NATIONAL RESEARCH FOUNDATION
PRIME MINISTER'S OFFICE
SINGAPORE

GYSS@one-north
GLOBALYOUNGSCIENTISTSSUMMIT
SINGAPORE 2015

Press Release

Friday, 23 January 2015

Singapore launches National Science Experiment, "Step Out for Science", involving more than 250,000 students, to explore sensing and Big Data technologies

1.   The third Global Young Scientists Summit 2015 was officially closed by President Tony Tan Keng Yam, the Patron of GYSS today.

2.   In his Closing Speech, President Tony Tan said Singapore would continue to build up its competitive advantages in science and technology, and leverage R&D to support its future economic growth and build a resilient nation.

3.   During the final day of GYSS, the research proposal by Dr Luca Giancardo, to develop the neuroQWERTY software system which measures with millisecond precision the "press and release" of one's finger on a keypad on laptops, mobile phones and tablets when the subject is typing, was judged the best research idea out of 9 final submissions. Dr Giancardo proposes to study individuals at high risk of Parkinson's disease to detect subtle motor decline correlated to the disease. Dr Giancardo, who is a post-doctoral research fellow at the Massachusetts Institute of Technology, was awarded the Singapore Challenge 2015 prize by President Tony Tan.

4.   As part of efforts to engage Singaporeans in science and technology, President Tan announced a National Science Experiment, "**Step Out for Science**", involving more than 250,000 students, to explore sensing and Big Data technologies. President Tan said that the outcomes from the National Science Experiment would also support Singapore's research programmes such as "Land & Liveability National Innovation Challenge" and the "Virtual Singapore" project, as well as the "Smart Nation" initiative.

5.   Noting the success of the GYSS platform, President Tan announced that GYSS would continue to be organised for the next five years.

6.   Twenty distinguished speakers - 12 Nobel Laureates, 4 Turing Awardees, 2 Fields Medallists, 2 Millennium Technology Prize Winners and nearly 300 young scientists participated in the five-day event.

7.   For more formation on the GYSS, Singapore Challenge award and Speakers, please visit http://www.nrf.gov.sg/gyss@one-north-2015.

Encls:

Annex A: Singapore Challenge 2015 Factsheet
Annex B: Singapore Challenge 2015 Final Judging Panel
Annex C: Abstracts of Singapore Challenge 2015 Proposals
Annex D: Singapore's National Science Experiment Factsheet
Annex E: GYSS 2015 Factsheet
Annex F: GYSS 2015 Participation Statistics

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National Research Foundation, Prime Minister's Office, Singapore
The National Research Foundation (NRF), set up on 1 January 2006, is a department within the 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. It also funds strategic initiatives and builds up R&D capabilities by nurturing research talent. The NRF aims to transform Singapore into a vibrant R&D hub that contributes towards a knowledge-intensive, innovative and entrepreneurial economy; and make Singapore a talent magnet for scientific and innovation excellence. For more information, please visit www.research.gov.sg

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SINGAPORE CHALLENGE FACTSHEET

A special feature of GYSS is the Singapore (SG) Challenge. It offers a platform for GYSS participants to present their research ideas and solutions to address challenges faced by global cities. This year, SG Challenge 2015 partners the Ministry of Health in the theme of "Ageing-in-Place". A total of 55 proposals had been submitted by the young scientists and nine projects have been chosen. The shortlisted participants will make their final pitches on the final day of the Summit.

The SG Challenge Medallion and a cash prize will be awarded to the most compelling idea. The prize recipient is encouraged to use the prize money to further develop the proposed idea, in partnership with an appropriate Singapore public agency or government-funded research institute/laboratory.

The partner agency for SG Challenge 2015 is the Ministry of Health.

The SG Challenge Final Presentation will take place on Friday, 23 January 2015, 2.00pm – 3.00pm at the NTU Nanyang Auditorium. There will be a poster exhibition showcasing the finalists' proposals outside the auditorium.

The announcement of SG Challenge 2015 winner and GYSS 2015 Closing Ceremony will take place from 4.00pm – 5.00pm at the same venue. The guest-of-honour for the ceremony will be President Tony Tan Keng Yam.

