EPD 690: Seminar in Nanotechnology and Society
Analytical and Pedagogical Approaches

Instructors:
Clark Miller, Science and Technology Studies
Wendy Crone, Engineering Physics
Karin Ellison, Graduate School
Greta Zenner, Materials Research Science and Engineering Center

Course Credit: 1 or 3 credits (see below)

EPD 690 (Section 48)
Class Number: 63535
Tuesdays, 5:00-6:00 pm (5-7 p.m. for 3 credit option)
Location: 514 Engineering Research Building

Course Objectives:

In recent years, nanotechnology has emerged as an exciting new arena of scientific research and technological innovation. At the same time, important questions have arisen about the technology's potential social, ethical, and environmental implications by prominent technology leaders, nanotechnology boosters, science fiction authors, policy officials, and environmental organizations. This seminar will offer an opportunity for graduate students from across campus, including the natural and social sciences, humanities, and engineering, to explore these questions and reflect on the broader place of technology in modern societies. No special prerequisites are required.

The seminar will be available for either 1 or 3 credits. Students who opt for the 1-credit option will be expected to attend the seminar's first hour, read and discuss class materials, and write a one-page response essay each week. This part of the seminar will focus on theories and approaches to understanding the social dimensions of technology, applied to the case study of nanotechnology.

Students who opt for the 3-credit option will also be expected to attend the seminar's second hour (to follow immediately after the first) and to develop over the course of the semester an annotated syllabus and teaching materials for an undergraduate seminar in nanotechnology and society. This latter part of the seminar is intended to provide graduate students with approaches, materials, and skills for teaching undergraduates how to think critically about the social aspects of technology. It is intended that these will be of value to future educators who want to teach such topics, either as stand alone courses or as part of another course.

Contact Prof. Clark Miller, Miller@Lafollette.wisc.edu, with questions.
Other contact information: Wendy Crone (crone@engr.wisc.edu); Greta Zenner (gmzenner@wisc.edu); Karin Ellison (kellison@bascom.wisc.edu). Office hours will be by appointment.

Grading for the 1-credit course will be determined on the basis of two factors:
- 50% Participation: Students will be expected to attend each class session, unless an absence is discussed with Prof. Miller prior to class, and to contribute to classroom discussions in each session.
- 50% Reading Responses: Students are required to submit a one-page, single-spaced response essay to each week's readings. These essays are due on the course website on Sunday evening.

Further details regarding requirements and materials for the 3-credit version of the course can be found in a supplementary syllabus.

<u>Course Activities</u>

Week 1: Course Introduction

Week 2: What is Nanotechnology? Why Do We Care about Its Societal Dimensions?
- Daniel Ratner and Mark Ratner, "Introducing Nano" and "Size Matters," *Nanotechnology: A Gentle Introduction* (Upper Saddle River: Pearson Education, 2003).
- M. C. Roco, "Broader Societal Issues of Nanotechnology," *Journal of Nanoparticle Research* 5 (2003): 181-189.
- Langdon Winner, testimony to Congress.
- Michael Crichton, "Introduction: Artificial Evolution in the 21st Century," *Prey*, 2002.

Week 3: What is Progress?
- Leo Marx, "Does Improved Technology Mean Progress?"
- Jack Uldrich and Deb Newberry, *The Next Big Thing is Really Small* (New York: Crown Business, 2003).
- Classroom discussion: What does Marx's argument imply about current discussions of the societal benefits of nanotechnology? Can we think of ways in which nanotechnology innovations might not necessarily contribute to progress?

Week 4: Technologies as Forms of Life
- Langdon Winner, "Technologies as Forms of Life," *The Whale and the Reactor* (Chicago: University of Chicago Press, 1986).
- Assignment: Find a news article describing an application of nanotechnology. Describe a form of life that might emerge involving this application, addressing who might see it as progressive and who might not.

Week 5: Social Choices and Technological Change
- Ronald Kline and Trevor Pinch, "Users as Agents of Technological Change: The Social Construction of the Automobile in the Rural United States," *Technology and Culture* 37: 763-795.
- Michael Flynn, "Soul of the City," *Analog* February, 1989: 100-105.

