STS 332 - NANOTECHNOLOGY AND SCIENCE REVOLUTION

Fall Semester 2006
2 to 3 pm MWF
Flawn Academic Center (FAC) 9

Instructor: Andy Karvonen
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Course Description

This course uses the emerging fields of nanoscience and nanotechnology to explore the complex relationship between society and technology. Studying scientific phenomena at very small scales has been a frequent practice for over a century but the recent emphasis on nanoscale research, design, and manufacturing has the potential to revolutionize almost all facets of human life. Many commentators have touted this new field as 'the Next Industrial Revolution'. Nano researchers are now working in a diverse range of fields including manufacturing, medicine, materials science, military, environmental protection, and energy generation. While these applications have many potential benefits to society, they also have undetermined social, legal, and ethical implications. A small group of social scientists in the growing field of Science and Technology Studies (STS) are examining the non-technical aspects of nanotechnology. The course will use STS theories and case studies to explore the various implications of nanotechnology.

There are three main objectives for the course:

1) To serve as an introduction to the emerging practice of nanotechnology and the related scientific and public debates.
2) To develop a critical approach to examining the relationship between scientific development, technological development, and society.
3) To hone our communication skills in reading, writing, speaking, and multimedia.

Readings

There is one required book for the course, available at the UT Co-op and other booksellers:

David E. Nye, *Technology Matters: Questions to Live With,* MIT Press, 2006

Additional book chapters and articles will be posted on the UT Blackboard website (blackboard.utexas.edu) throughout the semester. A bibliography of the required readings is provided in the course schedule on the following pages. Readings are to be completed by the date they are listed unless specified otherwise.

Assignments and Grading
Course grades will be based on class participation, daily/weekly assignments, quizzes, and the class project. Brief descriptions of each assignment are provided below and more detailed descriptions will be provided throughout the semester. Unless specified otherwise, assignments are due at the beginning of class.

Class Participation (15%) – Each student will be graded on participation. Participation means that as a class member, you attend class regularly and come prepared to discuss the assigned readings. Missing two or three class periods is acceptable and will not impact your participation grade. Missing more than three class periods without permission from the instructor will be reflected in your participation grade.

Daily/Weekly Assignments (35%) – Each class member is expected to submit daily and weekly assignments that may include brainstorming ideas, short (400-600 words) essays, news articles, informal presentations, and so forth. These assignments are intended to demonstrate your understanding of the course readings and give you an opportunity for thoughtful reflection.

Quizzes (20%) – A quiz will be given at the end of each section of the course. Each quiz will consist of short-answer questions and address the readings and class content for one section of the course (i.e., they are not cumulative). Sample questions will be provided by the instructor before each quiz. Quizzes are closed book and closed notes.

Class Project (30%) – The class project will be a collective effort by all class members to develop a website with various forms of media (text, audio, video, images). Each student will be assigned to a particular role for the project (webmaster, graphic designer, content editor, etc.) and contribute individually and in small groups. Each student will maintain a working journal that includes his or her ideas and contributions to the project as well as hours devoted to the project. This project will be described in detail in the near future.

**Extra Credit (5%) – The UT Science, Technology and Society Department will host a civic forum on 'Surveillance and You' on Saturday, October 21 from 9 am to 2 pm. Students are not required to attend but will receive extra credit for volunteering at the event and writing a two-page critique. More details will be provided before the event.

Your final grade for the course will be determined using the following scale, based on the total points earned in the course:

Grade	Description	Percentage
A	Excellent	90.0 to 105.0%
B	Above average	80.0 to 89.9%
C	Average	70.0 to 79.9%
D	Pass	60.0 to 69.9%
F	Failure	Below 60.0%

Students are welcome to check in with the instructor on a regular basis to inquire about their course performance.