For more information on the SG Challenge, please visit: http://www.nrf.gov.sg/gyss@one-north-2015/singapore-challenge/about-singapore-challenge

SG CHALLENGE 2015 FINAL JUDGING PANEL

Name	Designation/Organisation
Prof Edward Holmes	Adviser, NRF Singapore (Chair)
Ms Teoh Zsin Woon	Deputy Secretary (Development), Ministry of Health
Prof Lim Hock	Director (Research Governance and Enablement) Office of the Deputy President (Research and Technology), National University of Singapore
Sir Timothy Hunt	Nobel Prize in Physiology or Medicine (2001)
Prof Michael Grätzel	Millennium Technology Prize (2010)
Prof Aaron Ciechanover	Nobel Prize in Chemistry (2004)
Prof Ivy Ng	Group Chief Executive Officer, Singapore Health Services (SingHealth)

LIST OF SG CHALLENGE 2015 FINALISTS

S/N	Name/Designation/Organisation	Proposal Title
1	Dr Charmayne Mary Lee HUGHES Robotics Research Centre Department of Mechanical and Aerospace Engineering Nanyang Technological University, Singapore	The Development and Evaluation of a Robotic Upper Extremity Proprioceptive Assessment and Training System
2	Mr Christopher Moufawad EL ACHKAR Laboratory of Movement Analysis and Measurement École Polytechnique Fédérale de Lausanne, Switzerland	Smart Shoes to Promote Active Ageing [A prototype will be showcased during the final presentation and poster exhibition.]
3	Dr Luca GIANCARDO Research Fellow Massachusetts Institute of Technology, USA	NeuroQWERTY: Early Detection of Abnormal Motor Decline
4	Dr YUN Hae Young SUTD-MIT postdoctoral fellow in Architecture and Sustainable Design Singapore University of Technology and Design (SUTD), Singapore	Toward Ageing in Place in Barrier-Free Environments [A prototype will be showcased during the final presentation and poster exhibition.]
5	Dr James Paul ARMSTRONG University of Bristol, UK	The EnableT: Empowering the Older Generation
6	Mr LEUNG Hong Hang Department of Chemical and Biomolecular Engineering Hong Kong University of Science and Technology, Hong Kong SAR	Antimicrobial Coating for a Healthier Environment

S/N	Name/Designation/Organisation	Proposal Title
7	Mr ZHOU Ke MD-PhD candidate Health Service and Systems Research programme Duke-NUS Graduate Medical School, Singapore	Developing Cost-Effective Strategies to Help Hospital-Dependent Elderly Age in Place
8	Dr YU Han Research fellow Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly (LILY) Nanyang Technological University, Singapore	A Smart and Caring Interactive Technology Framework for Ageing-in-Place
9	Dr WANG Di Research fellow Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly (LILY) Nanyang Technological University, Singapore	eHealthPortal: A Social Support Hub for the Active Living of the Elderly [A prototype will be showcased during the final presentation and poster exhibition.]

ABSTRACTS OF THE SG CHALLENGE 2015 FINALISTS' PROPOSALS

Dr Charmayne Mary Lee HUGHES

Robotics Research Centre
Department of Mechanical and Aerospace Engineering
Nanyang Technological University, Singapore

Proposal Title: The Development and Evaluation of a Robotic Upper Extremity Proprioceptive Assessment and Training System

As our bodies age, neurodegenerative diseases or strokes can result in poor motor function, leading to falls and other injuries. Although research shows that training can help elderly individuals significantly improve their motor control, not all will have the means to benefit from the services of trained physiotherapists. Furthermore, there are no standardised means of assessing the degree of motor control an individual has, thus hampering the evaluation of rehabilitative programmes.

Charmayne Hughes proposes a robotic system that can both assess and train upper body motor function in elderly individuals. She is developing a customisable and inexpensive robotic rehabilitation device, known as "H-Man", to obtain objective measures of the motor abilities of the elbow and wrist joints. A simple comparison of an individual's motor abilities against a database of measurements from healthy young volunteers would provide a standardised method of evaluation.

Hughes also proposes to use "H-Man" as part of a multi-modal rehabilitative programme for the elderly. The robotic system is expected to help elderly users maintain motor function in the comfort of their own homes or at decentralised medical facilities, thereby alleviating the burden on therapists and healthcare systems.

