



16th International
Science Youth Forum

Science & Technology for Humanity: Building a Sustainable Future

8-12 Jan 2024

Organised by:



Supported by:



Ministry of Education
SINGAPORE

About ISYF



Our Goals:

Inspire Passion for Science Among Youth

ISYF aims to provide students who are highly inquisitive and passionate about the sciences with ample opportunities to share and discuss their interest in science, technology and research. They will be exposed to many fields of science which will broaden their outlook and understanding of the scientific world. Invited Nobel laureates and eminent scientists will inspire them through stories of their own life experiences and scientific discoveries. These interactions will help create greater awareness among the youth about the importance of broad-based knowledge, fuel their curiosity, engender relentless tenacity and a global outlook when considering the pursuit of science as a meaningful and fulfilling endeavour.

About ISYF

Establish Cooperation and Friendship Amongst Young Talented Science Students

Students will have many opportunities to interact in different cross-cultural groups and forge strong bonds with each other throughout the Forum. Activities are designed to promote mutual cooperation, understanding and appreciation of each other's diverse cultures while sharing a common passion in science, technology and research.

Build Capacities of Science Educators

Through professional sharing and discussions among science educators, ISYF helps build the competencies of teachers who are navigating an evolving educational landscape.

Theme

The theme “Science and Technology for Humanity: Building a Sustainable Future” highlights the important role of science and technology in driving sustainable and inclusive development. It reflects the need for a holistic approach to science and technology, considering their benefits for humanity and their accompanying ethical considerations in addressing societal challenges.

Responsible and ethical use of science and technology is essential to resolve pressing global challenges such as climate change, inequality and health disparities. At the same time, science and technology have the role of enhancing productivity in order to induce a dynamic transformation of the economy and increase growth rates. It is also important to consider the social, cultural, and ethical implications of scientific and technological advancements, and encourage discussions on how to mitigate potential negative impact and foster positive change through responsible innovation. The possibility of moving towards the free provision of technologies that contribute to meeting human challenges, making them accessible to all can be explored. In schools, the acquisition and dissemination of scientific knowledge, the building of innovation capabilities, and the push towards the collective goal of building a better world for future generations can be promoted. There is a pressing need for more conversations on the reform of policies and existing measures which can promote public interests in our pursuit of sustainability. If we are able to move forward and each adopt a more sustainable lifestyle, we definitely can make the change and create an impact in not just our own country, but the world.

Notes from Guest-of-Honour and Principal



**Professor Ng
Huck Hui**
**Assistant Chief
Executive, Research
and Talent
Development, A*STAR**

“The International Science Youth Forum is a vital platform for young researchers to be committed and act in realizing a world where innovation shapes a sustainable and thriving society.”



Mr Lee Peck Ping
**Principal
Hwa Chong Institution**

“The ISYF is a showcase of the delegates’ passion, intelligence, and creativity in kindling hope for a sustainable future, motivating them towards embracing fearless exploration and impactful innovation in science and technology.”

Message from Student Organisers



Dear Student Delegates and Educators,

Welcome to the 16th International Science Youth Forum (ISYF) @ Singapore, held from 8 to 12 January 2024!

ISYF provides a platform for student delegates from around the world to share their passion for science, technology and research whilst building long-lasting friendships. We hope that you will enjoy the lineup of activities meticulously planned by our Organising Committee!

The theme for this year's ISYF is: "Science and Technology for Humanity: Building a

Message from Student Organisers

Sustainable Future". In a world challenged by climate change and worsening disparities, mankind looks to the potential of science and technology in resolving pressing global issues. Through ISYF, we hope that delegates will consider the role of science and technology in driving sustainable and inclusive development, and be inspired to be the change they want to see.

The Organising Committee of ISYF 2024 looks forward to meeting you and we hope that you will have a fruitful time in Singapore!

Warmest regards,
Ling Jun Quan and Nguyen Chi Mai
Co-Chairpersons
ISYF 2024 Student Organising Committee

ISYF Programme

	Jan 7 SUN	Jan 8 MON	Jan 9 TUES
7 AM		School Assembly	
8 AM		Programme Briefing	
9 AM		Team Bonding Activities	Cultural Hour I 8 AM - 9 AM
10 AM		Singapore Discovery Trail 10 AM - 5 PM	Professor Sow's Lecture: Introduction to the Nanoworld @ National University of Singapore 10 AM - 12 PM
11 AM			Lunch at NUS
12 PM			
1 PM	ARRIVAL OF DELEGATES		
2 PM			Science Quest @ Science Centre Singapore 2 PM - 5 PM
3 PM			
4 PM			
5 PM			
6 PM		Dinner	Dinner
7 PM		Science Activity 7 PM - 8:30 PM	Cultural Hour II 7 PM - 9 PM
8 PM			
9 PM			

