinguished Visiting Professor, Biochemistry Department, NUS, Singapore.

Prof Chua is a Fellow of the Royal Society, United Kingdom (1988), an Academician of the Academia Sinica, Taiwan (1988) and a Foreign Academician of the Chinese Academy of Sciences, China (2006).

He has served on advisory boards of governmental organizations, academic institutions and multinational companies in 17 countries. In addition to having served as a consultant to Monsanto Company, DUPONT, and Sumitomo Chemical Corporation, Professor also advises various biotechnology companies, biotechnology venture capital funds and patent law firms biotechnology-related matters.

Professor Chua received his B.Sc. from the University of Singapore and AM and Ph.D from Harvard University as a Fulbright Scholar. He was awarded an honorary doctorate by NTU in 2008.

### **Aaron THEAN**

Professor, Electrical and Computer Engineering, National University of Singapore

Aaron Thean is the Director of HiFES and a Professor of Electrical and Computer Engineering at the National University of Singapore. He also serves as the Co-Director for A\*Star SIMTech – NUS Joint laboratory for Large-Area Flexible Hybrid Electronics. In addition to his technical responsibilities, Aaron has been appointed as NUS' Director of Industry Engagement and Partnerships at the Office of Deputy President (Research-Technology) as well.

Prior to joining NUS in 2016, Aaron served as IMEC's Vice President of Logic Technologies where he led IMEC's International path-finding research consortium on advanced semiconductor technologies, which included top industry partners like Intel, Samsung, TSMC, Globalfoundries, Qualcomm. Prior to IMEC, he was with Qualcomm in San Diego, California, USA. There, he led the Strategic Silicon Technologies Group responsible for new System-On-Chip technologies. From 2007 to 2009, Aaron led an technology alliance team to develop low-power bulk CMOS technology at IBM East Fishkill, New York. His team developed the Industry's first foundry-compatible Gate-First High-k Metal-Gate with novel SiGe channel Low-Power bulk CMOS technologies. It enabled some of today's most successful smart mobile devices in production by the foundry partners.

Aaron started his industry career as a senior staff scientist with Motorola's Advanced Product Research and Development Laboratory (APRDL) and Freescale Semiconductor. He subsequently led the Novel Device Research Group there in Austin, Texas. He graduated from the University of Illinois at Champaign-Urbana, USA, where he received his B.Sc. (Highest Honors & Graduated as Edmund J. James' Scholar), M.Sc., and Ph.D. degrees in Electrical Engineering. He was awarded the 2001 Gregory Stillman Semiconductor Research Award for his Ph.D. work. He has published over 300 technical papers and holds more than 50 U.S. patents for inventions in the field of advanced electronics. He also serves an editor for the IEEE Electron device letters.



*Panel Discussion - Experiences of Returning Singaporean Scientists***Andrew LIM**

Head of Department (Industrial Systems Engineering and Management), Director (Centre for Maritime Studies), National University of Singapore

Professor Andrew Lim is Head of the Department of Industrial Systems Engineering and Management and Director of the Centre for Maritime Studies at the National University of Singapore (NUS). As a technopreneur, Andrew has spearheaded numerous industry projects that have not only resulted in multi-million dollar savings for his clients, his work has also been recognized through the numerous organisational, national and international awards and innovation prizes that he has won. As an academic, Andrew's work into helping companies and organizations compete effectively have been published in key journals in Operations Research and Management Science. Before Andrew was recruited by NUS under The National Research Foundation's Returning Singaporean Scientists Scheme in 2016, he spent more than a decade in Hong Kong where he held professorships in The Hong Kong University of Science and Technology and The City University of Hong Kong. In 2013, Andrew was recruited by Nanjing University under the Thousand Talents Program that was launched by the Chinese government in 2008. Andrew is currently involved in a number of initiatives. While some of them involve big data analytics, others are concerned with demand generation and supply management problems in the domains of healthcare, logistics and transportation.

**PEH Li-Shiuan**

Provost's Chair Professor of Computing, School of Computing, National University of Singapore

Peh Li Shiuan joined NUS as Provost's Chair Professor in the Department of Computer Science, with a courtesy appointment in the Department of Electrical and Computer Engineering in September 2016. Previously, she was Professor of Electrical Engineering and Computer Science at MIT and was on the faculty of MIT since 2009. She was also the Associate Director for Outreach of the Singapore-MIT Alliance of Research & Technology (SMART). Prior to MIT, she was on the faculty of Princeton University from 2002. She graduated with a Ph.D. in Computer Science from Stanford University in 2001, and a B.S. in Computer Science from the National University of Singapore in 1995. Her research focuses on networked computing, in many-core chips as well as mobile wireless systems. She received the IEEE Fellow in 2017, NRF Returning Singaporean Scientist Award in 2016, ACM Distinguished Scientist Award in 2011, MICRO Hall of Fame in 2011, CRA Anita Borg Early Career Award in 2007, Sloan Research Fellowship in 2006, and the NSF CAREER award in 2003.