The participant is currently a senior research fellow at the Nanyang Technological University Department of Mechanical and Aerospace Engineering. She is the project leader and manager of the "H-Man" project, which is conducted in collaboration with the Centre for Advanced Rehabilitation Therapy at Tan Tock Seng Hospital.

Mr Christopher Moufawad EL ACHKAR

Laboratory of Movement Analysis and Measurement
École Polytechnique Fédérale de Lausanne, Switzerland

Proposal Title: Smart Shoes to Promote Active Ageing

In otherwise healthy adults above the age of 65, as many as 40 per cent experience a fall every year, with the likelihood of falling increasing with age. The fear of falling leads many elderly people or their caregivers to restrict the amount of physical activity that the elderly engage in. However, reduced physical activity can result in a poorer quality of life and is associated with a greater risk of conditions such as cardiovascular disease, diabetes and osteoporosis.

Seeking to monitor and encourage physical activity in the elderly, Christopher Moufawad el Achkar proposes a wearable device equipped with movement and pressure sensors. By miniaturising existing technology, he hopes to design a shoe insole that will unobtrusively track the daily-life physical activities of the elderly user.

Data collected by the device can then be used to provide tailored and prompt feedback to the elderly user and inform caregivers of the onset of frailty. The smart shoes could also be integrated into a telehealth system. For example, if a person has stayed indoors for a couple of days, a friendly persuasive message can be sent to encourage the user to go out and meet up with a friend, or simply have a walk outside.

Moufawad El Achkar is currently a PhD student at EPFL, Switzerland, in the Laboratory of Movement Analysis and Measurement. He holds an MSc in Biomedical Engineering from the University of Oxford and the Bachelor of Engineering in mechanical engineering from the American University of Beirut.

Dr Luca GIANCARDO

Research Fellow
Massachusetts Institute of Technology, USA

Proposal Title: NeuroQWERTY: Early Detection of Abnormal Motor Decline

Parkinson's disease (PD), the second most frequent neurodegenerative disorder in the world, is clinically diagnosed many years after disease onset, when almost 50 per cent of dopaminergic neurons die. But subtle motor signs of PD, such as tremor and rigidity, are known to happen up to a decade before clinical diagnosis.

Luca Giancardo aims to identify the motor signature of at-risk individuals by studying their typing behaviour on laptops, mobile phones and tablets. He has developed the neuroQWERTY software system which uses algorithm to measure with millisecond precision the key press and release when the subject is typing.

In pilot studies, his team detected the motor signature of early PD patients by analysing 15 minutes of non-privacy sensitive typing behaviour. He proposes to study individuals at high risk of PD to detect subtle motor decline correlated to disease. Eventually, he hopes to conduct a mass screening of the general population.

Giancardo believes that the neuroQWERTY system is a good fit especially in Singapore, where an estimated 51 per cent of all adults between 50 and 59 years access the Internet at least once a week. The system can be used at home, allowing for high compliance and monitoring of longitudinal change.

Giancardo is a post-doctoral research fellow at the Massachusetts Institute of Technology, USA. In 2014, he was granted a provisional patent on the neuroQWERTY technology comprising an algorithm of he was a key contributor to. His group has conducted two pilot studies on how key-press evaluation could be used to detect neurological dysfunction.

Dr YUN Hae Young

SUTD-MIT postdoctoral fellow in Architecture and Sustainable Design
Singapore University of Technology and Design (SUTD), Singapore

Proposal Title: Toward Ageing in Place in Barrier-Free Environments

For most elderly people in Singapore, going out of the home for exercise, shopping or socialising involves walking and taking public transportation. However, the environment outside the home presents challenges for those with visual impairment or physical disabilities.

Yun Hae Young wants to identify some of the most common barriers in the urban environment and what could be done to address them. To answer these questions, she proposes to first recruit older adults and track their activities using motion capture cameras equipped with global position system (GPS). She intends to carry out interviews with elderly volunteers to assess the demographic characteristics, commonly reported barriers and quality of life of this cohort.

The information gathered from her studies will then inform the development of a smart watch mobility helper. The smart watch will incorporate functions such as GPS, a motion picture camera, a barrier detector and a signage translator to enhance safety and the out-of-home mobility of older adults. It will also help urban designers and policy makers make urban environments more pedestrian-friendly and make transportation more accessible for the elderly.

