

**Science & Technology Studies (STS) 201  
Nanotechnology and Society  
Spring 2005**

Time: 9:30 – 10:45 am, Tuesdays and Thursdays  
Location: 58 Bascom

Instructor: Ricky Leung

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Office Hours: Tues 11-1 and by appointment

Course description:

In recent years, nanotechnology has emerged as a multidisciplinary field of research and development. While nanotechnology promises scientific breakthroughs, the emerging technology has also generated skepticisms and controversies in society. To increase your understanding about the relationship between nanotechnology and society, this course will cover a wide range of social issues that accompany the emergence of nanotechnology.

For this purpose, the course is organized around four major objectives:

1. To help you develop a basic understanding about the technical aspects of nanotechnology;
2. To learn about government initiatives, policies and regulatory bodies that are shaping the development of nanotechnology;
3. To find connections between theories from Science and Technology Studies (STS) and nanotechnology;
4. To design social studies for investigating nanotechnology-related topics.

All course materials are carefully chosen to reflect the wide scope of interests and debates that nanotechnology encompasses. However, this course is designed to be self-contained, and there is no prerequisite for enrolment. Students from all disciplines are welcome to participate in this course.

Course requirements:

1. Attendance and Participation:

You are expected to attend and participate in all class meetings.

2. Assignments:

- a. You should finish assigned readings before coming to each class session;
- b. You are expected to write two 4-page essays and one 1-page comments during the semester;
- c. You are expected to form a project group with 4-5 students for a class project. Each group will present their project in two class sessions (Proposal and Result), submit a project proposal, and a final report.

Grading:

1. Class participation and attendance: 20%
2. Two 4-page essays and One 1-page commentary: 30%
3. Mid-term exam 25%
4. Two class presentations: 10%
5. Proposals and Reports: 15%

\* Think-pieces for bonus points: 5-10% (Throughout the semester, you will have opportunities to write think-pieces for bonus points. I have already included some topics for think-piece on the syllabus. There will be additional topics available for writing think-pieces).

As the semester proceeds, I will provide more specific guidelines about various assignments.

### Textbooks and Readings:

#### *Required:*

All assigned readings are required unless marked “optional”. You may purchase a class reader that contains all reading assignments at the Life Science’s Copy Shop. The copy shop is located at Agricultural Engineering, Henry Mall.

#### *Optional:*

The following books are not required, but recommended for students who want to know more about nanotechnology and STS theories. You can purchase them at the University Book Store.

Fritz, Sandy and Scientific American. 2002. *Understanding Nanotechnology*. New York: Warner Books.

Ratner, Mark A. and Daniel Ratner. 2003. *Nanotechnology: A Gentle Introduction to the Next Big Idea*. Upper Saddle River, NJ: Prentice Hall/PTR.

Jasanoff, Sheila and Society for Social Studies of Science. 1994. *Handbook of Science and Technology Studies*. Thousand Oaks, CA: Sage Publications.

MacKenzie, Donald A. and Judy Wajcman. 1999. *The Social Shaping of Technology*. 2nd ed. Buckingham England ;, Philadelphia : Open University Press.

Pickering, Andrew (ed.) 1992. *Science as Practice and Culture*. Chicago: The University of Chicago Press.

### Academic Integrity:

For all class assignments, you are expected to express ideas and to sustain arguments in your own words. Otherwise, you are at risk of committing academic plagiarism.

Plagiarism ranges from the blatant—purchasing a term paper or copying on an exam—to the subtle—failing to credit another author with the flow of ideas in an argument. Simply changing a few words from the writings of other authors does not alter the fact that you are essentially quoting from them. Paraphrasing of this sort, where you use the words of another almost verbatim without acknowledging your source, is the most common form of plagiarism among undergraduates. When you state another author's viewpoint, theory, or hypothesis—especially when it is original or not generally accepted—you must also include a reference to the published work. In general, citations are unnecessary when the information is considered common knowledge or a matter of widespread agreement.

All papers prepared outside of class must have a bibliography at the end. This provides readers with a complete list of sources consulted, regardless of whether you quoted directly from them, and serves to acknowledge your intellectual debts to them. If you are unclear about collaborating, paraphrasing, quoting, or the need to indicate sources, I will be glad to speak with you and can recommend additional materials for clarification.

Properly acknowledging the use of the words of others and avoiding excessive quotation of the work of others will eliminate most plagiarism problems. If you want to quote from published work (including a web page), you must put the passage in quotation marks and provide a citation. Failure to maintain academic integrity in any portion of the academic work for the course shall be grounds for awarding a grade of **F** for that assignment.

Fortunately, the Writing Center has plenty of resources to help you avoid plagiarism. We will also spend time in class to discuss this issue.

