# 2014 PSTA WINNER CITATIONS

**PRESIDENT'S SCIENCE AND TECHNOLOGY MEDAL 2014**


**Professor John Eu-Li Wong**

**Isabel Chan Professor in Medical Sciences**
**Chief Executive, National University Health System**
**Senior Vice President (Health Affairs), National University of Singapore**

***"For his outstanding contributions to the scientific research and biomedical science communities, and his visionary leadership in healthcare and medical sciences in Singapore"***

Professor John Eu-Li Wong is widely regarded as a visionary leader in healthcare, a key contributor to the development of biomedical sciences and a champion of multidisciplinary and translational research.

His stellar career is distinguished by his deep passion as a physician, and his ability as a leader to inspire teams dedicated to developing multidisciplinary and translational solutions for improved patient care. Prof Wong is a renowned medical oncologist-haematologist, a master strategist and a respected administrator who has a strong focus on talent and the nurturing of young doctors, researchers and clinician-scientists.

In the area of biomedical sciences and research, Prof Wong made distinguished contributions as a key member of the team to establish Singapore's Biomedical Sciences Initiative in 2000 led by then A*STAR Chairman Mr Philip Yeo. He has served on the Biomedical Sciences Executive Committee from its inception, including chairing the Human Capital Working Group, and also served on the Translational Clinical Research Committee and the Industry Partnership Oversight Committee. He also contributed to mentoring bright young local clinicians and clinician-scientists, as well as recruiting top talent to Singapore from overseas.

A keen champion of translational clinical research, Prof Wong drew on his extensive clinical experience to establish the Cancer Therapeutics Research Group in 1997. The group brought together academic cancer centres in Singapore, Australia and across Asia to develop better treatments for cancers which predominantly affected Asian populations. Prof Wong currently serves on the National Medical Research Council and was the Founding Chair of the Board of the Singapore Clinical Research Institute.

Prof Wong's keen insights as a master physician and academic and research leader have contributed greatly to the development of Academic Medicine in Singapore. He played a key role in establishing

the National University Health System (NUHS), and currently serves as its Chief Executive. He was also the Founding Director of the National University Cancer Institute Singapore (NCIS). Under his leadership, NCIS has grown into a highly respected institution which provides outstanding clinical care and high quality training for cancer care specialists, professionals and researchers, as well as conducting high-impact and relevant research.

Prof Wong, who was Dean of Yong Loo Lin School of Medicine at NUS from 2003 to 2011, led the revamp of the curriculum into integrated tracks, emphasising the clinical relevance of basic science and early exposure of medical students to patients. He also pushed for improved patient care through multidisciplinary teams of healthcare professionals and scientists.

He was instrumental in the formation of the first undergraduate nursing degree programme at the medical school, and raised the global profile of Singapore medicine through institutional partnerships with some of the world's leading medical institutions, including Harvard Medical School's Beth Israel Deaconess Medical Center.
Prof Wong helped to steer developments in key multidisciplinary programmes that involved Medicine, Science, Computer Science, Dentistry, Engineering, Business, Arts and Social Sciences, and Public Policy. These programmes stretched across areas that include bioethics, health service research, epidemiology, genomics, proteomics, metabolomics, imaging, immunology, experimental therapeutics, tissue and bioengineering, molecular pathology, as well as medical and bioinformatics.

As the Founding Chair of the Board of the NUS Graduate School of Integrative Sciences and Engineering (NGS), Prof Wong led efforts to enable top graduate students to work with some of NUS' best faculty in the physical, engineering, and biomedical sciences. Integrative approaches were introduced at NGS to address challenges in medicine, engineering and the life, physical, and computer sciences.

Prof Wong obtained his MBBS from the National University of Singapore (NUS) and served his residency and fellowship at the New York Hospital-Cornell Medical Center, where he was the Chief Resident in Medicine, and Memorial Sloan-Kettering Cancer Center. Among many notable achievements, he represents Singapore in the M8 Alliance of Academic Health Centers and the Association of Academic Health Centers – International. He is a member of the Global Genomic Medicine Collaboration (G2MC) Steering Committee, the Nature Index Panel of Senior Medical Advisors, the International Editorial Board of the American Journal of Medicine, and the Editorial Board of the Journal of the American Medical Association. Prof Wong was also a member of the World Economic Forum’s Global Agenda Council on Personalized and Precision Medicine.

For his outstanding contributions to the scientific research and biomedical science communities, and his visionary leadership in healthcare and medical sciences in Singapore, Professor John Eu-Li Wong has been awarded the 2014 President’s Science and Technology Medal.

