# 2015 PSTA WINNER CITATIONS

**PRESIDENT'S TECHNOLOGY AWARDS 2015**


**Professor Neal Tai-Shung Chung**
**Department of Chemical & Biomolecular Engineering,**
**National University of Singapore**

***"For his outstanding research work on various novel membrane technologies, especially for water treatment, that have shown significant potential to make desalination more energy efficient and environmentally friendly, and that have helped to establish Singapore as a leading research centrefor water research"***

Professor Neal Chung has made major contributions to the field of membrane science. Not only has he furthered the fundamental understanding of membranes, but he has also been responsible for the development of numerous novel membrane designs that have been recognised by academics for their innovativeness, and adopted by industry for clean water and clean energy applications.

As a consultant to Hyflux, Prof Chung built and led its membrane R&D team from 2004-2008. There, he co-invented the Kristaltm 600 hollow fiber ultrafiltration membrane with Hyflux researchers, which has since been commercialised worldwide. This product was developed with Singapore's specific water treatment needs in mind by protecting public health through the use of stringent filtration methods to remove viruses and other contaminants. Today, the technology is so successful that it is not only used in Singapore's water recycling plants, but also globally as a pre-treatment in large seawater reverse osmosis (SWRO) plants.

Prof Chung and his team at NUS developed numerous novel membrane materials with various clean water and energy applications. One of these inventions is a double-repulsion nanofiltration (NF) membrane that effectively removes both positive and negative charged multivalent ions from industrial effluents. This technology allows for improved filtration of toxic heavy metal ions, such as arsenic, from industrial wastewaters. Two companies have already licensed this technology for commercialisation.

Prof Chung and his team successfully developed a novel process for advanced high flux forward osmosis (FO) membranes which surpasses the performance of most conventional NF processes, achieving a 99.5 per cent rejection rate for heavy metal ions. FO membranes with high oil rejections have also been developed to treat oil or water mixtures. Whilst these FO membranes primarily address the recycling of industrial wastewater, they have the potential to address wider problems such as water shortages in water scarce regions or groundwater contamination from pollutants.

Prof Chung also pioneered the design of biomimetic membranes by utilising aquaporin, a type of protein that allows fast transmission of water molecules, but blocks the passage of larger molecules and salts. These technological advancements increase the feasibility of fast desalination for fresh water reclamation.

Prof Chung and his team have also created innovative pressure retarded osmosis (PRO) membranes which have been noted for displaying the highest power density and mechanical strength ever recorded in scientific literature. These membranes could significantly lower energy consumption and production costs for seawater desalination if integrated with osmotic power generators and RO plants. Such an approach would also reduce or eliminate the need for complicated methods of RO brine disposal, creating a more streamlined and environmentally-friendly desalination process. Prof Chung was awarded grants in three rounds of the Competitive Research Program funded by the National Research Foundation. He and the team he built at NUS have published extensively and hold numerous patents. As an acknowledgement of his contributions to the field of water research, Lux Research USA, a consulting firm providing strategic data on emerging technologies, ranked NUS in 2013 as the global leader in water research, specifically citing Prof Chung's work on membranes for clean water.

As a faculty member of the National University of Singapore, Prof Chung is also passionate about nurturing students so that they may one day contribute to global efforts undertaken for cleaner water at lower cost. Prof Chung has trained 55 doctoral students, 18 Masters students and more than 70 post-doctorate fellows, who have gone on to become professors as well as entrepreneurs. Some of his students have also been recruited by major transnational corporations.

For his outstanding research and innovative work on membranes, particularly in the field of water, Professor Neal Chung is accorded the 2015 President's Technology Award.