Drug-transportation by carbon nanotubes

Faina Karchemsky and Oren Regev

Department of Chemical Engineering, Ben-Gurion University of the Negev, Beer Sheva 84105, Israel

Carbon nanotubes (CNT) have been proposed and actively explored as multipurpose innovative carriers for drug delivery due to their facile uptake cell membranes [1, 2]. However, the amount of loaded drug on a CNT is rather small. In this respect, liposomes (lipid vesicles) are employed for transporting a large amount of drug. The aim of this research is to develop a new drug delivery system, in which drug loaded liposomes are covalently bonded to carbon nanotubes. The advantage of this novel approach, liposomes – CNT attachment, is the large transported amount of drug that can be delivered by the CNT via the covalently attached nano-liposomes. This will allow high dose of drug to be effectively administered into cells thus preventing potential adverse systemic effects. This system is expected to provide versatile and controlled means for enhanced delivery of drug quantities (i.e. dissolved within the liposome lumen or in the aqueous interior). In this research the nanotubes are functionalized with carboxyl groups, and are covalently attached to the nano-liposome bilayer. Reaction indication is verified by FT-IR and cryo-TEM images. *In vitro* experiments with fluorescently labeled CNT and liposomes indicate CNT-liposome complex uptake by the cells.

.1 Kam, N.W.S., Z.A. Liu, and H.J. Dai, *Carbon nanotubes as intracellular transporters for proteins and DNA: An investigation of the uptake mechanism and pathway.* Angewandte Chemie-International Edition, 2006. **45**(4): p. 577-581.

.2 Lacerda, L., et al., *Cell-penetrating CNTs for delivery of therapeutics.* Nano Today, 2007. **2**(6): p. 38-43.