**PRESIDENT'S SCIENCE AWARD 2014**


**Professor Loh Kian Ping**
**Department of Chemistry**
**National University of Singapore**

***"For his outstanding research on graphene chemistry"***

Professor Loh Kian Ping is a pioneer and a world leader in the area of graphene chemistry research. In the last decade, Professor Loh spearheaded an internationally acclaimed research effort on advanced carbon materials. He is one of the key driving forces behind carbon research efforts at the National University of Singapore (NUS) and in Singapore generally. His research focuses on the growth, processing and application of diamond and graphene with a view towards technological applications.

Graphene is a one atom thick carbon sheet with huge technological potential. In 2010, the Nobel Prize in Physics was awarded for graphene research and since then, worldwide research efforts to study the properties and applications of this wonder material have intensified. Professor Loh's outstanding work in this field has contributed significantly to Singapore's position as a world leader in this hot research area.

Over the past seven years, Professor Loh and his team have made fundamental breakthroughs in graphene research. These discoveries include controlling the electronic properties of graphene by applying varying degrees of strain; using graphene as an optical material to generate high energy laser pulses; using nano-graphene oxide to seed the growth of ice at room temperature; and using graphene as a platform for the growth of stem cells. Prof Loh's work on graphene photonics was even highlighted by Prof Kostya S. Novoselov, winner of the 2010 Nobel Prize in Physics, in his Nobel Lecture.

Beyond fundamental studies, Professor Loh's work addresses engineering challenges such as the large scale synthesis of graphene. His team recently pioneered the growth and transfer of high quality graphene on silicon wafer in a single step, solving a major challenge critical for graphene commercialisation. This breakthrough was published in the highly prestigious scientific journal Nature in January 2014, winning recognition in the scientific community worldwide. Most importantly, the direct growth and spontaneous attachment of graphene on the silicon substrate is amenable to batch processing in a semiconductor production line, thus speeding up the technological application of graphene.

A prolific scientist, Professor Loh also invented a method to electrochemically exfoliate graphene flakes from graphite mineral. Unlike conventional methods, his novel method does not use oxidising

agents or concentrated acids, thus bypassing the tedious and dangerous steps used in conventional methods. To commercialise this invention, Professor Loh founded a spin-off company in 2012 for bulk synthesis of high quality graphene for applications in batteries and composites.

Trained as a physical scientist, Professor Loh's work has a strong focus on applications. Out of the 10 patents that he has filed, five have been licensed and spawned three start-ups that secured more than USD 3 million in overseas venture funds.

In 2008, Professor Loh was awarded a National Research Foundation Competitive Research Programme (CRP) for research on graphene and related materials. This highly successful programme led by him has contributed to the establishment of the Graphene Research Centre at NUS Faculty of Science. By 2013, research arising largely from this CRP had propelled NUS to be one of the top universities in the world for graphene research.

Over the last three years, Professor Loh had published more than 10 papers in Nature and its sister journals, among many other high impact papers. These achievements have contributed towards strengthening NUS' international reputation and research rankings.

Professor Loh has won many accolades for his outstanding research achievements. In 2008, he received the NUS Young Research award and in 2012, he was conferred the NUS Outstanding Researcher Award. Professor Loh was also presented with the highly prestigious American Chemical Society Nano Lectureship award in 2013. He is currently the associate editor of the American Chemical Society Journal, Chemistry of Materials.

For his outstanding research on graphene chemistry, Professor Loh Kian Ping has been awarded the 2014 President's Science Award.

**PRESIDENT'S TECHNOLOGY AWARDS 2014**


(from left to right)
**Professor Wynne Hsu, Professor Wong Tien Yin, Professor Lee Mong Li**

**Singapore Eye Research Institute, Singapore National Eye Center, Duke-NUS Graduate Medical School, National University of Singapore**
**School of Computing, National University of Singapore**

***"For their outstanding contributions to the development of novel ocular image analysis technology for the screening and evaluation of significant clinical problems in eye and vascular diseases"***

Professor Wong Tien Yin, Professor Wynne Hsu, and Professor Lee Mong Li, assisted by their collaborators from NUS, Singapore Eye Research Institute (SERI), and the Institute for Infocomm Research (I2R), developed a suite of novel ocular image analysis technologies and designed the architectural platform for the innovative application of these technologies to detect and track the progression of three major eye diseases which cause blindness. The technologies can also be used to study systemic vascular diseases.

The core technology is the Platform for Ocular Image Screening and Evaluation (POISE) that encompasses a suite of advanced image analysis algorithms and innovative integration of these methods. These include programmes that have been developed for large-scale clinical use for eye diseases such as glaucoma, diabetic retinopathy and age-related macular degeneration as well as systemic vascular diseases such as stroke, heart disease, dementia, diabetes and hypertension. The technology has enabled monitoring and documentation of subtle alterations in the retina over time. This makes early recognition of such diseases possible before the onset of clinical symptoms, thus allowing physicians to detect disease early, monitor disease progression and track treatment outcomes.