Yun is presently a SUTD-MIT postdoctoral fellow at the Singapore University of Technology and Design (SUTD). Her research interests include the relationship between quality of life and walking behaviours of older adults in neighborhood environments.

Dr James Paul ARMSTRONG

University of Bristol, UK

Proposal Title: The EnableT: Empowering the Older Generation

The loss of mobility and cognitive function can make elderly people feel trapped within their own homes and disconnected from their local community. In extreme cases, this sense of social isolation can lead to depression and a further decline in health. Connecting the elderly with each other and their wider community through online social networks is one way to overcome this problem. However, hindered by a lack of access and familiarity with technology, not many elderly people make use of existing social networks.

James Armstrong proposes the development of a low-cost and easy-to-use tablet to give the elderly an avenue to remain connected to the people around them. Called EnableT, the tablet will incorporate features such as social networking, multimedia entertainment and local activities - all aimed at giving users a sense of empowerment and purpose.

EnableT could also be used to track daily activities and monitor compliance with medication schedules, a feature which could be particularly useful for those with declining memory abilities. The tablet could also collect information and wirelessly transmit it to medical professionals, helping users to lead healthier lives while reducing the strain on the healthcare system.

Coming from a background in stem cell therapies and tissue engineering, Armstrong seeks to diversify his research into the field of smart devices, sensors and theranostics. He completed his PhD in functional nanomaterials and tissue engineering at the University of Bristol after his Masters in Chemistry with professional experience at the University of Warwick.

Mr LEUNG Hong Hang

Department of Chemical and Biomolecular Engineering
Hong Kong University of Science and Technology, Hong Kong SAR

## Proposal Title: Antimicrobial Coating for a Healthier Environment

Infectious diseases are a major cause of hospitalisation in the elderly. Drug resistant microbes such as methicillin-resistant *Staphylococcus aureus* (MRSA) that are a leading cause of hospital-acquired infection are now also found in the community, putting the elderly at increased risk.

At present, infection control methods include bleach, ethanol or simply soap and water. While these methods are effective, they do not have a residual cleaning effect and therefore require constant re-cleaning. To fill the gaps between each cleaning episode, Leung Hong Hang proposes the development of an antimicrobial coating.

In preliminary studies, Leung has developed a method to encapsulate a broad-spectrum disinfectant that slowly releases the disinfectant over five days. He found that this antimicrobial coating could reduce up to 99 per cent of *S. aureus* on the surface of test plastics after ten minutes of physical contact. Furthermore, initial studies show that the coating is non-allergenic and does not cause inflammation upon inhalation.

Leung is currently testing different combinations of disinfectants in order to both lower the dose and broaden the range of antimicrobial capabilities of the coating. He foresees that the coating could help reduce the frequency of cleaning and lower the rate of infections among the elderly.

A PhD student at the Hong Kong University of Science and Technology, Leung is currently working with colleagues at the Centre for Health Protection in Hong Kong, Queen Elizabeth Hospital, Princess Margaret Hospital, Tuen Mun Hospital and elderly homes to field test the antimicrobial coating in clinically-relevant settings.
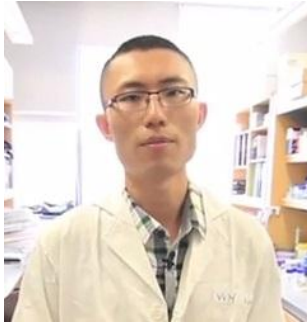
Mr ZHOU Ke

MD-PhD candidate
Health Service and Systems Research Programme
Duke-NUS Graduate Medical School, Singapore

Proposal Title: Developing Cost-Effective Strategies to Help Hospital-Dependent Elderly Age in Place

Around 30 per cent of patients in local hospitals are admitted for conditions that do not require inpatient care. Most of these patients are there for social issues, such as the lack of a primary caregiver at home, while others are admitted for recurring conditions. Collectively, these are known as hospital-dependent patients and they tend to be above 65 years old. From a clinical perspective, these hospitalisations are potentially avoidable, but it is unclear why intervention programmes fail.

Zhou Ke, a MD-PhD candidate at Duke-NUS Graduate Medical School, wants to better understand the barriers faced by hospital-dependent individuals to ageing in place by reviewing case notes, organising focused-group interviews and fielding questionnaires. Using econometric modelling, he will identify the relative importance of each risk factor and how they interact with each other.