Disabilities:

If you have a significant disability condition (e.g., physical, learning, psychiatric, vision, hearing, etc.), please contact me at the beginning of the semester. We will discuss what special arrangement you need to complete this course.

Reading list and Class Schedule:

Week 1: What is nanotechnology? Excitement and Concerns

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
1/18 (T)	1a. Introduction 1b. / 2a. Ralph Merkle, 1997. "It's a Small, Small, Small, Small World." <i>MIT Technology Review</i> (Feb/Mar 1997), p.25.	Organization / Group formation / Pictures taking
1/20 (R)	2b. Daniel Ratner and Mark Ratner, 2003. "Introducing Nano," and "Size Matters," <i>Nanotechnology: A Gentle Introduction</i> . Upper Saddle River: Pearson Education.	Understanding size of nano

Week 2: Visions and Debates

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
1/ 25 (T)	1a. Patrick Bailey, 2004. "Unraveling the Big Debate over Small Machines," <i>BetterHumans</i> (Aug 16, 2004). 1b. Reuters, 2003. "Get Ready for New 'Nano' Products," <i>Wired News</i> . (July 23, 2003).  Skim: 1c. Richard Feynman, 1959. "There is plenty of room at the bottom." Reprinted in <i>Feynman and Computation: Exploring the Limits of Computers</i> . MA: Perseus.	Review size  Debates  New products  Discussions
1/27 (R)	2a. Nanomedicine C A Haberzettl, 2002. "Nanomedicine: destination or journey?" <i>Nanotechnology</i> 13: R9-R13.  2b. Robert A. Freitas, 2001. "Robots in the bloodstream: the promise of nanomedicine," <i>Novartis Journal Pathways</i> .  2c. G. Dan Hutcheson, 2004. "The First Nanochips," <i>Scientific American</i> (April 2004).  Optional: 2d. Nanosensors National Research Council. Selections from "Ch 3," <i>Implications of Emerging Micro- and Nanotechnologies</i> . <a href="http://books.nap.edu/books/030908623X/html/80.html">http://books.nap.edu/books/030908623X/html/80.html</a>	Discuss pros and cons of various nanoproducts.  Watch simulation clips and images

Week 3: Nanomaterials and Environmental Concerns + Writing Guidelines

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
2/1 (T)	<p>1a. Gerd Binnig and Heinrich Rohrer, 1987. "The Scanning Tunneling Microscopy," <i>Reviews of Modern Physics</i> 59: 615-629.</p> <p>1b. UW Writing Center "Quoting and Paraphrasing Sources," <i>Writer's Handbook</i>. <a href="http://www.wisc.edu/writing/Handbook/QPA_plagiarism.html">www.wisc.edu/writing/Handbook/QPA_plagiarism.html</a></p> <p>1c. Jack Mason, 2002. "Nanocomposites in tennis balls lock in air, build better bounce," <i>Small Times</i> (Jan 29, 2002).</p> <p>1b. Philip Collins and Phaedon Avouris, 2000. "Nanotubes for Electronics," <i>Scientific American</i> (Dec 2000). p.62-69.</p>	<p>Discuss the environmental impacts of nanotechnology</p> <p>Writing / Avoid plagiarism</p>
2/3 (R)	<p>2a. Ivan Amato, 2004. "Nano's Safety Checkup," <i>Technology Review</i> (February 2004), p. 22-28.</p> <p>2b. Rick Weiss, 2004. "For Science, Nanotech Poses Big Unknowns," <i>Washington Post</i> (Feb 1, 2004).</p> <p>2c. Mark Sampson, 2004. "Type of buckyball shown to cause brain damage in fish," <i>Eurekaalert</i> Mar 28, 2004.</p> <p>2d. Barnaby J. Feder, 2004. "Health Concerns in Nanotechnology," <i>New York Times</i>. Mar 29, 2004</p>	

**Entire group meets with instructors**

#### Week 4: Minimizing Pollutions or Enhancing Environmental Qualities?

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
2/8 (T)	1a. Tina Masciangioli & Wei-xian Zhang, 2003. "Environmental Technologies at the Nanoscale," <i>Environmental Science &amp; Technology</i> Mar 03: p.102-108 (Mar 1, 2003).  1b. Wei-xian Zhang, 2003. "Nanoscale iron particles for environmental remediation: An Overview," <i>Journal of Nanoparticle Research</i> 5: 323-332.  Skim: 1c. Graham Collins, 2001. "Shamans of Small," <i>Scientific American</i> 285: 86-91 (Aug 30, 2001).	Design a nanotechnology research center.
2/10 (R)	2a. Testimony of Vicki Colvin before the U.S. House of Representatives Committee on Science in regard to "Nanotechnology Research and Development Act of 2003," (April 9, 2003).  2b. US Environmental Protection Agency, 2003. National Nanotechnology Coordinating Office (NNCO) Interagency Research Meeting/Workshop – Nanotechnology and the Environment: Applications and Implications  <a href="http://es.epa.gov/ncer/publications/nano/agenda.html">http://es.epa.gov/ncer/publications/nano/agenda.html</a>	Role playing exercise