Academic Conduct
All work that you submit for this course must be your own. Acts of plagiarism and other forms of cheating carry harsh penalties at UT and each student should take the issue of academic conduct very seriously. You are encouraged to study and discuss course material with class members but all assignments (unless otherwise directed) are to be written independently in your own words. When drawing information from another source, you must give credit by citing it as an endnote or footnote. Cheating on any assignments or quizzes will result in an F for the course. If you are unsure of what to do in a situation, ask the instructor. Further information on academic conduct can be found on the Blackboard website or in the UT General Information Catalog available from the Office of the Registrar (www.utexas.edu/student/registrar/).

Technology in the Classroom
Technology will be used on a regular basis in the classroom to facilitate discussions and illustrate concepts using multimedia. However, technology can also be a distraction if not used prudently. Laptop computers are allowed in the classroom but only for taking notes or referring to class materials. Surfing on the Web is not allowed unless it is for a specific class function. Cellular phones must be turned off or set to silent mode and text messaging is not allowed during class time.

Special Needs
Students with special learning requirements are encouraged to make arrangements with the instructor to accommodate their particular needs.

INTRODUCTION

8/30 Wed **Introduction**

9/1 Fri **Why Study Nanotechnology?**
Stix, Gary. 2001. "Little Big Science," *Scientific American* 285(3): 32-37.

THINKING ABOUT SCIENCE AND TECHNOLOGY

9/4 Mon [No class – Labor Day]

9/6 Wed **Scientific Revolution**
Hård, Mikael and Andrew Jamison. 2005. "The Scientific Reformation in Early Modern Europe," *Hubris and Hybrids: A Cultural History of Technology and Science,* New York, NY: Routledge, 19-43.

9/8 Fri **The Rise of Industry**
Cross, Gary and Rick Szostak. 2005. "Origins of Industrialization," *Technology and American Society: A History (Second Edition),* Upper Saddle Creek, NJ: Pearson, 53-67.

9/11 Mon **The Second Industrial Revolution**
Cross, Gary and Rick Szostak. 2005. "The Second Industrial Revolution," *Technology and American Society: A History (Second Edition),* Upper Saddle Creek, NJ: Pearson, 153-172.

9/13 Wed **What is Technology?**
Nye, David E. 2006. "Can We Define Technology?" *Technology Matters: Questions to Live With,* Cambridge, MA: MIT Press, 1-15.

9/15 Fri **The Allure of Technological Determinism**
Smith, Merritt Roe. 1994. "Technological Determinism in American Culture," *Does Technology Drive History? The Dilemma of Technological Determinism,* edited by Merritt Roe Smith and Leo Marx, Cambridge, MA: MIT Press, 1-35.

9/18 Mon **The Social Construction of Technology**
Nye, David E. 2006. "Does Technology Control Us?" and "Is Technology Predictable?" *Technology Matters: Questions to Live With,* Cambridge, MA: MIT Press, 17-47.

9/20 Wed **Technological Momentum**
Nye, David E. 2006. "How Do Historians Understand Technology?" *Technology Matters: Questions to Live With,* Cambridge, MA: MIT Press, 49-66.

Hughes, Thomas P. 1994. "Technological Momentum," *Does Technology Drive History? The Dilemma of Technological Determinism,* edited by Merritt Roe Smith and Leo Marx, Cambridge, MA: MIT Press, 101-113.

9/22 Fri **Business and Technological Development**
Nye, David E. 2006. "Should 'the Market' Select Technologies?" *Technology Matters: Questions to Live With,* Cambridge, MA: MIT Press, 135-159.

Cross, Gary and Rick Szostak. 2005. "Technology and the Modern Corporation," *Technology and American Society: A History (Second Edition),* Upper Saddle Creek, NJ: Pearson, 173-188.

9/25 Mon **Technology and Risk**
Nye, David E. 2006. "More Security, or Escalating Dangers?" *Technology Matters: Questions to Live With,* Cambridge, MA: MIT Press, 161-184.

Gladwell, Malcolm. 1996. "Blowup," *New Yorker,* 22 Jan 1996, 6 pages.

9/27 Wed **Debating Technology: The GMO Controversy**
Anderson, Dan R. 2001. "Biotechnology Risk Management: The Case of Genetically Modified Organisms (GMOs)," *CPCU Journal* 54(4): 215-230.

