

Summer Academy in Applied Science and Technology Nanotechnology 2014

Welcome to University of Pennsylvania's SAST Nanotech Program!

Nanotechnology, shortened, "Nanotech," is the study of the control of matter on an atomic and molecular scale. Generally, nanotechnology deals with structures of the size 100 nanometers (nm) or smaller, and involves developing materials or devices within that size. There has been much debate on the future implications of nanotechnology. Nanotechnology has the potential to create many new materials and devices with wide ranging applications, such as in medicine, electronics, and energy production. On the other hand, nanotechnology raises many of the same issues as with any introduction of new technology, including the concerns about the toxicity and environmental impact of nanomaterials.

This class with focus on the atomic and molecular structure of nanomaterials and other concepts necessary to understanding why very small systems exhibit unique behavior. We will also explore various applications. Through lecture, class discussion, and labs, we will cover topics in nanomaterials, nanofabrication techniques, imaging technology, real-life applications of nanotechnology, and nanoscience ethics.

Class time and dates:

July 7 – July 25, Monday – Friday, 9AM – 5PM

All students should begin each morning and afternoon in Berger Auditorium unless advised otherwise.

Location:

AM: Laboratory Sessions (225 Skirkanich)

PM: Lecture and other Activities in Berger Auditorium (Skirkanich)

Grading:

Lecture		Lab	
Final Presentation	20%	Lab Reports	15%
Final Paper	10%	Lab Exam	20%
Final Poster	5%	Poster Preview	5%
Quizzes (2)	5%		
Project Proposals	10%		
Final Exam	10%		
	60%		40%

The SAST Staff

Instructor: Dr. Marilyn Huff

Laboratory Instructor: Dr. Robert Bucki

Teaching Assistants: Kailash and Jisoo

Resident TAs: Jesse, Ravit, Morgan and Kevin

SAAST Nanotech 2014 Syllabus

Date	Laboratory (AM)	Lecture (PM)
Monday, July 7	<i>Welcome Assembly</i> Introduction and Safety	Introduction to Nanotechnology Atomic Structure Atomic Bonding
Tuesday, July 8	Important Laboratory Skills	Lattices Nanostructures
Wednesday, July 9	Preparation of Nanoparticles	Electron Microscopy Scanning Probe Microscopy
Thursday, July 10	Functionalization of Nanoparticles	<i>Tour of Singh Center Characterization facilities</i> <i>Quiz 1</i> Nanofabrication
Friday, July 11	Nanoparticles, DNA, and bacteria	Bottom Up Fabrication Quantum Dots <i>Project Topic Selection</i>
Monday, July 14	Large Unimolecular Vesicles	<i>Tour of Singh Center Nanofabrication facilities</i> Nanomedicine
Tuesday, July 15	Biological activity of nanoparticles	<i>Tour of Singh Center Nanofabrication facilities</i> <i>Quiz 2</i> <i>Guest Lecture: Praful Nair</i> <i>Self Assembly</i>
Wednesday, July 16	Recombinant DNA	<i>Tour of Singh Center Nanofabrication facilities</i> <i>Guest Lecture: Dr. Daeyeon Lee</i> <i>Microfluidics</i> <i>Guest Lecture: Dr. Prathima Nalam</i> <i>Nanocharacterization</i>
Thursday, July 17	Recombinant DNA <i>Master Lecture</i>	<i>Tour of Singh Center Nanofabrication facilities</i> <i>Project Proposals</i> <i>Guest Lecture: Frank Streller</i> <i>Nanosensors</i>
Friday, July 18	<i>Field Trip to University City Science Center</i>	<i>Tour of Singh Center Nanofabrication facilities</i> <i>Project Proposals</i>
Monday, July 21	Green Fluorescent Protein <i>Admissions Workshop</i>	Solar Cells <i>Guest Lecture: Pedro Ducos</i> <i>Biosensors</i>
Tuesday, July 22	<i>Poster Preview</i> Liquid Crystals	Nano and the Environment <i>Guest Lecture: Dr. Dave Issadore</i> <i>Lab on a Chip</i>
Wednesday, July 23	Lab Exam Solar Cells	Exam Submit Posters
Thursday, July 24	Nanotechnology Wrap up	Practice Presentations
Friday, July 25	Presentations, Poster Session, and Graduation	

SAAST NANOTECHNOLOGY TOPICS

Week I

1. Laboratory Safety, Procedures and Regulations. Nanotechnology in different aspects of human life.
2. Measuring and dispensing liquids. How to Pipette.
3. Preparation of magnetic nanoparticles useful for biomedical applications.
4. 6-APA functionalization of MNP
5. MNP interactions with bacteria. Bacteria killing assay. Activity against bacteria biofilm.

Week II

6. Bacteria killing assay read out. Evaluation of biofilm mass using CV staining
7. Preparation of LUVs (100 nm containing PS) Extrusion of multilamellar liposomal suspensions using membranes with a pore size of 0.1 μ m Testing procoagulant activities of PS/LUVs. Preparation of fibrin substrate with antibacterial activity (with addition of ceragenin CSA-13).
8. Recombinant DNA Technology (part I/ part II). pGLO™ Bacterial Transformation.
9. Recombinant DNA Technology (part III - data collection and analysis). Restriction analysis.
10. Field trip to US Science Center.

Week III

11. Nanocrystalline Solar Cell Lab
12. Poster preview. LCD Lab.
13. Final exam (Lab report due).
14. Liquid Crystal Thermometer Lab. Exam results
15. Presentations