ISYF Programme

	Jan 10 WED	Jan 11 THURS	Jan 12 FRI
7 AM			
8 AM			
9 AM	Preparation for Masterclasses	Preparation for Masterclasses	Science Activity Solutions 8 AM - 10 AM
10 AM	Masterclasses I 9:30 AM - 11 AM	Masterclasses II 9:30 AM - 11 AM	
11 AM	Cultural Exhibition 11 AM - 12:30 PM	Lunch	
12 PM	Lunch		Closing Lunch & Farewell 12 AM - 3 PM
1 PM		ISYF Keynote Lecture 1 PM - 2:30 PM	
2 PM		Poster Exhibition 2:30 PM - 3:30 PM	
3 PM	Unlocking the Wonders Excursion @ Bird Paradise 2 PM - 5:30 PM		
4 PM			
5 PM			
6 PM	Dinner	Team Bonding Outing	
7 PM	Cultural Hour III 7 PM - 8 PM		GOODBYE! We hope you had a good time!
8 PM	Science Quest Reflections 8 PM - 9 PM		
9 PM			

Keynote Lecture Programme

1245h	Guests to be seated
1300h	Arrival of Guest-of-Honour, Professor Ng Huck Hui Welcome Address by Mr Ling Jun Quan, Co-Chairperson, Student Organising Committee
1305h	Address by Guest-of-Honour
1315h	Keynote Lecture by Professor Duncan Haldane
1400h	Q&A
1425h	Presentation of token of appreciation
1430h	End of Keynote Lecture
1435h	Reception and Poster Exhibition

Guest-of-Honour



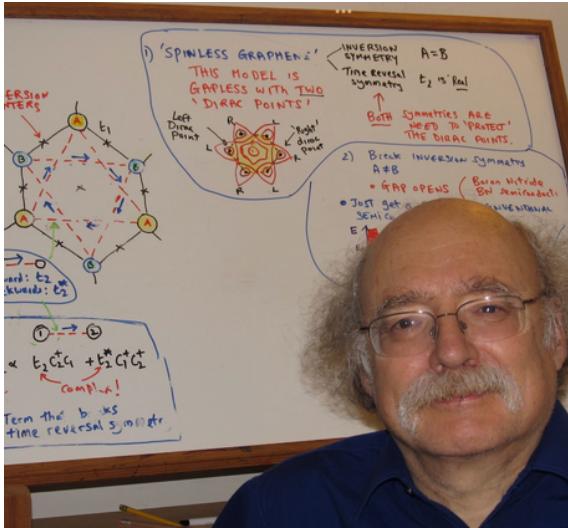
Professor Ng Huck Hui

**Assistant Chief
Executive, Research
and Talent
Development, A*STAR**

Professor Ng Huck Hui is the Assistant Chief Executive of Research and Talent Development (R&TD), under the Agency for Science, Technology and Research. Professor Ng helped to set up and implement several national funding initiatives such as the Singapore Food Story, Prenatal and Early Childhood for Human Potential and Nucleic Acids Therapeutics.

Professor Ng is active in research and sits on several boards such as Science Center Singapore and NUS High School, and R&D funding steering committees. In recognition of his scientific contributions, Professor Ng has received numerous local and international honours and awards.

Keynote Speaker



Professor Duncan Haldane

The Nobel Prize in
Physics 2016

Professor Duncan Haldane, who shared the 2016 Nobel Prize in Physics with David Thouless and Michael Kosterlitz, is the Sherman Fairchild University Professor of Physics at Princeton University, as well as a Fellow of the Royal Society of London, the U.S. National Academy of Sciences, and the Slovenian Academy of Sciences and Arts (as a Foreign Fellow). He was awarded a share of the Nobel Prize for his theoretical work on topological states of matter, including pioneering work on unexpected (and initially controversial) topological quantum states of one-dimensional systems of magnetic atoms (for which he had previously received the 1993 Oliver Buckley Prize of the American Physical Society), and on the theoretical prediction of topological insulators, for which he had shared the 2012 Dirac medal of the International Center for Theoretical Physics (Trieste) with Charles Kane and Shou-Cheng Zhang. He currently works on quantum geometry in the fractional quantum Hall effect.