# POSTER ABSTRACTS

**SINGAPOREAN RESEARCHERS  
GLOBAL SUMMIT**

AUGUST 2019

## POSTER 1

## A SEARCH FOR THE REPRESENTATIONAL CONTENT IN THE PUTATIVE NUMBER FORM AREA

Darren J. YEO<sup>1,2</sup>, Courtney Pollack<sup>1,3</sup>, Daniel Ansari<sup>4</sup>, & Gavin R. Price<sup>1</sup>

<sup>1</sup>Peabody College, Vanderbilt University, USA

<sup>2</sup>College of Humanities, Arts, & Social Sciences, Nanyang Technological University, Singapore

<sup>3</sup>McGovern Institute for Brain Research, Massachusetts Institute of Technology, USA

<sup>4</sup>Department of Psychology & Brain and Mind Institute, The University of Western Ontario, Canada

### Description of Research:

Recent studies suggest a putative number form area (NFA) in the inferior temporal gyrus (ITG) that responds preferentially to Arabic numerals versus other symbols. It is assumed to be recruited in any task that involves visual processing of Arabic numerals. Although meta-analytic convergence in the right ITG has been observed for numeral-selectivity, its recruitment is not as obligatory as previously assumed. It is thus unclear whether the numeral-selective ITG region is specialized for processing visual shapes, and/or ascribing or accessing conceptual associations, and if active processing is necessary.

### Objectives:

Here, using multi-voxel representational similarity (RS) analysis of functional magnetic resonance imaging data, we tested the claim of a task-independent NFA by investigating the content represented in the numeral-selective ITG region during passive viewing of digits, letters, and scrambled digits/letters in 39 adolescents. We tested RS within core nodes of a symbolic number processing network against 6 hypothetical models: (1) pixel- and (2) deformation-based physical shape similarity, (3) symbols versus novel characters (3a: digits and letters are indistinguishable, 3b: digits and letters are distinct), (4) digits versus letters versus non-symbols (equally distinct and equidistant), and (5) digits versus non-digits (letters and novel characters indistinguishable).

### Key findings:

RS across exemplars of the 4 categories in the NFA did not match any of the hypothesized models. These findings suggest that the NFA, at least during passive viewing, may lack categorical information. Minimally, existing work has shown that the shape identity needs to be actively processed for its recruitment, and could be part of an interactive loop with top-down processes from parietal and prefrontal regions. This suggests a nuanced role of the putative NFA in category specific digit processing that requires further empirical investigation. In contrast, RS in the left inferior parietal lobule (IPL) matched models 1, 3b, & 4. The left IPL may be involved in the automatic retrieval of associations between shapes and concepts to allow familiar shapes to be distinguished from novel ones, and numerical objects (digits) to be distinguished from nonnumerical ones (letters).

POSTER 2

## SOCIAL IDENTITY AND INCENTIVES IN TEAMS

Jonathan YEO

Nanyang Technological University

### Description of Research:

At the workplace, individuals interact in a common organisational environment, each having possibly very different social backgrounds and associated cultures. Disparities between cultures mean that the extent to which members share a common identity could thus be an important determinant of their behaviour within the organisation's ecosystem. Subsequently, it might be important for organisations to adapt incentives in order to appropriately motivate productivity. Given the scant causal evidence of this in the literature, a lab-based experiment is ideal to examine this issue.

In this study, I examine how the optimal incentive scheme is influenced by the extent to which members of teams share a common "culture". Hypotheses are first generated using a simple model where individuals care about externalities imposed on others, weighted by team-identity salience. I utilise a real effort task where output depends on both individual effort and cooperation within one's team. Group identities are first induced in participants using a standard social identity paradigm, after which they are randomly assigned to teams which are either homogeneous or heterogeneous. Each team is then randomly assigned an incentive scheme which is either competitive (tournament) or cooperative (output sharing).

### Objectives:

To evaluate the impact of social identity composition of teams on the relative effectiveness of different incentive schemes. To elucidate the mechanism by which the above occurs: are choices of work inputs consistent with that predicted by the model?

### Key findings:

I find that cooperative incentives have markedly higher productivity than competitive incentives in homogeneous, but not heterogeneous teams. These productivity differences can be explained by the varying impacts of the incentive schemes on effort and cooperation depending on team composition. In general, cooperative incentives improve cooperation, but at the cost of reduced effort from free riding. However, a team's social identity composition moderates these incentive effects in manner consistent with the proposed model. Compared to heterogeneous teams, homogeneous teams experience a larger improvement in cooperation and smaller reductions in effort under cooperative incentives, albeit weaker in the latter case. I also find evidence that choices of effort and help are related to participant's team-identity salience which is initially positively influenced by homogeneity and cooperative incentives.

## POSTER 3

## EXPLORING THE INTERSECTION OF “SMART” AND SUSTAINABLE IN SINGAPORE’S HIGH-RISE GOVERNMENT HOUSING ESTATES

Nurul Amillin HUSSAIN

DPhil, 2nd Year, Department of Geography and the Environment, University of Oxford

This project aims to investigate the kinds of environmental governance that emerge in the particular kind of urbanism formed at the intersection of sustainability and the ‘Smart Nation’ in Singapore. Conceiving of these initiatives as dense, complex assemblages that mobilize particular forms of statecraft, this project explores 2 main questions:

- (1) How does the intersection between sustainability and “smart” become part of the infrastructure that sustains the ‘everyday’ life of residents within high-rise government housing estates, particularly those in the “eco-town” of Punggol?
- (2) What are the political dimensions of the particular and complex state assemblages of sustainability and “smart” within the larger ‘Smart Nation’ of Singapore? How are these assemblages governed, and to what extent are they reproducible across all levels of society?

