Bioe599w, Fall 2006
BIONANOTECHNOLOGY

Instructor: Xiaohu Gao, Assistant Professor of Bioengineering
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Emails: *bioe599w@u.washington.edu* & *xgao@u.washington.edu*
Course website: *http://courses.washington.edu/bioe599w*
Office Hours: by e-mail appointment with Dr. Gao.

Meeting time & Location: Wednesday / Friday (11:30 - 12:50 pm, MGH 295)

Synopsis: Bionanotechnology is an emerging area where biology, medicine and nanosciences converge. It's a multidisciplinary field combining biology, chemistry, physics and engineering. The rapid development of bionanotechnology also has ethical and environmental implications. Bioe599w will focus on nanomaterials with *practical* applications in biology and medicine. Specifically, this course will discuss following topics:

- Semiconductor quantum dot theory and synthesis
- Quantum dot surface properties and functionalization
- Interface with biological systems
- *In vitro* sensing and detection with quantum dots
- *In vivo* molecular imaging with quantum dots
- Magnetic nanoparticle theory and synthesis
- Applications of magnetic nanoparticles in *in vitro* sensing
- Applications of magnetic nanoparticles in *in vivo* imaging and drug delivery
- Metallic colloids theory and synthesis
- Raman spectroscopy with metallic colloids
- Application of metallic colloids in ultrasensitive detection
- Nanotubes and applications in sensing and implantable devices
- μ-Fab and local resources
- Nanomaterial toxicity
- Nanomaterial characterization techniques

Course Structure and Grading Policy: The course employs lectures (majority given by Dr. Gao with two guest lectures), assigned readings, student presentations, a midterm review article, and a final design project.

- Midterm review article: A topic will be given 2 weeks before the midterm. The students will form 3-4 groups and work on the review article based on the lecture series and homework reading assignments. (40% of the final grade)
- Team presentation: A list of presentation topics on biotechnology will be given by the instructor. The students' performance will be evaluated by their

peers. (10% of the final grade) Each team should also provide two Q-A to the instructor after the presentation.

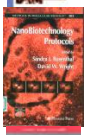
- Short quiz: A short quiz on the student presentations will follow, using the questions provided by each team. (10% of the final grade)
- Final design project: The student will be asked to write a short research proposal based on the course contents. A topic will be announced 3 weeks before the due date. Again, the students will form 3-4 groups and work on the short proposal. In the last lecture, we will 'mimic' a NIH study section to evaluate the proposals and acquaint the students with the review process. (40% of the final grade)

Course Pre-requisites: General chemistry and biology.

Homework: Selected research articles will be posted online after lectures as reading assignments.

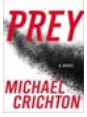
Textbook: There is no required textbook for this course. Related reference books include:

Nanobiotechnology-Concepts, Applications and Perspectives
edited by CM Niemeyer and CA Mirkin, Willey-VCH ISBN 3-527-30658-7



NanoBiotechnology Protocols in Methods in Molecular Biology Series
edited by SJ Rosenthal and DW Wright, Humana Press, ISBN: 1-58829-276-2

Understanding Nanotechnology
by Scientific American, ISBN: 0446679569



Prey (a novel)
by Michael Crichton, ISBN: 0066214122

Student Learning Outcomes: Upon completing this course, students will be able to

- understand, explain, and discuss scientific papers in the bionanotech field.
- give oral presentations based on the scientific literature in bionanotechnology.
- apply nanotechnology and biotechnology approaches in future research.