

CHEMICAL ENGINEERING

SEMINAR SERIES



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Lipid-like materials for RNA delivery: A how-to guide for hacking gene expression

ABSTRACT: Despite the promise of RNA therapeutics, progress towards the clinic has been slowed by the difficulty of delivering RNA drugs, such as short interfering RNA (siRNA) and messenger RNA (mRNA), into cellular targets within the body. RNA therapeutics are large ($10^4 - 10^6$ g/mol) and negatively charged; they do not have favorable biodistribution properties in vivo nor an ability to cross the cellular membrane of target cells. In response to these challenges, our lab has created and tested large libraries of biodegradable lipid-like materials called 'lipidoids' using high-throughput methodologies. Lipidoids are able to efficiently manipulate gene expression in a variety of biological systems, including hepatocytes, white blood cells and tumors. Furthermore, structure-function analysis has revealed material design criteria that reliably predict in vivo delivery efficacy without the need for any biological testing. Current efforts on application of lipidoid nanoparticle technology for the treatment of Mantle cell lymphoma, a deadly subtype of Non-Hodgkin's B-cell lymphoma, will be discussed.

RECEPTION 3:30 • LECTURE 4:00 - 5:00
PHYSICS ASTRONOMY BLDG. (PAA) A118

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BIOGRAPHY: Kathryn A. Whitehead is an Assistant Professor in the Departments of Chemical Engineering and Biomedical Engineering (courtesy) at Carnegie Mellon University and a member of the McGowan Institute for Regenerative Medicine at the University of Pittsburgh. The interdisciplinary research interests of her lab include the chemical and biophysical analysis of biomaterials as well as their use in delivering biologic drugs to diseased tissue. Prof. Whitehead obtained both her B.S. (Univ. of Delaware, 2002) and Ph.D. (UC Santa Barbara, 2007) in chemical engineering. Her postdoctoral work at MIT focused on the development and translation of RNA interference delivery systems. She is the recipient of numerous awards, including the DARPA Young Faculty Award, the CMBE Young Innovator Award, and the Kun Li Award for Excellence in Education. Prof. Whitehead was named as a Pioneer on the MIT Technology Review's Innovators Under 35 list in 2014 as well as one of the Brilliant Ten by Popular Science in 2015. Several of her patents have been licensed and are currently being developed for reagent and therapeutic use.