Through considerations of the agency of the ‘material’ of the ‘Smart Nation’, this project hopes to develop an understanding of how non-human objects interact with human actors and come to have a political life – especially within the context of strong state. By paying attention to the complex negotiations of the ‘everyday’ material, this project also hopes to add to current understandings of how infrastructural and material aspects of policy have the potential to contribute to both nationbuilding and the national imaginary. Additionally, this project hopes to contribute to current scholarship on ‘smart cities’ and sustainable transitions within urban centres in developed Asia, where political formations and ‘activism’ often take a different form from that seen in Western Europe, America and developing countries.

Key Findings: This project draws largely on ethnographic methods of data collection, which include participant observation, 1-1 interviews and “walk-alongs”, as well as group workshops. Data collected so far suggests various points that encourage further study in the next phase of fieldwork:

- There are strong infrastructural, material and affective elements that represent the continuity of earlier eras in Singapore’s environmental history in today’s implementation of recent sustainability and ‘smart’ policies. From colonial ideas of the “Garden City” and earlier developmental logics of modernity, to recent neoliberal understandings of the city as a “living laboratory”, the movement from specific kinds of post-colonial city planning to deliberate urban planning with a focus on exporting policy overseas, this trajectory is both complex and contentious
- By studying the intersection of sustainability and ‘smart’, this project has been able to tease out new ways of understanding entangled distributions of power within human and nonhuman assemblages – what often seems like an issue within policy-making (e.g. not enough citizen engagement, lack of awareness, apathy) may not be a problem on-the-ground when we consider the socio-material realities that depend on specific kinds of disengagement in order to achieve the political aims of the state
- The reproduction of the ‘smart’ and sustainable city is uneven across various levels of society, with the individualization of citizenship and engagement (as prescribed by a ‘citizenfocused’ emphasis on ‘smart’) shifting responsibility from the state to the people. How does the intersection of sustainability and ‘smart’ make sense of the centrality of participatory democracy in a city like Singapore?
- By situating subjects spatially and considering the politics of visibility when it comes to both sustainability and ‘smart’ infrastructures, this project has also been able to unpack the process of the formation of citizens by focusing on the affective work involved in maintaining the ‘everyday’ in government estates.

POSTER 4a

## PARENTING AND CAREGIVING STRUCTURES AND THE POSITIVE DEVELOPMENT OF ADOLESCENTS: THE SOCIAL CAPITAL OF EXTENDED FAMILY MEMBERS IN LOW-INCOME SINGAPOREAN FAMILIES

KWAN Jin Yao

University of California, Los Angeles; National University of Singapore

The combination of a low fertility rate and an ageing population has resulted in shrinking family sizes in Singapore, where there is geographical proximity of nuclear and extended families. In addition to smaller family sizes, parenting and caregiving structures are increasingly non-nuclearised. Long-term low unemployment rates and financial support for low-income Singaporeans who continue working, moreover, keep parents present at work, and absent from home.

Extant research shows that parental or caregiver presence at home is associated with the positive development of adolescents. Yet, the family unit is often understood narrowly in nuclearised terms, and even when extended family members are accounted for, studies rarely discern the influence of proximity or living arrangements among nuclear and extended family members. And compared to other families who could pay for caregiving, the parents of low-income families might benefit if they tap into the social capital of extended family members.

### Objectives:

Guided by ecological systems theories of human development and of family social capital, this cross-sectional study of 120 adolescents proposes to add to our understanding of family processes involving parenting and caregiving structures and the positive youth development (PYD) of adolescents from low-income families in Singapore. Three research questions follow: Do varying structures predict youth developmental outcomes?; Does the involvement of extended family members vary by proximity or living arrangements?; and What is the relationship between three-generation parenting and caregiving structures and PYD?

A total of six Singaporean social service agencies – AMKFSC Community Services, Care Corner Singapore, the Salvation Army (Singapore), SHINE Children and Youth Services, TOUCH Community Services, and Yayasan MENDAKI – were involved in recruitment and data collection.

### Key achievements:

Not only should the association of three-generation parenting and caregiving structures – including extended family members beyond the grandparents – with positive youth development be evaluated in tandem with family quality, different measures of family quality ought to be considered too. Findings from this research will better inform the design and the evaluation of family-based interventions to increase the PYD of adolescents from low-income Singaporean families. Knowledge of parenting and caregiving structures associated with lower levels of PYD will allow for targeted familial interventions, reducing the likelihood of adolescents getting into trouble.

## POSTER 4b

# YOUTH CONTRIBUTION AND VOLUNTEERISM IN SINGAPORE: UNDERSTANDING THE MOTIVATIONS OF YOUNG ADULT SINGAPOREANS

KWAN Jin Yao

University of California, Los Angeles; National University of Singapore

## Description:

Singapore has a strong tradition of school and community-based volunteerism, but little is known about how contribution or volunteerism is generally understood by young adults, or the voluntary and civic activities they are engaged in. And even though school-based community service is compulsory, with the expectation that students will continue to volunteer after graduation, only 29 per cent of youth adults aged 25 to 34 years old volunteer. The proportion is below the overall average of 35 per cent, and it is also a significant drop from the 41 per cent proportion of those aged 15 to 24 who volunteer, a trend which has persisted since 2000. Member of Parliament Louis Ng spoke in parliament of the need to understand the effectiveness of Singapore's school-based volunteer programmes, and if participation in these programmes determine whether students continue to volunteer after graduation.