Zhou will then propose an economically sustainable strategy to help hospital-dependent individuals age in place, using system dynamics modelling techniques and two Singapore healthcare system models established at Duke-NUS.

As part of his MD-PhD studies, Zhou is already collaborating with the geriatrics department at Khoo Teck Puat Hospital to retrospectively study the prevalence and predictors of "avoidable" hospitalisation. He is also collaborating with doctors at the Singapore General Hospital to examine the impact of bed crunch on patient outcomes.

Dr YU Han

Research fellow
Joint NTU-UBC Research Centre of Excellence in Active Living
for the Elderly (LILY)
Nanyang Technological University, Singapore

Proposal Title: A Smart and Caring Interactive Technology Framework for Ageing-in-Place

In Singapore, four out of five seniors above the age of 65 are healthy enough to perform daily activities with no assistance. In addition, the proportion of seniors with a university degree will increase from 4.8 per cent in 2010 to 15.4 per cent in 2030, representing an untapped resource to society.

Dr Yu Han proposes a new framework, called Smart and Caring Interactive Technology (SCIT), to empower senior citizens to age gracefully. The first aspect of SCIT uses personalised sensing to continuously monitor the elderly person in his/her home environment. In one example, pressure sensors can be embedded into personal items such as slippers to unobtrusively monitor movement.

Second, SCIT will anticipate an elderly user's emotional state in real time and generate data-driven stories based on changes in user's behavior patterns to help the caregiver better understand the situation and follow up. This type of research is called affective computing, where machines interpret human emotion and adapt their behaviour accordingly.

Finally, SCIT will empower the elderly to continue contributing to the society. Using a crowd sourcing platform he has already built, Yu wants to help volunteer organisations reach out to seniors and match them with activities they enjoy. A mobile app will help them manage their activities, and even provide a reward system as a further motivation.

Yu is a post-doctoral research fellow at the Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly (LILY) at the Nanyang Technological University, Singapore. His research is inter-disciplinary, spanning software engineering to cognitive sensor networks and interactive virtual learning environments.

Dr WANG Di

Research fellow
Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly (LILY)
Nanyang Technological University, Singapore

Proposal Title: eHealthPortal: A Social Support Hub for the Active Living of the Elderly

Statistics from the Ministry of Social and Family Development in 2009 showed that around one third of the seniors in Singapore are socially isolated. This group faces challenges in four major aspects of life: physical, cognitive, emotional and social.

Wang Di proposes a cross-platform social support hub called "eHealthPortal", to provide unobtrusive sensing, proactive care, and companionship in the form of a robotic pet. eHealthPortal uses algorithms to sense movement and activity, assigning wellness scores based on identified activities of daily living (ADL) of the elderly. In addition, the elderly may also self-report on their activities.

Humans and intelligent agents will collaborate to take care of the elderly under the framework. For example, a robotic companion called "Robot Dog" will collaborate with two virtual agents, "Virtual Nurse" and "Smart Butler", to help prevent falls (physical), remind the elderly to take their medication (cognitive), tell a joke (emotional), and provide companionship (social).

Di believes that the cost of eHealthPortal will be reasonable, as 83 per cent of Singaporeans aged 55 and above already own at least one smartphone, while the Housing Development Board has plans to implement sensors in housing units. In addition to direct benefits for the elderly, eHealthPortal can be used to collect anonymous user information for big data analysis.

The eHealthPortal proposal is based on current work at the Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly (LILY) at Nanyang Technological University, where Di is working as a post-doctoral research fellow.

ANNEX D

Igniting Dreams, Inspiring Discovery

Singapore's National Science Experiment:
"Step Out For Science"

Summary:

"You cannot teach a man anything; you can only help him discover it in himself." - *Galileo*

Great scientific discoveries arise from simple curiosity and a desire to know the truth. Now for the first time in the development of our nation's history, Singapore will take her youths on an exciting journey of self-discovery and exploration. The National Science Experiment (NSE), "Step Out For Science", seeks to awaken a sense of wonderment and fascination with science in our young people. The experiment encourages them to free their imagination and venture out of the comfort zone.

