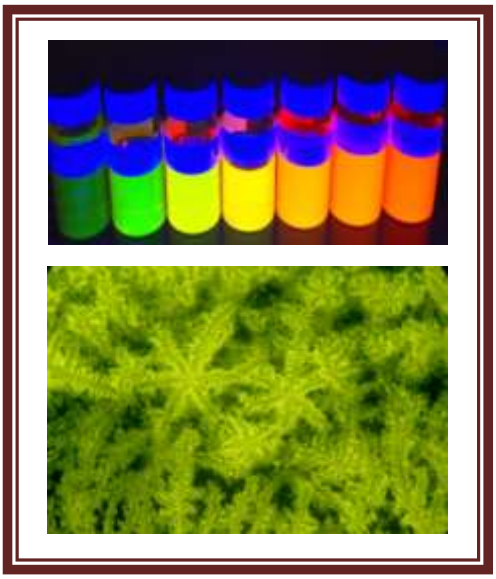
Syllabus

Introduction to Nano-Bio Physics

Spring 2008, MW 9:30 -10:50, SH 105



PHYS 5391-002 SEM 24402 for the graduate course, PHYS 4391-010 LEC (25648) for the undergraduate course.

Instructor
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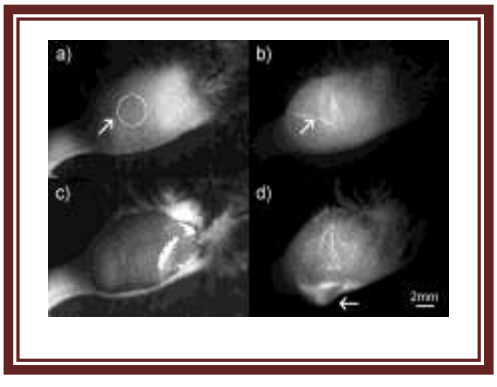
Office Hours: Tuesday: 3:00-4:30 PM, Friday: 4:00 – 5:00 PM; Other times by appointment

Course Description

The objective of this course is to provide students with an in-depth understanding of the Physics of Nanotechnology and its biological applications. The course is composed with three parts: Nanoparticle Physics, Biological Physics, and Nano-Bio Physics. In the first part, the Physics of Nanotechnology will be introduced, such as Physics of Quantum size confinement, nanoparticle preparation and characterization, nanoparticle optical properties, Physics of metallic, semiconductor, magnetic, organic, and doped nanoparticles, carbon nanotube, nanowires and single electron transistors. In the second part, basic concepts such as cell biology, DNA, RNA, Gene expression, energy and photosynthesis will be introduced. The third part is the biological applications of nanotechnology, we will focus on how to understand the PHYSICS of these applications. Topics in this part include Bioconjugation Chemistry and Physics, cellular imaging, in vivo imaging, nanoprobles for nucleic and hybridization detection, energy transfer based sensing, X-ray medical imaging and nanoparticle therapeutics. We will concentrate on the Physical Aspects of these applications. For examples, what is the Physics behind the X-ray storage imaging enhancement using nanoparticles and what is the Physical mechanism for energy transfer in nanoparticle system and related sensors? The understanding of the Physical objectives for these applications will be helpful for the exploration of Nano-Biotechnology. Key advances from the recent literature will be reviewed and introduced to students as supplemental topics.



Course Outcomes:

1) Students should be able to understand the basic concepts in biological systems;
2) Students should be able to master the general concepts in Nanotechnology;
3) Students should be able to understand the Physics of Nanoscale Materials
4) Students should be able to master the biological applications of nanotechnology and understand the Physics of these applications;

5) Students should be able to learn how to use the modern Nanotechnology to solve some practical issues,
6) Students should be able to gain the technique and know-how for scientific investigation, scientific writing and presentation skills.

Textbooks

There is no standard textbook for this course. The materials adopted in the lectures are collected from a large volume of books, publications, presentations and from the instructor's own research projects. Lecture Notes will be provided to students. Attending class is the most effective way for learning in this course. Exams will be based on lecture notes. Books listed below are good reference books for this course:

1. Nanochemistry: A Chemical Approach to Nanomaterials (Hardcover) by Geoff Ozin, A Arsenault

Publisher: Royal Society of Chemistry; 1 edition (November 22, 2005)

ISBN: 085404664X

2. Nanoscale Technology in biological systems, Ralph S. Greco, Fritz B. Prinz, R. Lane Smithm CRC Press, 2005

3. Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience by Edward L. Wolf **Publisher:** Wiley-VCH; 2 edition (October 20, 2006) **ISBN:** 3527406514

4. Cancer Nanotechnology, eds. H. S. Nalwa and Thomas Webster, American Scientific Publishers, 2007, **ISBN: 1-58883-071-3**

7. Introduction to Nanotechnology, Charles P. Poole, Jr., Frank J. Owens; John Wiley & Sons, 2003, ISBN 0471079359

8. Nanobiotechnology Molecular Diagnostics: Current Techniques and Applications (Horizon Bioscience) (Hardcover), by K.K. Jain

Publisher: Taylor & Francis; 1 edition (March 1, 2006), **ISBN:** 1904933173

Homework, Exams and Grading

Grading policy:

Homework	40 %
Quiz:	10 %
Mid-term test:	20 %
Final Exam	30 %