In the broader literature, there are also unresolved tensions surrounding the compulsory or voluntary nature of community service, as well as the characteristics of, motivations for, and outcomes of service-learning. There are disagreements over the most effective types or forms of service-learning: Social or non-social activities, voluntary or compulsory configurations, and the possible range and operationalisation of outcomes such as civic engagement. Singapore therefore offers an interesting context, because school-based volunteerism is compulsory for all primary and secondary school students. Existing studies have focused largely on the schools and have not sought to understand why the proportion of young adults who volunteer decreases significantly after graduation. And against the background of an ageing population, the Singapore government is also working to double the country's overall volunteerism rate. This study is funded by the National Youth Council of Singapore.

## Objectives:

The main research question is to describe how young adult Singaporeans understand contribution or volunteerism, and how their perceptions may have changed as they moved from school and into the community. It is anchored by three aims: To identify the types of school and community-based voluntary and civic activities they are or were involved in, and how their preferences may have changed over time; to elicit in-depth narratives about their motivations for contribution or volunteerism, or the absence of these motivations; and to develop a framework exploring how school-based volunteerism shapes community-based endeavours, especially in terms of future contribution.

## Key achievements:

Guided by constructivist grounded theory, personal, in-depth interviews were conducted with 50 young adult Singaporeans between the ages of 25 and 34 years in December 2018. The lack of previous research about the perceptions of contribution or volunteerism in Singapore consequently limits insights on motivations and processes. The purpose of crafting a theory of how school-based volunteerism, which is mandatory, shapes voluntary and civic activities in the community, when it is no longer mandatory, is to allow for the evaluation of the schoolbased programmes, to identify the activities and motivations which might be associated with future contribution, and ultimately to increase the rate of contribution or volunteerism in Singapore

POSTER 5

## FEMALE-TO-MALE TRANSGENDER IDENTITIES, COMMUNITIES AND CITIZENSHIP IN JAPAN

YUEN Shu Min

National University of Singapore

Description:

This is a presentation of my current book project on the negotiation of citizenship by Female-to-Male (FTM) transpeople in contemporary Japan. This monograph-in-progress is based on my PhD dissertation and post-doc research completed under OGS and OPF.

Objectives:

Combining medico-legal discourse analysis, textual analysis of media representations, and ethnographic research in the Japanese FTM community, this book aims to uncover the processes of negotiations that FTM transpeople are constantly engaged in, with both the state and commercial markets, and with these institutions' regulation of their gendered personhood in their attempt to claim inclusion as (trans)gender subjects in Japanese society.

Key findings/achievements:

My research findings reveal that while there is a strong desire among many of my FTM informants to be socially recognized and accepted as "normal" men, many of them also continue to participate regularly in social events organized by, and predominantly for FTM transpeople, to gain a sense of community and belonging to a collective sociality. I argue that this claiming of dual citizenship—a double occupation of "FTM" and "man", two identity positions that appear to be at odds with each other—demands a (re) conceptualization of trans inclusion that transcends the current language of rights, recognition and equality.

This dual position not only troubles the dichotomy of assimilation versus resistance that is commonly found in current citizenship discourse, but can also suggest a new and more ethical way of thinking about transgender citizenship that does not only focus on claiming universal rights, but also remains sensitive to differences.

This book makes a direct intervention into the severe lack of representations of Japanese FTM transgender people in academic research, and challenges existing Western frameworks for understanding queer/transgender lives. It is also the first comprehensive study on the cultural history of Japanese FTM transgender people in both Japanese studies, and the newly institutionalized and booming field of transgender studies.



## POSTER 6

## CONCENTRATING MOLECULES AT FUNCTIONAL SOLID@MOF INTERFACE TO PROMOTE GAS-BASED REACTION, SENSING AND GAS-TO-FUEL TRANSFORMATION AT 1 ATM AND 298 K

Hiang Kwee LEE<sup>1</sup>, Charlynn Sher Lin Koh<sup>1</sup>, Howard Yi Fan Sim<sup>1</sup>, Xing Yi Ling<sup>1</sup>

<sup>1</sup>Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University, 21 Nanyang Link, Singapore 637371, Singapore.

### Research description:

Reactions/processes involving gases are important in industry but are typically slow and difficult to monitor in situ owing to their intrinsic low molecular concentration. Energy-intensive operations involving elevated temperatures and pressures are often required to increase the efficiency of gas reactions and detections. Here, we aim to concentrate molecules at the interface formed between a functional solid and a metal-organic framework (MOF) layer to enhance gas-based reactions and sensing, even at 1 atm and 298 K. Our strategy utilizes the excellent gas sorptivity of MOF to continuously accumulate gas molecules onto solid surfaces with functional plasmonic and/or catalytic properties.

### Objectives:

There are four main objectives in this research. We aim (1) to unravel the dynamic molecular footprint of gas molecules at the solid-MOF interface when subjected to continuous gas flow at ambient conditions. By understanding how molecules interact with each other and with functional solid surfaces, we subsequently aim to extend our solid@MOF platform towards three important gas-based applications, namely (2) ultratrace gas detection, (3) gas-liquid reaction and (4) gas-to-fuel valorization.