#### Week 5: STS Research

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
2/15 (T)	1. Andrew Pickering, 1992. "From Science as Knowledge to Science as Practice." In Andrew Pickering (ed.) <i>Science as Practice and Culture</i> . Chicago: The University of Chicago Press. pp.1-28.	Overview of STS
2/17 (R)	2. Joan Fujimura, 1987. "Constructing 'Do-able' Problems in Cancer Research: Articulating Alignment," <i>Social Studies of Science</i> 17: 257-293.	Example of STS research

#### **Due: Decide Topic for Group Projects**

Week 6: Nanotechnology, Organizational Complexity and Technological Risk

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
2/22 (T)	1a. David Rotman, 2003. "Measuring the risks of nanotechnology," <i>Technology Review</i> 106:3 (April 2003).  1b. Diane Vaughan. 1997. "Trickle Down Effects," <i>California Management Review</i> 39: 80-102.	How to build a safe nanotech organization?
2/24 (R)	2a. Charles Perrow, 1981. "Normal Accidents at Three Mile Island," <i>Society</i> 18: 17 – 26.  2b. Karlene Roberts, 1988. "Some Characteristics of One Type of High Reliability Organizations," <i>Organization Science</i> 1: 160-176.	Discuss various concepts in Perrow's and Roberts' papers, whether safe organization is possible?
<b>Mid-term Exam</b>		

Week 7: Nanotechnology as "Big Science"?

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
3/1 (T)	1a. Gary Stix, "Little Big Science," <i>Scientific American</i> 285: 32-37 (Aug 30, 2001).  1b. Peter Galison, 1992. "Introduction: The Many Faces of Big Science." In Peter Galison and Bruce Hevly (eds) <i>Big Science: The Growth of Large-Scale Research</i> . Stanford, CA: Stanford University Press. Pp. 1-20.	What is big science?
3/3 (R)	2a. M. C. Roco, 2003. "Broader Societal Issues of Nanotechnology." <i>Journal of Nanoparticle Research</i> 5:181-89.  2b. M.C. Roco, 2004. "The US National Nanotechnology Initiative after 3 years (2001 -2003)," <i>Journal of Nanoparticle Research</i> 6: 1-10	How is nanotechnology a big science in US?

Week 8: Commerce

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
3/8 (T)	1a. Jack Uldrich and Deb Newberry. 2003. "Interesting – But What Do I Have to Do?," <i>The Next Big Thing Is Really Small</i> . New York: Crown Business  1b. Cyert, R.M. and James March. 1963. "A Summary of Basic Concepts in the Behavioral Theory of the Firm." <i>A Behavioral Theory of the Firm</i> . Prentice Hall. pp. 114-127.	Role playing as nanotech business organizations.
3/10 (R)	1c. Patrick Justo, 2003. "Nanotech Gets Down to Business," <i>Wired News</i> (May 14, 2003). Choose one for review:  Jim Gimzewski and Victoria Vesna, "The Nanomeme Syndrome: Blurring of fact & fiction in the construction of a new science," <i>Technoetic Arts</i> 1.  Cynthia Selin, "Expectations in the Emergence of Nanotechnology,"	<b>Group presenting articles</b>

**Mid-term Evaluation**

Week 9: Review & Preview

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
3/15 (T)	Review  <b>Proposals due</b>  <b>Presentation of Proposal 1</b>	
3/17 (R)	<b>Presentation of Proposal 2</b>  Preview of schedule after Spring Break  <b>Essay 1 due</b>	<b>Think piece</b>

3/19 – 3/27: Spring Recess

Week 10: Convergence of Technologies or Interdisciplinarity?

*Date*                      *Readings / Assignments Due*                      *Major themes / Activities*

3/29  
(T)                      1. Selections from Philip Anton, Richard Silbergliitt, and James Schneider, 2001. "The Global Technology Revolution: Bio/nano/Materials Trends and Their Synergies with Information Technologies by 2015," *Prepared for the National Intelligence Council*. Santa Monica: RAND National Defense Research Institute.

**1-page comment on proposal due**

3/31  
(R)                      2. Peter Galison, 1997. Selections from "Monte Carlo Simulations: Artificial Reality," and "Trading Zone," *Image and Logic: A Material Culture of Microphysics*, Chicago: University of Chicago Press.

