

BIOEN 6405/PHCEU 7960-006 Nanomedicine, Fall Semester 2013

Scope and Theme: The convergence of recent advances in nanotechnology with modern biology and medicine has created the new research domain of *nanobiotechnology*. The use of *nanobiotechnology* in medicine is termed *nanomedicine*. Nanomedicine research includes the development of diagnostics for rapid monitoring, targeted cancer therapies, localized drug delivery, improved cell material interactions, scaffolds for tissue engineering, and gene delivery systems among others. Successful research and development in nanomedicine where ultimately patients and the general public can benefit from these new technologies require the interaction of a multitude of disciplines including chemistry, materials science and engineering, cellular biology, pharmaceutical sciences and clinical translational research. This interdisciplinary course will span the spectrum of how such materials are fabricated, characterized, interact with the biological environment, used in specific biomedical applications and translated from concept to the clinic and commercialization. Topics to be taught by experts in the respective areas will include fundamentals of nanomedicine, bottom up and top down approaches to nanofabrication, conjugation strategies, physicochemical characterization, cellular uptake and toxicity, biodistribution, clinical and preclinical nanomedicine as well as special topics in nanobiosensors, polymer therapeutics and commercialization of nanomedicine products. *This course is a requirement for the Nanotechnology Graduate Training Program students, and as elective for Pharmaceutics and Bioengineering Graduate Programs and potentially other departmental graduate programs at the University of Utah.*

Course Master: Hamid Ghandehari, Professor of Pharmaceutics and Bioengineering

Course Master Contact Information:

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Teaching Assistant: TBA

Prerequisite: Undergraduate organic, inorganic and physical chemistry and cell biology or course master's consent.

Lecture Time: ***Mondays and Wednesdays, 10:45 am-12:05 pm***

Location: ***SMBB 2650***

Objectives:

1. Provide a graduate-level foundation on contemporary nanomedicine principles.
2. Discuss concepts of top down and bottom up nanofabrication.
3. Review methods of conjugation chemistry and characterization of nanomaterials.
4. Introduce approaches for evaluating the toxicity of nanoconstructs.
5. Overview steps for clinical translation and commercialization of nanomedicine products.
6. Provide detailed case-studies in nanomedicine research and development.

Readings: Assigned readings will be provided for individual lectures.

Web Page: Log on to Canvas

Academic Conduct: All students are expected to abide by the Student Code for academic integrity and dishonesty such as cheating as defined by the National Academy of Sciences and specifically in the University of Utah Student Code: <http://www.regulations.utah.edu/academics/6-400.html>.

Terminal behavior objectives:

By completing this course, students should be able to:

- Design and develop nanoconstructs for biomedical applications
- Comprehend fundamentals of the nanofabrication and synthesis of nanoconstructs
- Understand approaches to conjugating bioactive and imaging agents to nanoconstructs
- Design studies to evaluate biocompatibility of nanomaterials in vitro and in vivo
- Articulate steps required for successful translation of nanomedicine products for clinical use and commercialization
- Gain insight into specific case studies where nanomaterials are used for biomedical applications

Assessment and Grading Criteria

10% Class participation

50% Exam (25% each, one midterm, one final)-closed book. Exams will be short essays and cover materials discussed in lectures.

30% Term Paper-Students are required to write a term paper on a topic of their choice related to the broad area of nanomedicine. The paper topic can, but does not have to be chosen from the list of lecture topics taught in class. Integration of concepts learned in class for writing the paper for specific biomedical applications is strongly encouraged. Papers must be at least 15 pages double spaced excluding references.

10% Homework Assignments

Attendance: Students are expected to arrive on time, fully attend and participate in ALL class sessions. Extenuating circumstances causing absence should be discussed with the instructor **before** the absence occurs, not post-facto.

Accommodations for Disabled Students:

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you require such accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for necessary and appropriate accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.