### Key findings/achievements:

Our research offers four key findings/achievements. (1) By integrating MOF with surface-enhanced Raman scattering (SERS)-active Ag nanoparticles, we are able to directly observe the concentration of gas molecules into a quasi-condensed phase at the nanoscale solid-MOF interface, notably at ambient operating conditions.<sup>1</sup> This valuable insight highlights solid@MOF as an immensely attractive platform to address the persistent problem of needing immense pressure and/or temperature in conventional gas-based applications. Leveraging on such unique molecular phenomenon, solid@MOF platforms also allow (2) the detection of non-adsorbing gas species down to part-per-billion (ppb) level in < 5 s,<sup>2</sup> (3) the activation of industrially-significant gas-liquid reaction that is otherwise inert at ambient conditions,<sup>3</sup> as well as (4) selective (~ 90 %) and efficient (~ 20 %) conversion of nitrogen gas into ammonia – an important green fuel and chemical precursor.<sup>4</sup> Our solid@MOF design therefore offers enormous scientific/technological opportunities in relevant fields including chemistry, heterogeneous catalysis, greenhouse gases removal and energy-related gas-to-fuel conversions.

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POSTER 7

## THE NEURAL BASIS OF SUGAR PREFERENCE

Hwei Ee TAN<sup>1,2</sup>, Alexander Sisti<sup>1</sup>, Hao Jin<sup>1</sup>, Martin Vignovich<sup>1</sup>, Yossef Goffer<sup>1</sup>, Charles Zuker<sup>1</sup>

<sup>1</sup>Columbia University; <sup>2</sup>Agency for Science, Technology and Research (A\*STAR)

### Research description:

Sugar is a fundamental source of energy for all animals, and correspondingly, most species have evolved dedicated brain circuits to seek, recognize, and motivate the consumption of sugar. In humans, the recruitment of these circuits for reward and pleasure, rather than nutritional needs, is thought to be an important contributor to the overconsumption of sugar, and the concomitant increase in obesity rates. In Singapore, the average daily intake of sugar in the last year is 60g – more than double the World Health Organisation's recommendation of 25g a day.

Sweet compounds are detected by specific taste receptor cells (TRCs) on the tongue and palate epithelium. Activation of sweet TRCs sends hardwired signals to the brain to elicit recognition of the sweet-tasting compound and consumption. Surprisingly, even in the absence of a functional sweet-taste signaling pathway animals can still acquire a preference for sugar. Furthermore, although artificial sweeteners activate the same sweet taste receptor as sugars, and they do so with vastly higher affinity, they fail to substitute for sugar in generating a behavioral preference. Notably, artificial sweeteners were introduced in consumer products over four decades ago, however, their overall impact in decreasing sugar consumption, preference, and craving has been negligible.

### Objectives:

To understand the neural basis of sugar preference; Specifically, to uncover a sugar-specific, rather than “sweet” specific pathway, that operates independently of the sense of taste to create preference for sugar and motivate consumption.

### Key findings/achievements:

We demonstrate that a population of neurons in the brainstem are activated via the gut-brain axis to create preference for sugar. These neurons receive input from the vagal ganglia, are stimulated in response to sugar but not to artificial sweeteners, and are activated by direct delivery of sugar to the gut. Using functional imaging we monitored the activity of the gut-brain axis by optically recording the activity of vagal neurons in vivo, and identified the neurons activated by intestinal delivery of glucose. We engineered animals where synaptic activity in the sugar-stimulated neurons was silenced, and demonstrate that blocking this gut-to-brain circuit prevents the development of behavioral preference for sugar.

Our findings reveal a gut-to-brain post-ingestive sugar-sensing pathway critical for the development of sugar preference. In addition, they explain the neural basis for the differences in the behavioral effects of sweeteners versus sugar, and uncover an essential circuit underlying sugar's highly appetitive effects.

With this circuit-level understanding, it may now be possible to develop a new class of sweeteners that activate both the sweet taste receptor in the tongue and the gut-brain axis, and consequently help moderate the strong preference and drive to consume sugar.

## POSTER 8

## ANTIGEN- AND PATHOGEN-DRIVEN METABOLIC REMODELING OF IMMUNE CELLS

WANG Liang Wei

Harvard University; Agency for Science, Technology and Research (A\*STAR)

### Description and Objectives:

I am interested in immune cell remodeling in response to viral pathogens, self-antigens and allergens. In my Ph.D. studies, I focused on Epstein-Barr virus (EBV), a clinically significant pathogen that causes infectious mononucleosis and is associated with a variety of human malignancies, such as nasopharyngeal carcinoma, NK/T lymphoma and gastric cancer. While the roles of viral oncoproteins in instigating metabolic changes have been well-investigated in stably transformed cell lines, little is known about metabolic reprogramming in the early stages of latent EBV infection, which is important for determining metabolic vulnerabilities that can be targeted to disrupt effective virus establishment. To that end, my colleagues and I have characterized the roles of one-carbon metabolism and de novo syntheses of serine, cholesterol and lipids in Epstein-Barr virus (EBV) transformation of primary human B-cells. By combining multiplexed proteomics, chemical and genetic perturbation experiments and metabolomics, we have made key insights into the contributions of these myriad pathways to cellular anabolism and reprogramming of the signaling milieu.

In my current position as a postdoctoral fellow at SIgN, A\*STAR, I hope to investigate immunometabolism in the contexts of atopy and autoimmunity. Cells in these pathophysiological states generally display limited proliferative metabolism and given their propensity to produce large amounts of proteins and chemokines, metabolic remodeling to support acute inflammatory responses is highly likely yet under-investigated. Understanding the metabolic dependencies of those cells will be crucial to mitigating pathologic consequences, especially with the increasing frequencies of atopic and autoimmune disorders in the developed world.

