Title: Superparamagnetic Nanoparticles for Imaging and Therapeutics
Type: Student
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Description: Superparamagnetic nanoparticles have many biomedical applications (e.g. cell separation, contrast enhancement in magnetic resonance imaging, drug delivery, hyperthermic therapies at the cellular level, and magnetic-field-assisted radionuclide therapy). The goal of this research is to develop novel liposome/nanoparticle-conjugate/drug systems with combined cancer diagnostic and therapeutic functions. These "smart" nanoparticle conjugates or liposomes are designed to recognize tumor-specific markers and target only individual tumor cells. These particles will enable doctors to detect tumors with MRI at the cellular level in very early stages, and measure therapeutic efficiency of hyperthermia simultaneously. The efficacy of nanoparticle delivery to cells is limited by three major factors: (1) short half-life of particle circulation time, (2) non-specific targeting, and (3) low efficiency of internalization of endocytosed ligands grafted on the nanoparticle surface. To increase the circulation time and efficacy of nanoparticle internalization, in the first thrust of this research we will study the mechanism that governs nanoparticle dispersion during the ligand coating and delivery (*in vivo* and *in vitro*) processes. In the second thrust of this research, we will focus on the targeted delivery of nanoparticles to specific cancer cell lines. The third thrust will be focused on the development of effective methods for delivering drugs via a liposomal/nanoparticle system.