Keynote Lecture Synopsis

Professor Haldane's lecture is entitled "Entanglement, Quantum Mechanics and Topology." Much recent work in quantum mechanics centers on understanding and using non-local "entanglement" to store and process information. In particular, "topological quantum states" of matter show the exciting possibilities that quantum mechanics permits, and which may be harnessed in future information-processing technologies.

Professor Haldane delivers his Keynote Lecture in ISYF 2024 courtesy of Global Young Scientists Summit 2024, organised by the National Research Foundation.

Masterclass Speakers



Professor Dame Sue Black

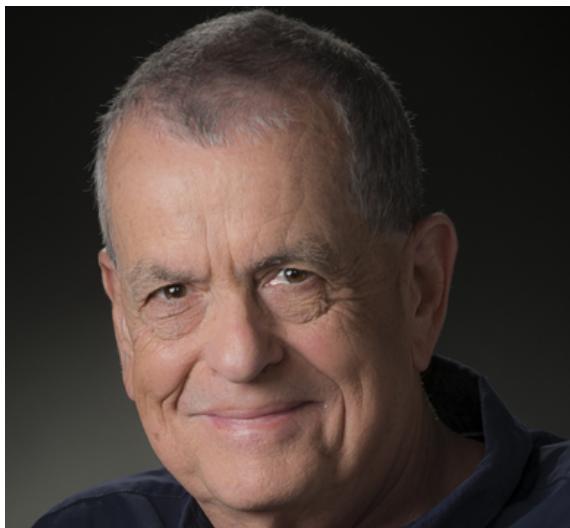
President, St John's
College, Oxford

Professor Dame Sue Black is President of St John's College, Oxford. She is a leading forensic anthropologist who has been involved in many mass fatality events and war crimes investigations.

In her masterclass, Professor Black will talk about the perception of forensic science that is portrayed in the media and how the reality is very different. This is an inter and multi disciplinary field that impacts on justice, freedom and societal health. When it goes wrong, such as miscarriages of justice, the impact is significant, sometimes at a global level.

Professor Black delivers her masterclass in ISYF 2024 courtesy of Global Young Scientists Summit 2024, organised by the National Research Foundation.

Masterclass Speakers



Professor Aaron Ciechanover

The Nobel Prize in
Chemistry 2004

Professor Ciechanover is a Distinguished Research Professor in the Faculty of Medicine at Technion-Israel Institute of Technology. He is a member of many scientific academies, including the Israel National Academy of Sciences and Humanities, European Molecular Biology Organisation, American Academy of Arts and Sciences (as a Foreign Fellow), Chinese Academy of Sciences (as a Foreign Member) and Pontifical Academy of Sciences at the Vatican. Apart from the Nobel Prize, his awards include the 2000 Albert Lasker Award, the 2002 EMET Prize, the 2003 Israel Prize for Biology and the 2006 Sir Hans Krebs Medal.

Professor Ciechanover's masterclass is entitled "The Revolution of Personalized Medicine: Are We Going to Cure all Diseases and at what Price?" Many important drugs such as penicillin and aspirin were discovered by serendipity. Other major drugs like the cholesterol-reducing statins were discovered using more advanced technologies, such as screening of large libraries of synthetic or natural compounds. In all these cases, the mechanism of action of the drug were largely unknown at the time of their discovery, and was

Masterclass Speakers

unraveled only later. With the realization that patients with similar diseases - breast or prostate cancer, for example, - respond differently to similar treatments and their disease course is vastly different, we have begun to understand that the molecular mechanistic base of what we assumed to be the same disease entity, are different. Thus, breast or prostate cancers appear to be subdivided to smaller distinct classes according to their molecular characteristics and the underlying mechanisms/mutations.

As a result, we are now exiting the era where treatment of many diseases is “one size fits all”. Instead, we are entering a new era of “personalized medicine”, where the treatment is tailored according to the patient’s molecular or mutational profile. Here, the understanding of the mechanism will drive the development of new drugs. This era will be characterized initially by the development of technologies to sequence individual genomes, transcriptomes, proteomes and metabolomes, followed by identification and characterization of new disease-specific molecular markers and drug targets, and by design of novel, mechanism-based drugs to these targets. The era will also be accompanied by complex bioethical problems, such as high pricing and limited accessibility of drugs to a large fraction of needy patients. The achievements of biomedical research also means that genetic information of large populations will become available, and protection of privacy will be an important, yet fragile issue. The introduction of gene editing technology to the armamentarium of novel therapeutic modalities, will add yet another layer of bioethical complexity to the one imposed by access to generic information and the ability to predict the future of health course of patients.

