

2014 PSTA WINNER CITATIONS

PRESIDENT'S TECHNOLOGY AWARDS 2014



(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-conjunctival 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.