In this nationwide project, more than 250,000 young Singaporean students carry specially-designed pocket devices to collect data in the environment. These data can then be analysed to derive insights into their lifestyle activities such as the number of steps they take each day, the time they spend in the open, and their travel footprint. Students perform measurements on the data collected, analyse results, compare trends among their cohorts, derive meaningful insights from the findings, and make informed choices for their activities. Students will also play a part in creating an image collage of Singapore's neighbourhood.

Through these interactive activities, our young learn some of the important concepts of science - explore, examine, test, and share; and learn to appreciate the values of inquiry, imagination, passion and perseverance.

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Singapore's National Science Experiment Factsheet

To promote an interest in Science, Technology, Engineering, Mathematics (STEM), and as part of the SG50 celebrations, the Ministry of Education, National Research Foundation Singapore, Singapore University of Technology and Design, and the Science Centre Singapore, will be launching a nationwide science experiment in the second half of this year involving more than 250,000 students.

The National Science Experiment (NSE) seeks to excite and interest young Singaporeans in science and technology. Themed "Step Out For Science", this project will bring together thousands of young Singapore students from primary schools to junior colleges to analyse collected data from the environment using specially-designed low-cost, simple-to-use pocket devices, called "SENSg".

The NSE aims to make experimental approaches accessible to young Singaporean students. It enables our young to explore science at first hand in an outdoor environment. Through this platform leveraging image and advanced image recognition technologies, students learn scientific concepts such as Big Data and analytics.

The collected data will be passed wirelessly to a central server, where it is anonymously stored. The raw data is processed, and can be accessed by means of a simple and intuitive interface. From it, they are able to derive insights into their daily activities, which will then enable them to make informed choices about their lifestyles.

Time Span of NSE
To be piloted in April 2015, the NSE will take place over three years, from 2015 to 2017. The first experiment will start in the second half of 2015 and the first set of results is planned for release by the end of this year.

The experiment will be carried out with different objectives and experiments in the subsequent years to sharpen interest and provide meaningful challenges for the participants.

NSE Participants
Students from Primary 3 to Junior College Year 2 will be participating in the nationwide exercise.

National Science Experiment 2015

For the National Science Experiment 2015, the challenges for the students will relate to the number of steps taken during a day (i.e. to measure their daily walking activity), as well as the amount of time in which they spend outdoors over two to three days.

To explore image sensing and computing technologies, students will be encouraged to use SENSg to capture 10-15 photos of their favourite neighbourhood hangout places, which would help form an image collage of Singapore's neighbourhood. Advanced images recognition technologies will be used by participants and researchers to establish the popular hangout places of young Singaporeans in each neighbourhood.

Aim for Students for NSE 2015:

To use sensing and Big Data technologies to inform students about their activity level (e.g. time spent outdoors, number of steps taken). The students will carry SENSg to collect data in the environment around them and learn about how the data can be analysed to find out:

1. How active am I? i.e. the steps taken and the time spent outdoor;
2. What is my travel carbon footprint, i.e. my mobility patterns/choices - car, buses, MRT?
3. Where are my favourite hangout spots in the neighbourhood? That is, students will use SENSg to capture 10-15 pictures of their hangout spots in the neighbourhood.

Learning Points for Students:

Students will be able to log into the NSE web portal to visualize and validate their own personal data and compare their activity level against their peers. (Their peers' data are anonymous to them and to others.) Tools will be available within the web portal for students to analyse their own data and to learn big data concept and data analytics techniques.

Targets such as 12,000 steps per day and 2 hours per day outdoors time will be established to motivate the students to challenge themselves. Real-time feedback mechanisms will be included in the SENSg to give an indication to the students on their activity level relative to the targets.

A set of experiments, complementing existing science curriculum and syllabus, will be developed by the Science Centre Singapore for schools to carry out, using the SENSg device. Teaching resources will be available for school teachers via the National Science Experiment web portal. The schools are encouraged to design their own experiments which utilise the SENSg to sense the environment, and share their experiments on the web portal.

NSE Results

A series of data visualizations will be produced at the end of the experiment. The data will be analysed and presented to enable the participating students, schools, and citizens to be inspired to contribute to the future progress of the nation.

The experiment would make available the following insights:

1. How active are our young Singaporeans?
2. What are the mobility patterns of young Singaporeans?
3. What are the top hangout spots for the young Singaporeans in each neighbourhood?