Professor Ciechanover delivers his masterclass in ISYF 2024 courtesy of Global Young Scientists Summit 2024, organised by the National Research Foundation.

Masterclass Speakers



Sir Tim Hunt

The Nobel Prize in
Physiology or Medicine
2001

In 1982, Sir Tim Hunt performed the experiment that led to the discovery of cyclins and subsequent research on the control of the cell cycle. In 1990, Tim joined ICRF (now The Francis Crick Institute) in London. He became a fellow of the Royal Society in 1991, a foreign associate of the US National Academy of Sciences in 1999 and shared the Nobel Prize in Physiology or Medicine with Lee Hartwell and Paul Nurse in 2001.

Sir Tim Hunt's masterclass is entitled "Ways to Succeed in Science." He grew up in Oxford wanting to be a scientist, loving gadgets and processes like melting lead pipes, or electrolyzing salt solutions to make poisonous and explosive gases. Luckily, he had excellent teachers who channeled these enthusiasms into a deeper and more formal understanding of chemistry and biology so that it was possible to study at Cambridge University and carry on there with a Ph.D. in biochemistry, on the business of the control of haemoglobin synthesis. He will explain how he arrived at this—it was an accident—and also where he pursued the subject. It took ten years, many interesting side roads, a lot of travel and a devastating fire to solve

Masterclass Speakers

the problem of how the synthesis of haem was coordinated with the synthesis of globin to make haemoglobin. Very recently, 50 years later, he realised that he and his colleagues may have slightly but significantly misunderstood this control... After that, it took another 7 years or so to find a really good new problem to work on, but on July 22nd 1982 he was teaching and researching at the Marine Biological Laboratory, Woods Hole, and was amazed to see a prominent newly-synthesized protein, later called cyclin, vanishing just before fertilized sea urchin eggs divided for the first (and every subsequent) time they divided. Finding out what this protein was, and what it did, took another six or seven years of very exciting work, leading away from the control of protein synthesis to the control of cell division. Yet amazingly, the underlying mechanisms were identical, involving protein kinases, which attach phosphate residues onto other proteins, thereby modifying their behavior. He has always liked biological switches and finding how they work.

Most recently, however, he has been drawn to the study of the enzymes that remove phosphates from proteins and their control, which turn out to be very important in the switches that initiate and terminate cell division. The path was marked by unexpected discoveries all along the way, almost always stemming from sensible experiments designed to test something different! He is not exactly sure what lessons should be drawn from all this, except to keep your eyes open for interesting, unexpected things and above all, just keep going.

Sir Tim Hunt delivers his masterclass in ISYF 2024 courtesy of Global Young Scientists Summit 2024, organised by the National Research Foundation.

Masterclass Speakers



Professor Takaaki Kajita

The Nobel Prize in
Physics 2015

Professor Takaaki Kajita is the Special University Professor at The University of Tokyo, and also the professor at the Institute for Cosmic Ray Research (ICRR) of The University of Tokyo.

In 2015 he shared the Nobel Prize in Physics for his role in discovering atmospheric neutrino oscillations. Currently, he is the project leader for KAGRA Project, aiming to explore the gravitational wave astronomy.

In his masterclass, Professor Kajita will talk about neutrinos, which are sub-atomic particles that are very difficult to observe. They have been assumed to have no mass. It was predicted that, if they have masses, they could change their type while they fly. These phenomena are called neutrino oscillations. Neutrino oscillations were discovered by deep underground neutrino experiments. He will discuss the discovery of neutrino oscillations, along with the implications of the discovery of the neutrino oscillations and the small neutrino masses.

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Professor Kajita delivers his masterclass in ISYF 2024 courtesy of Global Young Scientists Summit 2024, organised by the National Research Foundation.

Masterclass Speakers



Sir Richard Roberts

The Nobel Prize in
Physiology or Medicine
1993

Dr. Richard J. Roberts is the Chief Scientific Officer at New England Biolabs, Ipswich, Massachusetts. He received a Ph.D. in Organic Chemistry in 1968 from Sheffield University and then moved as a postdoctoral fellow to Harvard. He began work on the newly discovered Type II restriction enzymes in 1972 at Cold Spring Harbor Laboratory, with his laboratory discovering more than 70% of the first 100 enzymes described. His study of transcription in Adenovirus-2 led to the discovery of split genes and mRNA splicing in 1977, for which he received the Nobel Prize in Physiology or Medicine in 1993.

