Educational Goals and Learning Outcomes

Overall goals: The proposed minor and other program activities will facilitate and promote:

- Learning comprehension in basic principles of nanoscience and nanoscale engineering
- Understanding applications of nanotechnology to engineering and medical systems
- Student engagement and motivation
- Interdisciplinary experience and teaming
- Generating a supportive, integrated learning community – a minor of the “community of scientists” which provides the structure for scientific advancement.
- Development of an appreciation for life-long learning
- A global understanding of the impacts and issues regarding nanotechnology and applications

Specific Course Learning Objectives: In addition to the overall program in Nanotechnology Studies, two courses have been developed specifically for the Minor: Introduction to Nanotechnology and Research (NTS 301) and Advanced Nanotechnology and Research (NTS 400). Both have been reviewed by an engineering college-wide committee (with representation from all Departments in the College of Engineering and the College of Arts and Sciences at Stony Brook University) and are now incorporated in the offerings of the University. Learning objectives for these two courses are:

Learning objectives of the Introduction to Nanotechnology Studies course include:
- Understanding basic interdisciplinary nature of nanotechnology: (physics, chemistry, computer and mechanical properties, biotechnology)
- Understanding societal impact and managing possible risks of nanotechnology: present and future
- Understanding some of the basic research tools and techniques involved in nanotechnology research and manufacturing
- Having enough of an introduction to see how student interests are connected to nanotechnology and how students can get involved in nanotechnology research

Learning objectives of the Nanotechnology and Research course include:
- Understanding the professional research enterprise
- Writing a journal-quality manuscript
- Write a research proposal in response to an RFP
- Writing a research proposal in response to a Request for Proposal
- Student learn about: nanomaterials, quantum dots, nanowires, carbon nanotubes, and use analytical techniques (atomic force microscopy, electron microscopy, and Raman microscopy)

Course design: Introduction to Nanotechnology Studies: A co-taught, cross-disciplinary course in the sciences and applications of nanotechnology, as well as societal impact, safety and business issues

Research: Students perform independent research projects related to nanotechnology applications in their area of study

Approach/Methods

Recruitment: Activities at University and College of Engineering and Applied Sciences programs

First year students from WISE (Women in Science and Engineering)

NTS 102: "Nanotechnology Fact and Fiction"

First year 1 credit seminar using science fiction to discuss perceptions of nanotechnology (20 students per year)

Recruitment: NTS 201 Research and Creative Activities

ESI499: Independent research on Design of Carbon Nanotubes: Structures, Chemistry and Applications

Examples of undergraduate research projects for NTS:

- Jonathan Hu
- Seon Kyuck Sik Seo
- Part
- Y. Liu
- P. Lu

Mechanism of Metal Nanoparticle Formation in Inorganic Materials: Novel Nanoparticle Growth and Characterization (Chemistry of Water in Nanoparticles)


Feedback from students in the program is overwhelmingly positive and participation is growing:

The first annual Nanotechnology Studies Undergraduate Research Symposium was held on April 30th, 2008. The program (images) at left included student speakers and posters detailing undergraduate research activities related to nanotechnology.

To generate a greater variety of research opportunities for NTS students, we are working with faculty in business, computer science, biology and other less traditional sources to develop collaborative research projects.

Broad Impact and Project Expansion

Interactive website developed, which includes on-line virtual conference room (using Adobe Connect), research opportunity dissemination and undergraduate research highlights: www.stonybrook.edu/unique

Expansion through new collaborations with Departments which were not original participants (Physics, Chemistry, School of Business)

Related projects being developed for K-12 outreach (with Brookhaven National Laboratory), teacher education, advanced technical training for local industry and graduate student training

NSF-Science Education for New Civic Engagements and Responsibilities (SENCER) implementation project: The Impact of Socio-Economic Diversity on the Global Development and Deployment of Nanotechnology

Joint project with Departments of Electrical Engineering, Biomedical Engineering, and Technology, and the program in Engineering Science

Enhance nanotechnology education through exploration of applications to societal needs in the developing world

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