Purpose of NSE 2015 for Singapore:

To create a sense of ownership amongst the students that the data they have collected contributes nationally to provide insights into how active are our young Singaporeans, their travel patterns, and to generate image collages of Singapore's neighbourhoods.

Learning Points for Singapore:

To derive students' travel patterns, maps on Singapore's urban outdoor environment (e.g. brightness) and the strength of Wi-Fi signals, which would be useful for research programmes such as Land and Liveability National Innovation Challenge.

Other Uses of the Data Collected:

Outcomes from the NSE will also be used to support ongoing research programmes such as Land and Liveability NIC, the Virtual Singapore as well as Smart Nation.

Agencies Involved:

The Singapore University of Technology and Design (SUTD), which designed and developed the '"SENSg" device, will work in collaboration with the Ministry of Education and the Science Centre Singapore in pedagogy development as well as in carrying out the experiment. The Science Centre Singapore will also be holding exhibitions where data can be explored and visualised.

GYSS@ONE-NORTH 2015 FACTSHEET

The Global Young Scientists Summit (GYSS), themed Advancing Science, Creating Technologies for a Better World", is an annual international boot camp for young scientists and researchers (PhD students and post-docs) from around the world. Each year, close to 300 promising researchers from top-tier universities in various countries are selected to attend the booth camp. These researchers gather in Singapore to interact with eminent scientists and technology leaders who are winners of prestigious global science and technology awards. They are mentored over a five-day programme, which is specially planned to inspire their minds and encourage them to continue to pursue their scientific dreams.

GYSS 2015 Summit

Date & Venue
Inaugurated in 2013, this year, the third GYSS Summit will be held from 19 to 23 January at the Nanyang Technological University. [Please refer to the venue map to find out where the various activities will be taking place.]

Guests-of-Honour
Singapore's Deputy Prime Minister Mr Teo Chee Hean will open GYSS 2015 on Sunday, 18 January. President Tony Tan Keng Yam is the Guest-of-Honour for the Closing Ceremony on Friday, 23 January.

Conference Programme

The conference comprises plenary lectures, panel discussions and small group session. Participants undertake site visits to universities, research institutes and public agencies to gain an understanding of how science and technology solutions are being developed to meet Singapore's national challenges.

Refer to **Annex B** for the daily conference programme and synopses of lectures.

Singapore Challenge 2015 – "Ageing-in-Place"
A special feature of GYSS is Singapore Challenge (SG Challenge) which offers a platform for our participants to present their research ideas and solutions to address challenges faced by global cities. This year, GYSS partners the Ministry of Health to address the issue of aging. A total of 55 proposals had been submitted by the young scientists and nine final projects have been chosen. Shortlisted participants will make their final pitches on the final day of the Summit. The young scientist with the most compelling research proposal is awarded a cash prize of US$100,000 and a gold medallion.

Refer to **Annex C** for more information about SG Challenge, the nine finalists and their proposals.

Partner Events/Public Talks

Public talks and panel discussions have been organised in conjunction with GYSS@one-north at various venues in Singapore. These talks, targeted at members of the public, academics, researchers, students and teachers, will be held at the National University of Singapore, Singapore Management University, National Library and the Science Centre Singapore. A total of 2,000 participants are expected for these events.

Refer to **Annex D** for event details.

Speakers and Participants

GYSS 2015 Speakers

Twenty world-renowned scientists who are recipients of the Nobel Prize, Fields Medal, Millennium Technology Prize and Turing Award will speak at GYSS this year.

Refer to **Annex E** for the profiles of the speakers.

Some of this year's speakers include:

- **Prof Stuart Parkin** is the winner of the Millennium Technology Prize in 2014. Prof Parkin discovered spintronics which allows a thousand fold increase in storage capacity and this has led to cloud computing. In the field of nanotechnology, Prof Parkin is now working on 'cognitive devices' which are memory or logic devices inspired by how we compute in our own brains.

- **Prof Shafi Goldwasser** developed a technique to secure messages by independently encrypting single bits. Together with 2012 Turing Award co-winner Professor Silvio Micali, Prof Goldwasser pioneered a rigorous definition of security for the encryption systems in use today. They found that encryption systems had to be randomised in order to meet their definition of security, a concept which revolutionised the field, making online bank transactions and digital signatures much more sophisticated. Her work not only laid the foundations for the science of modern cryptography, but also pioneered new methods for the efficient verification of mathematical proofs.