Through automation of ocular image analysis, previously labor-intensive eye disease screening programs can now be scaled up with reduced cost and less resource. The technology has been successfully adopted by public primary healthcare clusters and has significantly improved productivity, reduced waiting time and over-referrals to specialists.

The team has benefitted from close collaboration with NUS, SERI and I2R colleagues. Their research and achievements have placed Singapore on the world map as a leader in ocular image analysis technology and development. The technology has been licensed to and used by several academic and medical centres and research institutions, including University College London, University of Wisconsin-Madison, University of Melbourne, University of Sydney, the Centre for Eye Research Australia, theCommonwealth Scientific and Industrial Research Organisation, Moorfields Eye

Hospital and Topcon Inc. Several joint research labs such as SAILOR - the SERI-I2R-NUS Joint Lab, and the ATLANTIA Topcon-I2R Joint Lab have been established to drive the next generation of advanced ocular imaging technologies.

This work has resulted in more than 30 patents, and 20 end-user licenses with companies, institutions and hospitals globally full commercial licenses with multinational companies) ;more than 300 publications and multiple international prizes and awards. These systems have been extensively applied to different populations and cohorts in Singapore, USA, Europe, Australia and other Asian countries, in more than 100,000 adults and children ranging from healthy, community-based populations to high risk patient groups.

For their outstanding contributions to the development of novel ocular image analysis technology for the screening and evaluation of significant clinical problems in eye and vascular diseases, Professor Wong Tien Yin, Professor Wynne Hsu, and Professor Lee Mong Li, are awarded the 2014 President's Technology Award.


(from left to right)
**Professor Subbu Venkatraman, Associate Professor Tina Wong, and Professor Freddy Boey**
**School of Materials Science and Engineering, Nanyang Technological University**
**Singapore Eye Research Institute**

***"For their innovative application of nanostructures and novel drug delivery approach to combat blindness from glaucoma"***

Professor Subbu Venkatraman, Associate Professor Tina Wong and Professor Freddy Boey have developed a simple and painless injection of anti-glaucoma nanomedicine that can effectively control the disease for several months. This sustained release nanomedicine treatment administered by doctors would overcome sub-optimal management of glaucoma due to patients' non-compliance to daily topical application of eye drops and poor drug penetration from eye drops, leading to progression of blindness. This novel approach could change the paradigm of clinical management of glaucoma and could also potentially be applied to treatment of other diseases.

Glaucoma is the leading cause of irreversible blindness worldwide and is estimated to affect 80 million people by 2020, with Asians accounting for almost half the world's glaucoma afflicted population. For the last 150 years, doctors have been reliant on prescribing daily eye drops to early glaucoma patients to manage increase in ocular pressure – a treatment regime that is heavily reliant on patients remembering to use their eye drops correctly and regularly.

The interdisciplinary team comprising Venkatraman, a biomaterials scientist, Wong, a senior consultant ophthalmologist and Boey, an experienced entrepreneur and bioengineer, worked together to address this challenge. The team developed a deep understanding of complex drug-nanostructure interactions and the loading principles of drugs into self-assembling nanocarriers such as liposomes. With this understanding, the team was able to load a sufficient amount of commonly used glaucoma medication into each nanoparticle, administer it through a sub-conjuctival injection and to control its release for 90 days in vivo. This is the first known injectable nanomedicine for glaucoma treatment. This avoids the risks and discomfort associated with sustained-release solid implants, whose drug efficacy may last up to 2 months in clinical trials. By administering anti-glaucoma treatment once three months via a single injection, the need for daily eye drop application with its associated risk of blindness from non-compliance and poor drug bioavailability was minimized.

The team managed to advance their ocular nanocarrier research, application development and preclinical animal studies from concept through to successful first-in-man clinical trials in just 4.5 years, which is about half the time of a typical drug commercialization cycle. This novel glaucoma nanomedicine treatment is expected to be commercially available after larger scale clinical trials through a spin-off company in about two years and could significantly change the clinical management of glaucoma.

In addition, the understanding of nanostructure-drug interactions and the nanocarrier drug delivery platform for glaucoma has opened the possibilities of this as a translatable platform technology to benefit other eye diseases as well as other applications requiring localized and systemic sustained delivery of drugs.

For their innovative application of nanostructures and development of novel drug delivery approach to combat blindness from glaucoma, Professor Subbu Venkatraman, Associate Professor Tina Wong and Professor Freddy Boey are awarded the 2014 President's Technology Award.