Since winning the Nobel Prize, Dr. Roberts has been involved in organizing a number of Nobel initiatives to correct scientific misunderstandings and promote humanitarian causes. His most recent campaign has been on the issue of GMOs, where 160 Nobel Laureates have supported the use of GMO techniques to improve plant breeding practices that could greatly help the developing world.

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Dr. Roberts masterclass is entitled “The Discovery of RNA Splicing.” He will be describing his personal path into science, how he became a molecular biologist and the work that led to the discovery of RNA splicing. It is a tale of a clever experiment that went wrong, but when he and his colleagues explored the reasons, he discovered that Nature was trying to tell them that their hypothesis about transcription and the production of mRNAs in eukaryotes was wrong. They had assumed that the process would be identical to that found in bacteria and bacteriophages. He will describe the initial experiment, which aimed to characterise a eukaryotic promoter and how its failure led them to spend more than a year trying to find out what had gone wrong and to explain the strange results they obtained during the post-mortem.

Sir Richard Roberts delivers his masterclass in ISYF 2024 courtesy of Global Young Scientists Summit 2024, organised by the National Research Foundation.

Masterclass Speakers



Dr Gregory Goh

Executive Director of
the National
Metrology Centre at
A*STAR.

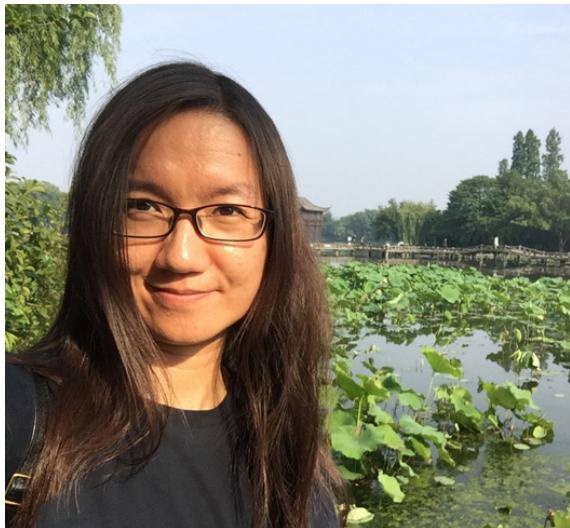
Dr Goh is the Executive Director of the National Metrology Centre at A*STAR. Before this appointment, he was Deputy Executive Director of the Institute of Materials Research and Engineering at A*STAR and had held appointments such as Director of the Strategic Research Office and also Head of the Ceramics Materials department. Prof. Goh is the Covering Focal Point for the Sub Committee on Materials Science and Technology that is part of the ASEAN Committee on Science, Technology and Innovation. He has also held an adjunct position in the Materials Science and Engineering department at the Nanyang Technological University since 2005.

Dr Goh's masterclass is entitled ““From Materials to Metrology”. From the Bronze Age to the Iron Age to the Silicon Age, the progress of civilization has been described in terms of materials. Indeed, materials, and the processes needed to fashion them into useful devices and applications, are often the basis of innovations. Another important aspect in the progress of civilization, specifically trade, is

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metrology – the science of measurement. Metrology facilitates trade by providing a set of globally agreed measurement units that the manufacture of goods and the provision of services can be based on. This lecture will discuss examples of how materials and metrology from the author's own experience can be used to develop and support a sustainable society by increasing productivity, improving accuracy and reducing energy use.

Masterclass Speakers



Associate Professor Huang Shao Ying

Singapore University of
Technology & Design

Dr Huang Shao Ying is an Associate Professor in the pillar of Engineering Product Development, Singapore University of Technology and Design. She received her B.Eng., M. Eng., and Ph.D. degree from Nanyang Technological University, Singapore in 2003, 2006, and 2011, respectively. Her research interests include low-field portable MRI (magnets and coils), non-linear MRI image reconstructions, RF aspects of MRI, MR electrical property tomography, radiofrequency (RF) / microwave noninvasive / contactless sensing, wireless power transfer, and wideband RF/microwave components. She owns 10 patents and 6 technology disclosures. She has authored and coauthored more than 60 papers in refereed journals, 1 book chapter, and more than 200 international conference papers.

Dr Huang's masterclass is entitled "Sustainability & Inclusiveness from the perspective of medical imaging." Medical imaging is critical for diagnosis and treatments in model medical care. Among medical imaging modalities, magnet resonance imaging (MRI) is safe and shows the best soft tissue contrast. In recent years, there has been a

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strong driving force to push medical imaging devices towards sustainability and democratization. It is extremely important to MRI which has been high-maintenance exclusive for developed countries/regions. This talk will detail the recent developments of MRI for a sustainable and inclusive world, the contribution from Singapore in this direction, and Dr Huang's experience with the work on this topic.