9/29 Fri **QUIZ 1**

NANOTECHNOLOGY PERSPECTIVES

10/2 Mon **How to Do Academic Research**
-No readings-

10/4 Wed **The Historical Development of Nanotechnology**
Peterson, Christine L. 2004. "Nanotechnology: From Feynman to the Grand Challenge of Molecular Manufacturing," *IEEE Technology and Society Magazine* 23(4): 9-15.

Kulinowski, Kristen. 2004. "Nanotechnology: From 'Wow' to 'Yuck'?" *Bulletin of Science, Technology & Society,* 24(1): 13-20.

Feynman, Richard P. 1959. "There's Plenty of Room at the Bottom," transcript of 29 December 1959 lecture at the annual meeting of the American Physical Society, downloaded from www.zyvex.com, 11 pages.

10/6 Fri **Revolution or Evolution?**
Drexler, K. Erik. 2004. "Nanotechnology: From Feynman to Funding," *Bulletin of Science, Technology & Society* 24(1): 21-27.

Smalley, Richard E. 2001. "Of Chemistry, Love and Nanobots." *Scientific American* 285(3): 76-77.

Baum, Rudy. 2003. "Nanotechnology: Drexler and Smalley Make the Case for and against 'Molecular Assemblers'," *Chemical and Engineering News* 81(48): 37-42.

10/9 Mon **Class Project Brainstorming**
-No readings-

10/11 Wed **The Threat of Gray Goo**
Joy, Bill. 2003. "Why the Future Doesn't Need Us," *Technology and the Future, Ninth Edition,* edited by Albert H. Teich, Belmont, CA: Thomson Wadsworth, 295-317.

Brown, John Seely and Paul Duguid. 2003. "A Response to Bill Joy and the Doom-and-Gloom Technofuturists," *Technology and the Future, Ninth Edition,* edited by Albert H. Teich, Belmont, CA: Thomson Wadsworth, 318-323.

10/13 Fri **U.S. Congressional Hearings on Nanotechnology**
U.S. Congress. 2003. *The Societal Implications of Nanotechnology,* Serial No. 108-13, 9 April 2003, 103 pages.

10/16 Mon **U.S. Congressional Hearings [continued]**
-No readings-

10/18 Wed **Regulation and Policy, Part 1**
Davies, J. Clarence. 2006. *Managing the Effects of Nanotechnology*. Project on Emerging Nanotechnologies, Woodrow Wilson International Center for Scholars, 34 pages.

Phoenix, Chris and Mike Treder. 2004. "Applying the Precautionary Principle to Nanotechnology," working paper from the Center for Responsible Nanotechnology (www.cmano.org), published January 2003 and revised in December 2003 and January 2004, 3 pages.

10/20 Fri **Public Perceptions of Nanotechnology**
Sheetz, Tanya, Jorge Vidal, Thomas D. Pearson, and Karen Lozano. 2005. "Nanotechnology: Awareness and Societal Concerns," *Technology in Society* 27(3): 329-345.

10/21 Sat ****EXTRA CREDIT** Civic Forum: Surveillance and You**

10/23 Mon **Who Funds Nanotechnology Research?**
Roco, M.C. 2003. "The US National Nanotechnology Initiative after 3 Years (2001-2003)," *Journal of Nanoparticle Research* 6: 1-10.

10/25 Wed **The Nanotechnology Industry**
Berube, David M. 2006. "Nano-Industry and Nano-Entrepreneurs," *Nano-Hype: The Truth Behind the Nanotechnology Buzz,* Amherst, NY: Prometheus Books, 213-243.

10/27 Fri **Investment in Nanotechnology**
Di Justo, Patrick. "Nanotech Gets Down to Business," *Wired News*, 14 May 2003, 3 pages.

Thayer, Ann M. 2004. "Nanotech Investing," *Chemical and Engineering News*, 83(18): 17-24.

10/30 Mon **Property Rights and the Law**
Vaidhyanathan, Siva. 2005. "Nanotechnology and the Law of Patents: A Collision Course," unpublished manuscript, 25 pages.

