UNH Materials Science Seminar

11:10-12:00, Thursday, Jan. 31, 2008
Kingsbury Hall S145
University of New Hampshire

Functional Nanoparticles for Biomedical Applications

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Nanoparticles are finding increasing applications in the areas of medical diagnostic and therapeutics. Fundamentally nanoparticles allow practitioners to bridge the gap between biochemistry which occurs at a scale extremely challenging to observe and analytical tools that can report information at the macroscale. Nanoparticles can be engineered to have specific combinations of properties to allow interaction with biological systems, while minimizing immune response and invasion. Progressively nanotechnology allow more specific diagnostics, less invasive tests, more effective therapy with fewer side effects and better comfort of patients. The following examples will be elaborated upon with an emphasis on synthesis.

Diagnotics

Targeted magnetic nanoparticle sensors for Magnetic Resonance Imaging of angiogenesis.

Polymeric nanoparticles containing a core of magnetite (Fe_3O_4) are functionalized with polyethylene glycol and a NGR homing peptide. The PEG layer enhances circulation time in the blood, while NGR allows targeting of the nanoparticles to CD13/APN cell surface receptor, that are over expressed in areas of neo-vessels growth. This MRI contrast agent has clinical utility for the diagnosis of cardiac diseases.

Targeted contrast agents for intravascular ultrasound imaging.

Concurrently we are developing immuniliposomes that can be loaded with fluorobutane in order to generate microbubbles at the

temperature of the human body. Additionally these nanoparticles are functionalized with a homing NGR peptide to improve clinical utility. Such contrast agent allow rapid diagnostic with advanced ultrasound devices.

Therapeutics

Targeted Gene Delivery of DNA to the ovarian cancer microenvironment.

We synthesized immunonanoparticles based on a combination of 3 phospholipids by self and direct assembly. The immunoliposomes contain folded plasmid that codes for interleukin 18 and green fluorescent protein (GFP), folded on spermamine. The liposomes are functionalized with antiCD11c in order to target CD11c cell receptors that are over expressed in ovarian cancer cells.

Targeted nanoparticle mediated drug delivery

Triblock copolymers of polyethylene glycol, polylactic acid, polyglutamic acid are synthesized in order to create a nanocapsule with potential for drug delivery. These particles are further functionalized with a TAT peptide to increase cellular uptake.

Host: Professor Donald Sundberg x1878