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Dr Lee Hwee Kuan

Head of the Imaging Informatics Division,
A*STAR

Dr. Lee Hwee Kuan earned his Ph.D. from Carnegie Mellon University in Pittsburgh, PA, USA, in theoretical physics. Currently, he serves as the Head of the Imaging Informatics Division as well as the Deputy Director for Training and Talent development at the Bioinformatics Institute, A*STAR in Singapore. Dr. Lee's expertise lies in the development and deployment of machine learning and deep learning algorithms.

At present, Dr. Lee Hwee Kuan leads a laboratory dedicated to the advancement of Artificial Intelligence (AI) research for clinical and biological purposes. Beyond his role at the Bioinformatics Institute, Dr. Lee holds significant appointments in various local universities and research institutions.

Dr Lee's masterclass is entitled "The use of Artificial Intelligence to make healthcare more sustainable." Ageing and growing population worldwide is putting a strain on earth's natural resources. The phenomenon of an ageing population is not restricted to only a few countries in the world. For example, China being the world's second

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most populated country, is experiencing an ageing population. On the other hand, new technologies have always been incorporated into the healthcare system to help to manage resources. In recent years, a lot of attention has been put into Artificial Intelligence (AI) technologies to make a more sustainable future for humankind. This seminar will outline some niche areas of application of Artificial Intelligence in healthcare, focusing only on a few niche areas of research such as cancers, heart disease and drug discovery.

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Associate Professor Sierin Lim

Nanyang Technological
University, Singapore

Dr Sierin Lim is an Associate Professor of Bioengineering at the School of Chemistry, Chemical Engineering and Biotechnology at Nanyang Technological University, Singapore (NTU). Her research group focuses on the design and engineering of hybrid nano/microscale biodevices using proteins for applications in health and the environment.

She is currently serving as the Associate Dean of Global Partnerships at the NTU Graduate College. She earned her B.S. in Chemical Engineering and Ph.D. in Biomedical Engineering from University of California Los Angeles (UCLA).

A/Prof Lim's masterclass is entitled "The Role of Biotechnology in Building a Sustainable Future." She will be talking about her journey to becoming a scientist in bioengineering, as well as how her

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research topic, plastic wastes, has evolved in the past 16 years. After explaining the background and problem of plastic wastes, she will propose a solution using her educational background of bioengineering. Additionally, she will share interdisciplinary approaches, such as sustainability and biotechnology, to solve global problems, while reiterating the importance of collaboration and teamwork in these approaches.

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Professor Bin Liu

Tan Chin Tuan
Centennial Professor,
National University of
Singapore

Professor Bin Liu is Tan Chin Tuan Centennial Professor and Deputy Provost (Research and Technology) at the National University of Singapore (NUS). She is a leader in the field of organic functional materials, and has been well-recognized for her contributions to polymer chemistry and organic nanomaterials for energy and biomedical applications. She is named among the World's Most Influential Scientific Minds and the Top 1% Highly Cited Researchers by Clarivate since 2014.

Bin has received many awards, including the National Science and Technology Young Scientist Award (2008), the President's Technology Award (2016), the American Chemical Society ACS Nano Lectureship Award (2019), the Royal Society of Chemistry's Centenary Prize (2021), Kabiller's Young Investigator Award (2021) and the IUPAC Distinguished Women in Chemistry or Chemical Engineer Award (2023).

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Professor Bin's masterclass is entitled "Aggregation-Induced Emission: Materials and Biomedical Applications." Recent years have witnessed the fast growth of fluorogens with aggregation-induced emission characteristics (AIEgens) in biomedical research. The weak emission of AIEgens as molecular species and their bright luminescence as nanoscopic aggregates distinguish them from conventional organic luminophores and inorganic nanoparticles, making them wonderful candidates for many high-tech applications. In this talk, she summarises her recent AIE work in the development of new fluorescent bioprobes for biosensing and imaging. The AIE dot probes with different formulations and surface functionalities show advanced features over quantum dots and small molecule dyes in noninvasive cancer cell detection, long-term cell tracing, and vascular imaging. In addition, her recent discovery that AIEgens with high brightness and efficient reactive oxygen species generation in the aggregate state further expanded their applications to image-guided cancer surgery and therapy. By combining the accurate prediction of material performance via first-principle calculations and Bayesian optimization-based active learning, a self-improving discovery system was realized for high-performance photosensitizers, which significantly accelerated materials innovation for biomedical research.