### Key Findings and Achievements:

For my work on one-carbon metabolism, I won the Best Poster prize (top 3 out of more than 100 entries from graduate students, postdoctoral scholars and clinicians) at the inaugural American Association for Cancer Research (AACR) Advances in Malignant Lymphoma Meeting in 2018. My work has also been positively received at a number of symposia, including the Boston Herpes Area Symposium and the International Conference on DNA Tumor Viruses in 2018. Additionally, the same work formed the basis of the prestigious Priscilla Schaffer Memorial Lecture given by my thesis advisor, Dr. Benjamin Gewurz, at the 2018 International Herpesvirus Workshop. Our manuscript has been favorably received and is currently under revision for eventual publication by Cell Metabolism. I have also submitted a second manuscript on my investigations of cholesterol and lipid syntheses, which is currently under review at PLoS Pathogens.

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POSTER 9

## ZEBRAFISH AVATARS OF HUMAN CANCER

YAN Chuan, Daniel Do, Yang Qiqi, Karin McCarthy, Alessandra Welker, Claudia Yun Wei, Tiffany Eng, Alexandra Veloso, Sowmya Iyer, Sara Garcia, David Langenau

Massachusetts General Hospital (MGH), Harvard Stem Cell Institute

### Research description:

Immunocompromised mice are the current gold standard in transplantation studies, revealing important biological knowledges about cell proliferation, differentiation, disease progression and therapy responses. However, these murine models have inherent disadvantages such as high maintenance cost, therefore limiting scale of studies conducted, as well as are furred, thus requiring complexed imaging module for high resolution imaging of engrafted cells. In contrast, zebrafish, as an alternative transplantation model, has traits that nicely complement their murine counterpart. The animal is optically clear and highly amendable to high-resolution imaging, as well as a much lower husbandry and maintenance cost. However, till date, while allogenic transplantation in partially immunocompromised zebrafish has become a routine procedure, there is a lack of adult fully immunocompromised zebrafish that can robustly engraft human cells.

### Objectives:

Generating an optically clear, adult immunocompromised zebrafish model that allow robust, long term engraftment of human cancers will allow a few important improvements over currently existing transplantation models. Firstly, optical clarity of casper-strain immune compromised zebrafish is ideal for high-resolution imaging of different cancer cell processes. Secondly, coupled with the high throughput platform offered by zebrafish, engrafting a patient's tumor into large cohorts of animals will permit testing of a wide array of clinically available drugs, pairing responses in zebrafish avatars with clinical decision-making that stratifies patients into the most suitable treatment for their tumor. Finally, the adult immunocompromised zebrafish model also has the potential to transform pre-clinical animal modeling and drug discovery by administering drugs in a clinically achievable manner, increasing the throughput of in vivo screening, and providing faster imaging endpoints that capitalize on the ability to assess drug affects in real-time and at single cell resolution.

### Key findings/achievements:

We have created the first adult immunocompromised zebrafish mutant that lacked T, B and NK cells. These animals can survive at 37°C and robustly engraft a variety of fluorescently labeled human cancers for in excess of 28 days. Remarkably, the growth kinetics, histology, cell proliferation and apoptotic rates are largely similar when compared to the same tumor engrafted into NSG mice. Our study in zebrafish went on to identify a new drug combination, olaparib PARP-inhibitor and the DNA damaging agent temozolomide, that curbed growth of pediatric rhabdomyosarcoma muscle cancers, which elicited similar tumor responses in mouse xenograft studies and mimicked the same pharmacokinetics as observed in mouse and human. Based on these results, olaparib and temozolomide combination is soon to be tested in a phase II clinical trial, providing the first example of clinical translation for cancer therapy originating from zebrafish xenograft studies.

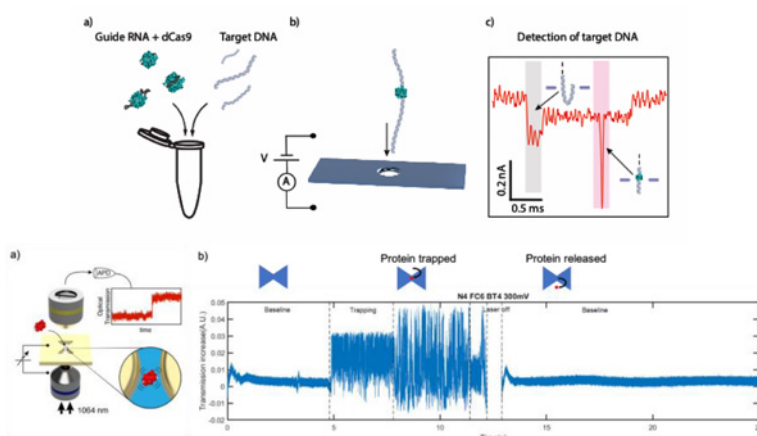
## POSTER 10

# BIOSENSING OF CRISPR-DCAS9 IN NANOPORES AND PLASMONIC NANOAPERTURES

Wayne YANG, Laura Restrepo-Pérez, Michel Bengtson, Madeleine van Dijk, Xin Shi, Daniel Verschuere, Stephanie J. Heerema, Anthony Birnie, Jaco van der Torre, Cees Dekker

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## Key Findings/Achievements:

- Development of fast e-beam lithography method for the fabrication of solid state nanopores
- User defined target binding and detection of DNA motifs with CRISPR-dCas9 in a nanopore
- Optical tweezing and detection of single proteins in gold plasmonic nanoapertures

Solid-state nanopores with their ease of fabrication<sup>1</sup> and simple readout have emerged as promising platforms for biosensing and interrogation of single biomolecules. We demonstrate two nanopore readout methods -electrical and optical readout, for utilization and study of the CRISPR-dCas9 complex in nanopores.

