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**Managing Editor: Elaine Nelson**

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**Coffee, Cacao, and Globalization**  
University of Guelph  
Univ 1200

Winter 2005  
E-mail: sgmccook@uguelph.ca

Prof. Stuart McCook  
Dept. of History

### **Description**

This course explores the social, cultural, and environmental shape of globalization through the study of two tropical commodities: coffee and cacao. While coffee originated in Africa and cacao in tropical Latin America, both commodities are now produced throughout the tropics, and consumed globally. We will explore the commodity chains that link producers in tropical Latin America, Africa, and Asia with consumers around the world, particularly in Europe and North America. The course will begin with the domestication of these plants, and follow their evolution from traditional goods with religious significance, to expensive luxuries available to only the wealthiest Europeans, to the inexpensive, commonplace foods they are today. The course will draw on perspectives from history, anthropology, and the environmental sciences.

This course also aims to help students develop critical skills in research and reading, such as finding, evaluating, and identifying primary and secondary sources. Students will learn how to develop their analytical voices, through short writing assignments, classroom discussion, and by completing a short research paper.

### **Textbooks**

Sophie D. Coe, Michael D. Coe, *The True History of Chocolate* (New York: Thames & Hudson, 2003)  
Mark Pendergrast, *Uncommon Grounds: The History of Coffee and How it Transformed Our World* (Darby, Pa.: Diane Publishing Company, 2002)  
Other readings, available in class or on WebCT

### **Requirements**

*Midterm Examination (20%)*. In class exam on February 18.

*Short Assignments (25%)*. Most weeks, there will be short writing assignments, some of which will be done in class, based on that week's themes. Others will be distributed ahead of time. These assignments will be the basis for class discussions on that day. For this reason, these assignments cannot be submitted late. The best **five** of these will be counted toward your final grade.

*Short Research Papers and Presentation (35%)* Students must submit one short (4-6 page) paper on a research topic of their choice (subject to approval by the professor) pertaining to coffee, cacao, and the global economy. Students must submit a one-paragraph project proposal and a bibliography of at least five scholarly sources (including at least three scholarly articles) on February 18. A complete, polished draft of the paper is due on March 28. I will comment on these and return them to you by April 1. Revised papers, based on my comments and suggestions, will be due on April 8. During the last three class meetings, each student will give a 6-8 minute presentation based on their research paper.

*Final Examination (20%)*.

## SCHEDULE OF MEETINGS

Note: the reading assignments on this syllabus are tentative.

- Week 1** Themes in the Social History of Tropical Commodities  
Jan. 10 Introduction: The Worlds of Tropical Commodities  
Jan. 12 The Botany and Domestication of Cacao  
*True History of Chocolate*, chapters 1, 2  
Jan. 14 The Botany and Domestication of Coffee
- Week 2** Coffee, Cacao, and Traditional Cultures before 1650  
Jan. 17 Cacao in Aztec Daily Life  
*True History of Chocolate*, chapter 3  
Jan. 19 Coffee in the Islamic World  
“The Vertues of Coffee” [1663]  
“The Nature of the Drink Kauhi” [1659]  
Jan. 21 Comparing Consumption, Trade, and Religion
- Week 3** Tastes of Paradise: Commodification and Transculturation in Europe, 1500-1800  
Jan. 24 The Birth of the Global Caffeine Culture and Caffeine Trade  
Ross W. Jamieson, “The Essence of Commodification: Caffeine Dependencies in the Early Modern World,” *Journal of Social History* 35:2 (Winter 2001): 269-294.  
Jan. 26 Cacao and Conquest  
*True History of Chocolate*, chapters 4, 5.  
Thomas Gage, *Travels in the New World* [1648], extracts  
Jan. 28 Coffee and Chocolate in the Age of Reason  
*True History of Chocolate*, chapter 7  
*The Women’s Petition Against Coffee* [1674]  
*Coffee-Houses Vindicated* [1673]
- Week 4** The Colonial Plantation Complex: Mercantilism and Slavery, 1500-1800  
Jan. 31 Cacao and Colonial Development in the Spanish Empire  
Robert J. Ferry, “Encomienda, African Slavery, and Agriculture in Seventeenth-Century Caracas,” *Hispanic American Historical Review* 41 (1981): 609-635.  
Robertson, *The History of America* [1777], excerpts  
Feb. 2 Coffee and Mercantilism in the British, French, and Dutch Empires  
Readings TBA  
Feb. 4 Comparing Plantation Complexes  
Readings TBA
- Week 5** Mass Consumption and Mass Production in the Long Nineteenth Century, 1780-1930  
Feb. 7 The Business of Coffee  
*Uncommon Grounds*, chapters 3, 6, 7, 9  
Feb. 9 Making Chocolate for the Masses  
*True History of Chocolate*, pp. 235-261  
Feb. 11 Changing Cultures of Consumption in the Nineteenth Century  
*Uncommon Grounds*, chapters 4, 8
- Week 6** Coffee, Cacao, and Colonialism in the Long Nineteenth Century  
Feb. 14 Peasants, Slaves, and Pioneers: The Worlds of Coffee  
*Uncommon Grounds*, chapter 2  
Multatuli, *Max Havelaar*, excerpts