- **Prof Harald zur Hausen** was able to isolate and identify a new virus in genital warts - human papilloma virus (HPV-16 and HPV-18) which he believed to be the true cause of cervical cancer. His discovery led companies to develop a cervical cancer vaccine based on his research. Today, the market is expected to grow from US$1.8 billion in 2001 to US$2.2 billion by 2018. More importantly, the highly

effective vaccines available have the potential to prevent 70 percent of cervical cancers, alleviating the suffering of many thousands of women. [Nobel Prize in Physiology or Medicine (2008)]

- **Sir Timothy Hunt** discovered the presence and function of cyclins which are considered key actors in the cell cycle. Today, cyclins are featured in high school biology textbooks around the world. In 2001, Sir Hunt was awarded the Nobel Prize in Physiology or Medicine for his discovery, which he had named after his hobby of cycling.

- **Prof Ngô Bảo Châu**
  Prof Ngô's 150-page proof of a fundamental Mathematics theory that linked arithmetic and group was hailed in TIME magazine in Dec 2009 as one of the top ten scientific discoveries of the year. It validated the work of other mathematicians whose studies were founded on the assumption that the theory was correct. For his contributions to algebraic geometry, Prof Ngô received the 2010 Fields Medal.

- **Prof Andrew Chi-Chih Yao**
  A Chinese-American computer scientist and computational theorist, Prof Yao formulated the first set of definition for random number generation. It is used in complex processes like data encryption and has since become known as the Yao's test. Prof Yao received the Turing Award – regarded as the most prestigious award in computer science – in 2000.

Science and Technology Topics

The subjects discussed at GYSS are multi-disciplinary in nature – ranging from chemistry, physics, medicine, mathematics, engineering, to computer science. Topics include cryptography and computing, future energy options, questions on blue sky or blue chip research, whether personalised medicine can cure all diseases, to the secret to winning a Nobel Prize and career opportunities for the next generation of scientists. Key trends and discoveries in science research, technology innovation and enterprise, will also be raised by speakers and scientists.

Participants

Close to 300 bright young scientists and researchers from 70 universities and research institutions in countries such as Australia, Israel, Taiwan, Korea, India, Japan, Thailand, Malaysia, Vietnam, UK, Germany, France, Sweden, Denmark, Switzerland and the Netherlands are attending the event.

Refer to **Annex F** for participation statistics from 2013-2015.

Organisers & Supporters

GYSS 2015 is organised by the National Research Foundation (NRF) Singapore, and supported by the Ministry of Education, Agency for Science and Technology, Nanyang Technological University, National University of Singapore, Singapore Management University, Singapore University of Technology and Design, Singapore Global Network, Defence Science and Technology Agency, Academy of Singapore Teachers, National Library Board, Science Centre Singapore, SingHealth Duke-NUS Academic Medical Centre, Institute of Advanced Studies and Hwa Chong Institution.

GYSS@one-north Website

For more information about GYSS 2015, please visit www.gyss-one-north.sg.

GYSS 2015 PARTICIPATION STATISTICS

A. GYSS 2015 Speakers

Award	2015
Nobel Prize	12
Millennium Technology Prize	2
Fields Medal	2
Turing Award	4
IEEE Medal of Honour	0
Total	20

B. GYSS 2015 Participants

Country	2015
Singapore-based/ Singapore	67
Asia/ Australia	76
Europe/ Israel/ United States	93
Corporate Laboratories	37
Total	293

Pie-Chart - Participant Breakdown by Country (2015)

European participants come from:
- Denmark
- France
- Germany
- Israel
- Norway
- Sweden
- Switzerland
- The Netherlands
- United Kingdom

ASEAN participants come from:
- Brunei
- Cambodia
- Indonesia
- Laos
- Malaysia
- Myanmar
- Philippines
- Thailand
- Vietnam

Asian participants come from:
- China
- Hong Kong
- India
- Japan
- Korea
- Taiwan

Pie chart segments:
- Singapore-based/Singapore 23%
- ASEAN 3%
- Asia 23%
- Australia 7%
- Europe 25%
- United States 7%
- Corp Labs 12%