First, we utilize the CRISPR-dCas9 protein, a variant of the Cas9 protein, as a targeted label for DNA sequence at a user defined site for nanopore readout<sup>2</sup>. While CRISPR-Cas9 is acclaimed for its gene editing potential, the CRISPR-dCas9 variant employed here does not cut DNA but instead remains tightly bound at a user-defined binding site, thus providing an excellent target for biosensing. The proteins exhibit a pronounced electrical current blockade signal that allows for facile identification of the targeted DNA sequence. Moreover, the binding position of the target sequence can be read from the spike position along the DNA. We envision the use of such nanopore sensing with CRISPR-dCas9 for the fast detection and identification of DNA motifs of medically relevant DNA targets for DNA typing based diagnostics such as quick disease-strain identification and antibiotic-resistance detection.

Second, we pioneer the study of CRISPR-dCas9 dynamics through optical transmission via gold plasmonic nanoapertures. The entrance of the protein into the gold nanoapertures is marked by an increase in the transmission of light through our gold nanoapertures due a shift in the resonance of our gold nanoapertures. The enhancement of the optical gradient by the gold nanoapertures provides an optical trapping force that allows molecules to be trapped for upwards of seconds, opening up new routes to acquire information on the proteins' shape, conformation and dynamics. On demand, we can release the trapped molecule by turning off the laser, allowing the molecule to diffuse back into the reservoir and for another protein to be interrogated. Ongoing experiments are being performed to study the shape and conformation dynamics of the dCas9 complex as it undergoes its target search mechanism using these optical traps.

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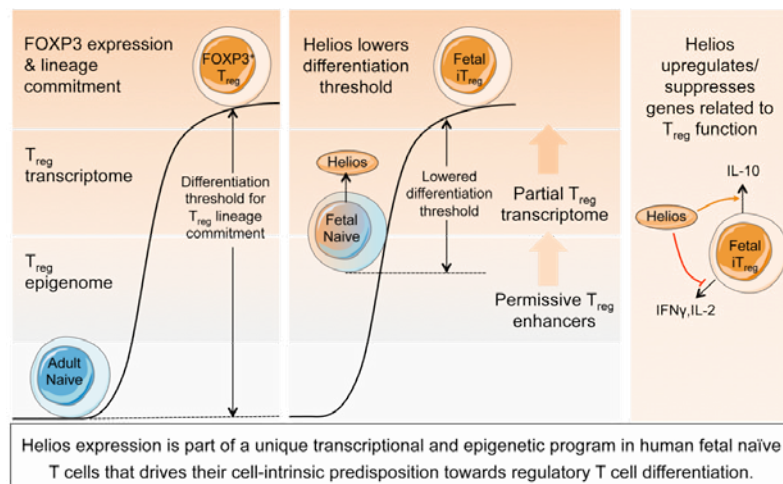
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## POSTER 11

## HELIOS ENHANCES THE DIFFERENTIATION OF HUMAN FETAL CD4+ NAÏVE T CELLS INTO REGULATORY T CELLS.

Melissa S. F. NG<sup>1</sup>, Theodore L. Roth<sup>1,2,3</sup>, Ventura F. Mendoza<sup>4</sup>, Alexander Marson<sup>2,3,5,6,7,8</sup>, Trevor D. Burt<sup>2,4,9\*</sup>

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Helios expression is part of a unique transcriptional and epigenetic program in human fetal naive T cells that drives their cell-intrinsic predisposition towards regulatory T cell differentiation. Activation of naive CD4<sup>+</sup> T cells by T cell receptor (TCR) stimulation and cytokine cues lead to differentiation into effector T cell populations with distinct pro-inflammatory or regulatory functions. Unlike adult naive T cells, human fetal naive CD4<sup>+</sup> T cells uniquely differentiate into FOXP3<sup>+</sup> regulatory T (Treg) cells upon TCR activation independent of exogenous cytokine signalling. This facility for Treg differentiation is crucial for generating tolerance in utero; however, the mechanisms underlying this fetal cell-intrinsic predisposition towards the Treg cell fate are largely unknown. Here, we reveal FOXP3-independent transcriptional and epigenetic programs shared between fetal naive T cells and committed adult Treg cells that are inactive in adult naive T cells. We further demonstrate that these FOXP3-independent transcriptional programs are retained upon Treg cell differentiation only in fetal-derived, but not adult derived induced Treg (iTreg) cells. We show that a subset of adult Treg-specific superenhancers is active within fetal naive T cells, including two active super-enhancers at Helios, a signature thymic Treg gene. Helios is only expressed in fetal naive T cells, but not in adult naive T cells, and only fetal-derived iTreg cells continue to express Helios. Fetal, but not adult iTreg cells, have suppressed IL-2 production, which is regulated by Helios in committed Treg cells. CRISPR-Cas9 ablation of Helios in fetal naive T cells subsequently resulted in increased IL-2 production by fetal iTreg cells. Critically, the loss of Helios expression in fetal naive T cells impaired their subsequent differentiation into Treg cells upon TCR stimulation, reduced the ability of fetal iTreg cells to upregulate key genes with Treg suppressive function such as IL10, and resulted in the increased upregulation of pro-inflammatory genes including IFNG. Subsequently, we show that Helios knockout fetal iTreg cells produced less IL-10 and more IFN $\gamma$ . Taken together, our results indicate Helios as a critical contributor to the cellintrinsic predisposition of fetal naive T cells for Treg differentiation and function. The Tregbiased transcriptional and epigenetic programs within fetal naive T cells identified could enable selection of gene targets or epigenetic strategies to engineer enhanced iTreg populations from adult naive T cells for adoptive cellular therapies in inflammatory and autoimmune settings.

