

NANO 243/CENG 207: NANOMEDICINE

Syllabus – Spring 2018

Class Time: 5:00-6:20 PM, Tuesday & Thursday
York Hall, Undergraduate Sciences Building (YORK), Room 4080A

Instructor: Professor Liangfang Zhang
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Office Hours: 4:00-5:00 pm, Tuesday
Structural and Materials Engineering (SME) Building, 203C

Course Website: <http://nano.ucsd.edu/~l7zhang/teaching.php>

Required textbook: No single textbook will be used. Recommended readings include:

- 1) Drug Delivery - Engineering Principles for Drug Therapy, by Mark Saltzman, 2001.

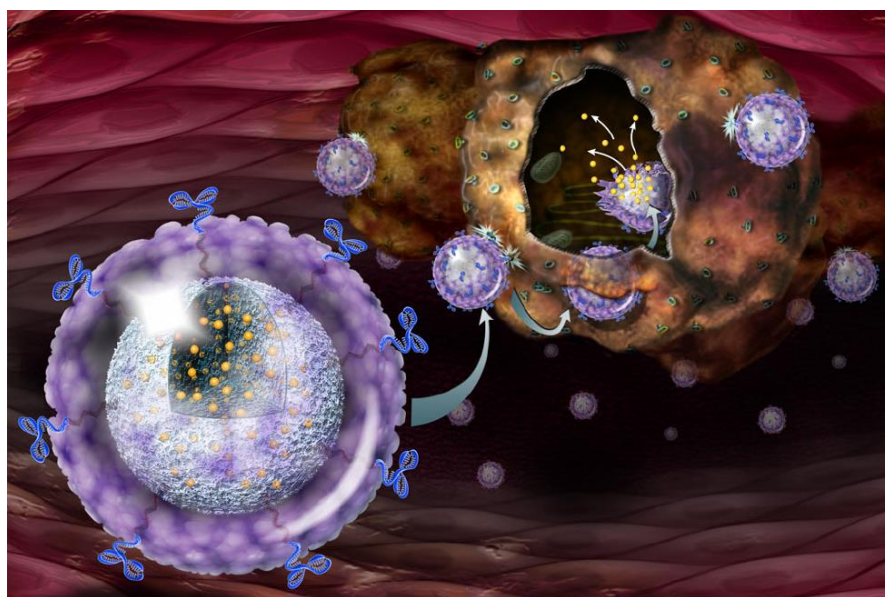
Grading:	Midterm Exam	25%
	Research Project	
	Project written report	25%
	Project oral presentation	25%
	Final Exam	25%

Exam and Project Due Dates:

Midterm Exam (**Lecture 1-8**): **May 1**, in class
Project Written Report due: **May 18**, (submit via email in PDF format)
Final Exam (**Lecture 9-19**): **June 14**, 7:00-10:00 PM, location TBD

Course Description:

This course focuses on the latest scientific developments and discoveries in the field of nanomedicine, the use of precisely engineered nanomaterials at the length scale of 1-100 nm to develop novel therapeutic, prophylactic and diagnostic modalities for medical applications. Another objective is to use nanomedicine-centric applications to teach the underlying engineering principles such as the laws revolved around molecular and particulate transport, sorting and binding. The course begins with a series of introductory lectures that describe the historic developments and cutting-edge discoveries in nanomedicine research. The following discussions cover some details of the required fundamental concepts in the field of nanomedicine. This course integrates science and technology advances in nanoengineering, bioengineering, chemical engineering, materials science and preclinical medicine, and serves for students who are interested in nanobiotechnology in healthcare.



Covered Topics:

- 1) Introduction to nanomedicine
- 2) Nanomedicine in drug delivery and detoxification
- 3) Nanomedicine in immunotherapy
- 4) Nanomedicine in diagnostics and bioimaging
- 5) Drug administration and transport by fluid motion
- 6) Drug dispersion and diffusion in biological systems
- 7) Drug permeation through biological barriers
- 8) Pharmacokinetics and biodistribution
- 9) Ligand-receptor engineering and targeted delivery
- 10) Drug loading and quantification
- 11) Controlled and responsive release
- 12) Combinatorial therapy and delivery
- 13) From bench to bedside translation
- 14) Case studies in nanomedicine

Research Project:

The research project will consist of two parts: (1) writing a research proposal on a self-selected disease-oriented nanomedicine topic (see below for a list of suggested topics); and (2) giving an oral presentation on the selected topic.

The research proposal will be due on **May 18** (electronic submission in PDF format). Proposal received after the deadline will receive no credit. The proposal should be no more than 5 single-spaced pages in length including all figures, illustrations and references. The font should be no smaller than 12 points (Time New Roman). The following aspects should be clearly described in the proposal: Specific Aims (what problem to be solved and/or what is the hypothesis) and Research Strategy (including three sub-sections: *Significance*, *Innovation*, and *Experimental Approaches*).

The oral presentation will be given individually in front of the entire class. It will consist of a 20-minute presentation and a 5-minute discussion (Q/A). **The contents of all individual presentations will be covered by the final exam.**

Grading on the proposal will be done by the instructor. Grading on the oral presentation will be done through peer evaluation. A “Peer Evaluation” form will be distributed to each student except the speaker to evaluate the speaker’s oral presentation. The following aspects will be specifically evaluated: novelty, structure, clarity, and overall presentation skill.

A List of Suggested Research Project Topics:

The research project topic should be about the application of nanomedicine in a specific disease, including but is not limited to:

Cancers: prostate cancer, breast cancer, brain cancer, pancreatic cancer, liver cancer, lung cancer, bladder cancer, skin cancer, colon and rectal cancer, kidney cancer, ovarian cancer, leukemia, melanoma, etc.

Cardiovascular diseases: coronary heart disease (heart attacks), cerebrovascular disease, hypertension, peripheral artery disease, rheumatic heart disease, congenital heart disease, heart failure, etc.

Immune diseases

Brain diseases

Bone diseases

Eye diseases

Skin diseases

Bacterial infections

Fungi infections

Virus infections