UCLA Engineering
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BIOENGINEERING

PRESENTS

Functional Nucleic Acid Nanotechnology

MONDAY, NOV 19, 2018
3:00 – 4:00 PM
5101 ENGINEERING V

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ABSTRACT:

Nucleic acid nanotechnology has drawn tremendous attention, since it can provide a precise tool for building multi-dimensional structures with a defined size, shape, and surface property. This is particularly of interest to the field of gene delivery. For targeted delivery of nanoparticles, conventional delivery nanoparticles such as liposomes and polymeric systems are heterogeneous in size, composition, and surface charge leading to suboptimal performance, lack of tissue specificity and potential toxicity. Here, we show that self-assembled functional nucleic nanostructures with a well-defined size can serve as a multi-functional platform to induce efficient RNA interference, mRNA expression, and CRISPR/Cas9 mediated gene editing. For the synthesis of functional RNA structures, we have utilized the rolling circle transcription of pre-designed DNA template to produce a large quantity of functional RNAs. For programmable and simultaneous gene silencing, we have design the dicer substrate RNA nanostructures to regulate three different fluorescent proteins (GFP, RFP, and BFP) in the target cells. Using three arm junction RNA nanostructures, we were able to show programmable regulation of fluorescent protein expression to generate 8 different fluorescent colored cells. For mRNA expression, in vitro transcription (IVT) of mRNA has been carried out to express three distinct fluorescent proteins (GFP, RFP, and BFP) in target cells. Long term expression can be obtained with the programmable assembly of mRNA into defined RNA structures. Finally, delivery of CRISPR/Cas9 with RNA nanostructures was attempted. Three different gRNAs can be co-delivered with Cas9 to show simultaneous gene editing, gene regression, gene induction.

BIOGRAPHY:

Dr. Hyukjin Lee is an associate professor of Graduate School of Pharmaceutical Sciences and College of Pharmacy at Ewha Womans University. He received his B.S. degree from the Johns Hopkins University, M.S. degree from the Columbia University, and Ph.D. from KAIST under the mentorship of Prof. Tae Gwan Park. Dr. Lee did his postdoctoral training with Prof. Robert Langer at MIT. His research group focuses on DNA nanotechnology for drug delivery and molecular diagnostics. Particularly, enzymatic and biological preparation of large-scale synthesis of DNA/RNA nanostructures for gene delivery and biosensing has been developed from his group. He is also working on the screening of highly potent ligands for intracellular delivery of macromolecules.