Stevens Institute of Technology

Nanotechnology Graduate Program

Multifunctional Stimuli-Sensitive Pharmaceutical Nanocarriers: Evolution of the Concept

Wednesday, March 28, 2007
Babbio Bldg, Room 122, Time 11 am

Vladimir Torchilin
Department of Pharmaceutical Sciences
Center for Pharmaceutical Biotechnology and Nanomedicine
Northeastern University, Boston, MA

Drug carriers are used to protect sensitive drug molecules from the inactivation by aggressive biological surroundings and to improve drug delivery to the site of disease. Ideally, drug carrier should be able: (a) to accumulate in required organ or tissue, and then (b) penetrate inside target cells delivering there its load (drug or DNA). Organ or tissue (tumor, infarct) accumulation could be achieved by the passive targeting via the enhanced permeability and retention effect or by antibody-mediated active targeting, while the intracellular delivery could be mediated by certain internalizable ligands or by cell-penetrating peptides. To be able to behave this way, drug carrier should simultaneously carry on its surface various moieties capable of functioning in a certain orchestrated order. This concept was developed over the years. First, drug-loaded nanocarriers have been designed, such as nanocapsules, nanospheres, liposomes, etc. However, these foreign particles were cleared from the blood very fast. To improve the accumulation of drug-loaded nanocarriers in the target, specific molecules were attached to the carrier surface capable of target cell recognitions. Although, some accumulation improvement was achieved, still the majority of carrier nanoparticles were cleared from the circulation. On the next step, long-circulating nanocarriers have been prepared by grafting their surface with water-soluble polymers with flexible main chain. In addition, such carriers were decorated with target-specific moieties. Thus, the nanoparticulate delivery system was built simultaneously capable of longevity and target recognition. In general, many other "useful" moieties can be attached to the drug carrier surface, such as diagnostic/imaging groups, cell penetrating peptide groups, stimuli-sensitive groups capable of releasing the drug under certain conditions, etc. All these moieties should function in mutually coordinated fashion. Various multifunctional nanocarriers will be described for targeted drug delivery to and into various pathological cells using such pathologies as cancer and myocardial infarction as an example.

Light refreshments will be served prior to seminar

STEVENS Institute of Technology

Co-sponsored by the Department of Chemistry and Chemical Biology (CCB)