**Attend Galison's talk**

**Think piece topic**

Week 11: The Military

*Date*                      *Readings / Assignments Due*                      *Major themes / Activities*

4/5  
(T)                      1a. David Talbot, 2002. "Super soldiers," *Technology Review* 105: 44-50 (Oct 2002).                      Activity: Watch MIT movie clip.

1b. Rodney Brooks, 2002. "The Merger of Flesh and Machines," in John Brockman (ed) *The Next Fifty Years: Science in the First Half of the 21<sup>st</sup> Century*. New York: Vintage Books.                      **Think piece topic**

4/7  
(R)                      2a. Arnall, Alexander H. 2003. Selections from "Future Technologies, Today's Choices: Nanotechnology, A.I. and Robotics," *A Report for the Greenpeace Environmental Trust* (July 2003).                      Role playing as town meetings.

2b. Center for Responsible Nanotechnology. 2003. *A Technical Commentary on Greenpeace's Nanotechnology Report* (Sep 2003).

**Attend Nanotech Symposium at UW (TBA)**

Weel 12: Nanotechnology and Government

*Date Readings / Assignments Due*

*Major themes /  
Activities*

4/12

1a. National Nanotechnology Initiative, *Nanotech Facts*.  
[http://www.nano.gov/html/facts/home\\_facts.html](http://www.nano.gov/html/facts/home_facts.html)

(T)

1b. M. M. Crow, and D. Sarewitz. "Nanotechnology and Societal Transformation." In *Societal Implications of Nanoscience and Nanotechnology Workshop organized by NTSC, NSF* (Sep 28-29, 2000).

4/14

2a. Langdon Winner, 1986. "Technologies as forms of life," and "Do Artifacts Have Politics?" in *The Whale and the Reactor: A Search for Limits in an Age of High Technology*. Chicago: University of Chicago Press.

(R)

2b. Testimony of Langdon Winner before the U.S. House of Representatives Committee on Science in regard to "The Social Implications of Nanotechnology" (April 9, 2003).

**Think piece  
topic**

2c. Shelia Jasanoff, 1990 [1994]. "Peer Review and Regulatory Science," and "EPA and the Science Advisory Board," *Fifth Branch*. Cambridge: Harvard University Press.

**Attend Jasanoff's talk**

Week 13: Public Understanding of Science and Nanotechnology

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
4/19 (T)	1a. Michael Crichton, 2002. "Introduction: Artificial Evolution in the 21st Century." <i>Prey</i> . New York: Harper Collins.  1b. Steve Shapin, 1992. "Why the public ought to understand science-in-the-making," <i>Public Understanding of Science</i> 1: 27-30.  1c. Bryan Wynne, 1992. "Misunderstood misunderstanding: Social Identities and Public Uptake of Science," <i>Public Understanding of Science</i> 1: 281-304.	Discuss the importance of public involvement.
4/21 (R)	2a. Michael Flynn, 1989. "Soul of the City," <i>Analog</i> : 100-105.  2b. Ronald Kline and Trevor Pinch, 1996. "Users As Agents of Technological Change: The Social Construction of the Automobile in the Rural United States." <i>Technology and Culture</i> 37:763-95.	Students find a fictional article.  Discuss the role of fiction in public understanding.

Week 14: International Development of Nanotechnology

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
4/26 (T)	TBA  <b>Essay 2 due.</b>	
4/28 (R)	Sharon Traweek, 1992. "Border Crossings: Narrative Strategies in Science Studies and among Physicists in Tsukuba Science City, Japan," In Andrew Pickering (ed.) <i>Science as Practice and Culture</i> . Chicago: The University of Chicago Press. pp.429-465.	

Week 15: Future

<i>Date</i>	<i>Readings / Assignments Due</i>	<i>Major themes / Activities</i>
5/3 (T)	1. Joy, Bill. 2000. "Why the future doesn't need us," <i>Wired</i> (April 2000).  <b>Final Presentation 1</b>	
5/5 (R)	2a. Michael Dertouzos, "Not by Reason Alone," <i>Technology Review</i> 103: 26 (Sep/Oct 2003).  2b. Ray Kurzweil and Michael Dertouzos, 2001. "Kurzweil vs. Dertouzos," <i>Technology Review</i> 104: 80-84 (Jan/Feb 2001).  <b>Final Presentation 2</b>  <b>Final report due on 5/11/2005 (Wed) at 02:45 p.m.</b>	

Suggested topics for class projects:

1. Report from 2-3 interviews with scientists interested in nanotechnology at UW
2. Analysis of quantitative data about social perceptions on nanotechnology
3. Debates about nanotechnology from a historical perspective
4. The international development of nanotechnology
5. Comparing nanotechnology and other emerging technologies (e.g. biotechnology / A.I. / information technology)
6. Institutional / Organizational Support for the development of nanotechnology
7. Application of STS theories in nanotechnology
8. Other acceptable topics