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Associate Professor Soo Han Sen

Nanyang Technological
University, Singapore

Dr. Soo Han Sen is an Associate Professor at the School of Chemistry, Chemical Engineering and Biotechnology in Nanyang Technological University (NTU) Singapore. He graduated from MIT with Bachelor's and Master's degrees and completed his Ph.D. work at U.C. Berkeley. Subsequently, he joined the Lawrence Berkeley National Laboratory as a postdoctoral fellow, working on materials and nanotechnology for artificial photosynthesis.

Dr Soo's masterclass is entitled "Sustainable & Green Technological Solutions for Global Climate Change & Plastics Pollution." In this presentation, he will talk about his journey from participating in the Science Mentorship Programme and the Science Research Programme in Singapore to going overseas for his studies before returning to Nanyang Technological University, Singapore to start mentoring students. He will share on how he arrived at a research programme focussing on finding ways to use solar and other forms of renewable energy to produce chemical feedstocks and fuels, also

Masterclass Speakers

known as artificial photosynthesis. In particular, he will discuss his team's latest research efforts in developing sustainable chemical technologies to address global climate change and plastics pollution concurrently. His team worked on developing catalytic processes to upcycle materials often considered as "waste", such as non-food biomass and plastics, into more valuable chemical feedstocks. His team first discovered some vanadium photocatalysts that could selectively cleave the carbon-carbon bonds in non-food biomass materials called lignin at room temperature and pressure without requiring additional applied heat. His team then used the same photocatalysts for the carbon-carbon bond cleavage and transformation of unactivated, commercially sourced alcohols and bioactive organic molecules into value-added products. Most recently, his team extended their technology to upcycle almost all plastics, including polyethylene, polypropylene, polystyrene, polyvinyl chloride, and even multi-layered packaging materials into carboxylic acid platform chemicals at ambient temperatures and pressures. He will conclude by describing an ongoing effort called Sustainable Plastics RepUposing for a Circular Economy (SPRUCE), which is a collaboration with Prof. Simba Chang from the Nanyang Business School and Prof. Saidul Islam from the School of Social Sciences.

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Professor Tang Kok Zuea

College of Design &
Engineering, National
University of Singapore

Professor Tang Kok Zuea is presently a senior lecturer in the Innovation and Design Programme (iDP), College of Design and Engineering, National University of Singapore since 2010. He received his Bachelor of Electrical Engineering (1998), Masters in Electrical and Computer Engineering (2000) and Doctor of Philosophy in Electrical and Computer Engineering (2005) from the National University of Singapore.

Prof Tang's masterclass is entitled "User-Centred Collaborative Design for a Sustainable Future". Desirability, Feasibility and Viability are the ingredients of successful innovation. Desirability pertains to how users want a solution to address their needs. Feasibility pertains to how a solution can be produced. Viability pertains to how a solution can be sustained.

This masterclass will focus on Desirability, although it does not mean that we will be content with solutions that are clearly not feasible (e.g., time machine) or viable (e.g., handing money out to people).

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How to design sustainable solutions that are desired by users? Assuming that our solution is feasible and viable, is it desired by users? Will users stand in line to get hold of the solution that has been designed?

In design, studies have demonstrated the importance of framing a problem. As a project is evolving, so is the designers' understanding about the project and the way the problem is framed. This course teaches students about framing (and reframing, when necessary) design problems. If a problem is well-framed, the solution will be well-designed, considering the 3 aspects of Desirability, Feasibility and Viability.

Masterclass Speakers



Professor Wu Wei

Nanyang Technological University, Singapore

Professor Wu Wei received his PhD degree at Swiss Federal Institute of Technology in Lausanne (EPFL), Switzerland. He is currently an Associate Professor at Nanyang Technological University (NTU), Singapore, and serves as the Honorary Secretary of Society for Rock Mechanics & Engineering Geology (SRMEG), the Associate Editor for International Journal of Rock Mechanics and Mining Sciences, and the Assistant Chair for Research in School of Civil and Environmental Engineering (CEE) at NTU.

Prof Wu's research focuses on experimental geophysics and energy geomechanics. He has received numerous awards, such as NTU CEE Research Award in 2023, SRMEG Outstanding Paper Award in 2017, and Swiss Perspective Researcher Fellowship in 2013.

In his masterclass, Professor Wu Wei will be talking about his learning journey, and his research work related to underground space development in Singapore. He will also discuss geo-energy extraction and storage in Singapore.

