MSE 498/599

Nanomedicine

(Credits: 3, Spring 2012, Tuesday and Thursday 3:30-5.00 pm, EEB 045)

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Course Description
The foundational research in nanosciences and the rapid development in nanotechnology have provided a new set of research tools and medical devices that will change our ways to practice medicine in the near future. The objective of this course is to provide students a broad understanding of cutting-edge development of nanomaterials and nanodevices. This course covers the methods of synthesis and characterization of nano-sized materials and specific considerations of their use within biological systems. The use of those structures, devices, and agents will then be discussed in the context of their clinical applications.

Course outline
1. Introduction: (1.5 week)
   - Introduction to nanomaterials
   - Nanoscale effect
   - Physical characterization of nanomaterials
   - Biological characterization of nanomaterials
2. Nanoparticle diagnostics: biosensors (2.5 weeks)
   - Types of biosensors
   - Transducers: nanocomponents and nanotechnologies
   - Nanoelectromechanical systems
   - Applications: nanoarrays, point of care diagnostics, and implantable systems
3. Nanoparticle diagnostics: imaging contrast agents (3 weeks)
   - Nanoparticle variants and synthesis
   - Nanoparticle conjugates
   - Applications of nanoparticles in cell trafficking, magnetic imaging, optical imaging, computed tomography, positron emission tomography, and ultrasound imaging.
4. Nanoparticle therapeutics (3 weeks)
   - Synthesis of nanoparticles
   - Nanoparticles for chemo drug delivery
   - Nanoparticles for gene delivery
Nanoparticles for cancer therapies: solid tumors, blood type tumors, and metastasis
Nanoparticles for biotechnology therapy: stem cell therapy, immunotherapy phototherapy, radiosensitization, and hyperthermia

**Textbooks**
None.

**Reference books and materials**
Lecture notes, review articles and reading materials will be distributed by the instructor.

**Homework and exams**
Homework assignments
Term paper

**Grading**
Homework 40%
Abstract and outline of a term paper 20%
Final (Term paper) 40%