Professor Leslie Yeo
Professor of Chemical Engineering
Australian Research Council Future Fellow
Micro/Nanophysics Research Laboratory
School of Engineering
RMIT University

Title:
A New Use of Sound Waves to Enhance Inhaled Stem Cell, Gene and Drug Delivery

Abstract:
Capitalizing on our recent discovery of a new class of sound waves—the first in over 60 years, we demonstrate an acoustofluidic nebulization platform for pulmonary drug, gene and stem cell delivery. In this talk, we specifically focus on the use of the device for inhaled DNA vaccination against influenza, although we also show that this generic platform technology can easily be adapted for the administration of both small molecule and macromolecular drugs such as RNAi, peptides and proteins (e.g., monoclonal antibodies) to treat a wide range of respiratory diseases including lung cancer, as well as stem cells for lung tissue regeneration and repair. Additionally, the technology is also a rapid, efficient and straightforward means for synthesizing 100 nm biodegradable polymeric particles within which the therapeutic molecules can be encapsulated. Finally, the ability to synthesize multiple polyelectrolyte coatings encapsulating these biomolecules is shown as a fast and efficient alternative to conventional layer-by-layer assembly. The low cost, particle size control, low power requirement, delivery efficiency, and miniaturizability altogether suggests the platform constitutes an attractive alternative to current nebulizers and inhalers, which we envisage could comprise the next-generation of devices that will revolutionize pulmonary drug and gene delivery for needle-free vaccination therapeutics.