- Classroom discussion: Are there other examples that you can think of in which users are shaping current technologies? What does this mean for how we think about the societal aspects of nanoscience and nanotechnology?

Week 6: The Politics of Technological Change
- Langdon Winner, "Do Artifacts have Politics?" *The Whale and the Reactor* (Chicago: University of Chicago Press, 1986).
- Michael Crow and Daniel Sariewitz, "Nanotechnology and Societal Transformation." *Societal Implications of Nanoscience and Nanotechnology* (Washington: NSF, 2001).
- Classroom discussion: Is technology political? What does this apply for how we think about technological design?

Week 7: The Military and New Technologies
- David Noble, "Command Performance: A Perspective on Military Enterprise and Technological Change," *Military Enterprise and Technological Change* (Cambridge: MIT Press, 1987).
- David Talbot, "Super soldiers," *MIT Technology Review* Oct 2002, 105(8): 44-50.
- "Soldier of the Future," movie from the MIT Institute for Soldier Nanotechnologies.
- Chris Gray, *Cyborg Citizen: Politics in the Post-Human Age* (New York: Routledge, 2001). Chapter on military technologies.
- What is the relationship between the military and new technologies? What interests does the military have in nanotechnology?

Week 8: Technological Accidents
- Charles Perow, "Introduction" and "Normal Accident at Three Mile Island," *Normal Accidents* (Princeton: Princeton University Press, 1984).
- What is a "normal accident"? Do Perow's concerns apply to nanotechnology?

Week 9: Technology, Risk, and Society
- Sheldon Krimsky and Alonso Plough, "The Release of Genetically Modified Organisms into the Environment: The Case of Ice Minus."
- Brian Wynne, "Misunderstood Misunderstandings: Social Identities and Public Uptake of Science," *Misunderstood Misunderstandings?* (Cambridge: Cambridge University Press, 1995).
- Why do experts and lay publics sometimes arrive at different reasoning regarding the risks of technologies?

Week 10: Nanotechnology Risks – Environment and Health Impacts
- Masciangioli and Zhang, "Environmental Technologies at the Nanoscale," *Env Sci & Tech*, March 1, 2003: 102A-108A.
- David Warheit, "Nanoparticles: Health Impacts?" *Materials Today* Feb. 2004: 32-35.
- Ivan Amato, "Nano's Safety Chekup," *MIT Technological Review* Feb. 2004, 107(1): 22-23.
- David Rotman, "Measuring the Risks of Nanotechnology," *MIT Technology Review* Apr. 2003 106(3): 71-73.
- How should we approach questions of environment and health risks associated with nanotechnology?

Week 11: Nano-Critics
- ETC Group, *The Big Down*.
- Greenpeace, *Future Technologies, Today's Choices*
- What social groups care about nanotechnology? What reasons do they give for their concerns?

Week 12: Government Assessments
- UK Royal Society, "Summary," *Nanoscience and Nanotechnologies: Opportunities and Uncertainties* July 2004: 2-11.
- John Marburger, opening address, "Workshop on Societal Implications of Nanoscience and Nanotechnology," NSF, 2003.

Week 13: Science Fiction
- Find and read at least one short story or at least part of a novel, or watch a science fiction movie or TV episode, dealing with futuristic nano-society. Examples include Michael Crichton's *Prey* or Neil Stephenson's *The Diamond Age* or at least a couple *Star Trek* episodes.
- Consider the advantages and disadvantages of science fiction as a medium for inquiring into and communicating about the societal aspects of nanotechnology.

Week 14: Technology and the Future
- Bill Joy, "Why the Future Doesn't Need Us," *Wired* April 2000, 8(4).
- Michael Dertouzos, "Not by Reason Alone," *MIT Technology Review*, Sep/Oct 2000, 103(5): 26.
- "Kurzweil vs. Dertouzos," *MIT Technology Review*, Jan/Feb 2001, 104(1): 80-84.
- Why is projecting out into the future of technologies so hard? How important is it to try anyway? If it's important, how should we approach the uncertainties involved?