11/1 Wed **QUIZ 2**

11/3 Fri [No class]

NANOTECHNOLOGY APPLICATIONS AND FUTURES

11/6 Mon **Products in the Marketplace**
Berube, David M. 2006. "Applications of Nanoscience," *Nano-Hype: The Truth Behind the Nanotechnology Buzz,* Amherst, NY: Prometheus Books, 185-211.

11/8 Wed **Guest Lecture**
[Readings to be determined]

11/10 Fri [No class]

11/13 Mon **Nanomedicine**
Freitas, Robert. 2001. "Robots in the Bloodstream: The Promise of Nanomedicine," downloaded from kurzweilai.net, 5 pages.

Haberzettl, C.A. 2002. "Nanomedicine: destination or journey?" *Nanotechnology* 13: R9-R13.

11/15 Wed **Environmental Applications and Impacts, Part 1**
Masciangioli Tina, and Wei-Xian Zhang. 2003. "Environmental Technologies at the Nanoscale," Environmental Science and Technology 37(5): 102A-108A.

Berube, David M. 2006. "Nanohazards and Nanotoxicology," *Nano-Hype: The Truth Behind the Nanotechnology Buzz,* Amherst, NY: Prometheus Books, 275-304.

11/17 Fri **Environmental Applications and Impacts, Part 2**
ETC Group. 2004. *Nano's Troubled Waters.* 1 April 2004, downloaded from www.etcgroup.org, 5 pages.

Friedman, Sharon M. and Brenda P. Egolf. 2005. "Nanotechnology: Risks and the Media*," IEEE Technology and Society Magazine* 24(4): 5-11.

Colvin, Vicki L. 2003. "The Potential Environmental Impact of Engineering Nanomaterials," *Nature Biotechnology* 21(10): 1166-1170.

11/20 Mon **Military Nanotechnologies**
Altmann, J. and M. Gubrud. 2004. "Anticipating Military Nanotechnology," *IEEE Technology and Society Magazine* 23(4): 33-40.

Talbot, David. 2002. "Super Soldiers," *Technology Review* October 2002, 4 pages.

11/22 Wed **National Security and Nanotechnology**
Tolles, W.M. 2000. "National Security Aspects of Nanotechnology," in Societal Implications of Nanoscience and Nanotechnology, edited by Mihail C. Roco and Williams Sims Bainbridge, Boston, MA: Kluwer, 218-237.

11/24 Fri [No class – Thanksgiving Holiday]

11/27 Mon **Technology as Progress?**
Marx, Leo. 2003. "Does Improved Technology Mean Progress?" *Technology and the Future, Ninth Edition,* edited by Albert H. Teich, Belmont, CA: Thomson Wadsworth, 3-13.

11/29 Wed **Democratic Science and Technology Development**
Sclove, Richard E. 2000. "Town Meetings on Technology: Consensus Conferences as Democratic Participation," Science, Technology and Democracy, edited by Daniel Lee Kleinman, Albany, NY: SUNY Press, 33-48.

Jamison, Andrew. 2005. "On Nanotechnology and Society," *EASST Review* 24(2/3), downloaded from www.easst.net, 6 pages.

12/1 Fri **Ecological Utopias?**
Hughes, Thomas P. 2004. "Creating an Ecotechnological Environment," *Human-Built World: How to Think about Technology and Culture,* Chicago, IL: University of Chicago Press, 153-173.

12/4 Mon **Considering the Societal Implications of Nanotechnology**
Fisher, Erik and Roop L. Mahajan. 2006. "Contradictory Intent? US Federal Legislation on Integrating Societal Concerns into Nanotechnology Research and Development," *Science and Public Policy* 23(1): 5-16.

12/6 Wed **Preparing Society for a Transformation**
Mills, Kirsty and Charles Fleddermann. 2005. "Getting the Best from Nanotechnology: Approaching Social and Ethical Implications Openly and Proactively," *IEEE Technology and Society Magazine* 24(4): 18-26.

12/8 Fri **Conclusions**
-No readings-

QUIZ 3 – during Final Exams Week, 12/13-19 (date to be announced)