## POSTER 12

COMPUTATIONAL EXPLORATION OF PALLADIUM-CATALYSED  
 $\delta$ -SELECTIVE C(SP<sup>3</sup>)-H ARYLATION

Xinglong ZHANG, Prof. Dr. Robert S. Paton

Physical and Theoretical Chemistry Laboratory, University of Oxford, South Parks Rd, Oxford OX1 3QZ, UK

My current research focuses mainly on the application of quantum mechanical tools, as implemented in computational software, to study the chemical reactions and mechanism of organometallic catalysis such as palladium catalysed C–H activation. C–H bonds are ubiquitous in organic molecules. The direct functionalisation of C–H bonds in molecules presents many opportunities for organic synthesis and drug molecule derivatisations. Transition metals (TMs) can be employed to selectively functionalise C–H bond, allowing chemists convert small alkanes to higher valued, functionalised molecules or directly manipulating complex molecules with other functional groups present. The use of computational tools can greatly enhance the understanding of mechanisms involved in the chemical reaction, allowing us to better design catalysts and screen substrates in similar chemical systems.

Objectives of this research direction

The main objective for our research is to understand how organometallic catalysts work at the molecular scale. Due to the transient nature of the transition states (structures that chemical reactants have to pass through in order to go to products), experimental tools for their direct observations are limited. Experimental techniques such as linear free energy relationships (LFERs), kinetic isotope effects (KIEs) and spectroscopic characterisation of reactive intermediates provide only indirect evidence for the reaction mechanism. Computational studies provide a complementary understanding of the reaction mechanism by directly accessing putative transition structures involved in a reaction. An understanding of reaction mechanisms are crucial to better reaction designs.

Key findings/achievements in applicant's submission

Aliphatic amines and  $\alpha$ -amino acids ( $\alpha$ AAs) are ubiquitous structural motifs in biologically active molecules and pharmaceuticals. The functionalisation at  $\delta$ -C(sp<sup>3</sup>)-H positions of primary aliphatic amines including  $\alpha$ AAs are rare due to the required formation of a six-membered metallacycle intermediate which is kinetically less favoured than a five-membered metallacycle. Our experimental collaborators reported a directed  $\delta$ -C(sp<sup>3</sup>)-H of  $\alpha$ AAs and their amine analogues using a transient DG based on picolinic acid.

Density functional theory (DFT) calculations were performed to understand the mechanism of selective  $\delta$ -C(sp<sup>3</sup>)-H arylation of  $\alpha$ -amino acid and its aliphatic amine derivatives. Mechanistic insights point to a key carbopalladated intermediate that cycled through Pd(II)/Pd(IV) manifold. Our computational investigations on the reaction mechanisms of structurally varying substrates for  $\delta$ -arylation shed light on the origins of differences in the observed reactivity. Detailed steric and electronic factors influencing the performance of different directing groups were analysed, lending justifications to the experimentally observed yields for different directing groups.

POSTER 13

## COMMUNAL PAIRING IN SUPERCONDUCTORS

Darryl C.W. FOO<sup>1</sup> T.M. Whitehead<sup>1</sup> G.J. Conduit<sup>1</sup>

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### Research description and objectives

A Fermi gas with an attractive contact interaction forms a superconducting state whose underlying components are Cooper pairs, as described by Bardeen, Cooper and Schrieffer [1] in the spin-balanced case and by Fulde and Ferrell [2], and Larkin and Ovchinnikov [3], in the spin-imbalance case in what is now called FFLO theory. We propose a significant extension to FFLO theory by considering a superconducting state whose underlying components are superpositions of Cooper pairs that share minority-spin fermions, thereby including correlations between all available fermions, making it energetically favorable to the FFLO superconducting state. A key prediction of the new communal pairing theory is a nonzero superconducting gap at momenta beyond the optimal pairing momentum predicted in FFLO theory. We further supplement the analytical theory with numerical results obtained from ab initio Density Monte Carlo calculations.

### Key Findings:

We have successfully extended FFLO theory to consider non-exclusive pairing of fermions, and found that the optimal ratio of the number of up- and down-spin fermions in the superconducting instability is set by the ratio of the up- and down-spin density of states in momentum at the Fermi surfaces, to fully utilize the accessible fermions. A superconductor based not on pairs but larger correlated groups of particles represents a dramatic step forward in the field. The Density Monte Carlo calculations provide complementary evidence to our analytical findings and we observe evidence of an oscillating superconducting order parameter that is nonzero at a range of momenta.

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# KEYNOTE AND PANELLIST DIRECTORY

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GLOBAL SUMMIT**

AUGUST 2019

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# POSTER PRESENTER DIRECTORY

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AUGUST 2019

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