Guest Lecturer



Professor Sow Chorng Haur

Vice Dean of the Faculty
of Science

Professor Sow Chorng Haur received his Bachelor of Science Degree (1st Class) in Physics from the National University of Singapore (NUS) in 1991. He received his Master of Science degree in Physics after spending two more years in NUS for research. Prof Sow then completed his PhD degree in the University of Chicago in 1998. For the next two years, he worked as a postdoctoral fellow at Bell Laboratory, Lucent Technologies. He then returned and joined the Department of Physics, NUS in 2001. He is now the Vice Dean (Outreach and Admissions) of the Faculty of Science and the Vice President of the Singapore National Academy of Science.

Professor Sow's lecture is entitled "Introduction to the Nanoworld!" Nanoscience is an exciting area of science that studies the world with objects that have very small dimension. All sort of scientists (physicist, chemist, biologist, material scientist, engineer etc.) are studying very very very very small thing in order to better understand the nanoworld. They want to manipulate and understand matter at molecular level, to create artificial structures. This is because

Guest Lecturer

structures exhibit novel and very much improved mechanical, chemical, electrical, optical and biological properties, due entirely to their nanoscopic size. Whenever scientists and engineers push their understanding and control over matter to finer scales (nanoscale regime), they invariably discover qualitatively new phenomena and invent qualitatively new technologies. The aim of this presentation is to give the audience an appreciation of the nanosized regime and scientists' fascination in the field of Nanoscience and Nanotechnology. The talk aims to address the following questions: (a) What is nanoscale? Why Nanoscience? (b) What are some applications of Nanotechnology? (c) How do you manipulate nanoscale objects? (d) How do you make structures out of nanomaterials? The talk shall be presented with the help of a number of fun-filled demonstrations aiming to illustrate the concepts discussed.

About HCI



Hwa Chong Institution (HCI) is one of Singapore's independent school with a rich history of over 100 years. The Institution is the culmination of the watershed merger in 2005 between the former Chinese High School (TCHS) and Hwa Chong Junior College (HCJC).

Offering a seamless and broad-based six-year Integrated Programme (IP), Hwa Chong caters to the needs of the top students from Singapore and the region. The strength of Hwa Chong's IP is in our ability to combine academic excellence with a range of learning opportunities beyond the classroom.

Hwa Chong is more than a school that produces scholars and world champions. We strive to empower our high-ability students to achieve their potential and live their aspirations, while embracing the values of passion, innovation, integrity, empathy and responsibility.

Overseas Participating Schools



**Ministry of
Education, Brunei
Darussalam**
Brunei



**The Angkor
Intellectual Academy**
Cambodia



**New Generation School
Preah Sisowath High
School**
Cambodia



HSAS
THE HIGH SCHOOL
AFFILIATED TO SUSTECH

**The High School
Affiliated to SUSTech**
Mainland China



**Diocesan Girls'
School**
Hong Kong



**SMA Negeri 4
Denpasar High
School**
Indonesia



SANTA LAURENSIA
Alam Sutera

**SMA Santa Laurensia
Alam Sutera**
Indonesia



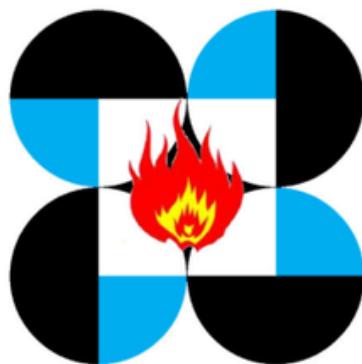
**Chung Ling High School
Penang**
Malaysia



**Toyama Prefectural
Toyama Chubu Senior
High School**
Japan



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Alam Shah**
Malaysia



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School Main Campus**
Philippines



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Singapore



**CHIJ Saint
Theresa Convent**
Singapore



**Clementi Town
Secondary School**
Singapore



Crescent Girls'
School
Singapore



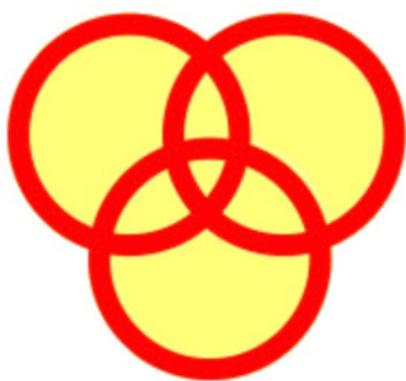
Dunman High
School
Singapore



Hwa Chong
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Singapore



Methodist Girls'
School
Singapore



Nan Chiau High
School
Singapore



Nanyang Girl's
High
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Singapore



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Founded 1842

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