Feb. 16	New Pioneer Fronts: Cacao moves to Africa Readings TBA
Feb. 18 Feb. 21-25	<b>Midterm Examination</b> (in class), and <b>Project Proposals Due</b> <b>Spring Break</b>
<b>Week 7</b> Feb 28	A Fragile Prosperity: Environments and Economies in Crisis, 1880-1930 Emergent Environmental Crises in the Tropical Countryside Warren Dean, "The Green Wave of Coffee: Beginnings of Agricultural Research in Brazil," <i>Hispanic American Historical Review</i> 69 (1989): 91-115.
Mar. 2	Stuart McCook, "The Liberal Epidemics," [typescript] Trying to Survive in a Global Marketplace: Valorization in Brazil <i>Uncommon Grounds</i> , chapter 5
Mar. 4	The Great Depression and the End of the Liberal Era <i>Uncommon Grounds</i> , chapters 10,11
<b>Week 8</b> Mar. 7	Mass Culture and Mass Consumption in the Developed World, 1920-1990 TV, Media, and Mass Marketing <i>Uncommon Grounds</i> , chapter 14 (selections)
Mar. 9	The Masters of Chocolate: Hershey and Mars Film: <i>Java Jive</i>
Mar. 11	New Centers and Patterns of Consumption <i>Uncommon Grounds</i> , chapters 14, 15 (selections)
<b>Week 9:</b> Mar. 14	Bitter Grounds: Nationalism, Decolonization, and the Cold War, 1930-1980 Coffee Republics and Cold War Politics in Latin America <i>Uncommon Grounds</i> , chapters 13-16, selections
Mar. 16	Cacao and Decolonization in Africa Danquah, "Rural Discontent and Decolonization in Africa"
Mar. 18	No Class
<b>Week 10</b> Mar. 21	The Specialty Revolution: Cultures of Production and Consumption in the Neoliberal Era The Specialty Revolution <i>Uncommon Grounds</i> , chapters 16 (selections), 17 <i>True History of Chocolate</i> , pp. 261-268
Mar. 23	Case Study: Starbucks Coffee <i>Uncommon Grounds</i> , chapter 18
Mar. 25	Good Friday – No class
<b>Week 11</b> Mar. 28	Surviving Neoliberalism: Production and Fair Trade in a Global Economy Neoliberal Crises <i>Draft Papers Due</i> <i>Uncommon Grounds</i> , chapter 19 Robert Rice, "Coffee Production in a Time of Crisis: Social and Environmental Considerations," <i>SAIS Review</i> 23:1 (Winter-Spring 2003): 221-245
Mar. 30	The Fair Trade Movement: Origins Oxfam, <i>Mugged</i>
Apr. 1	The Fair Trade Movement in Practice Film: <i>Coffee with a Conscience</i>
<b>Week 12</b> Apr. 4	Presentations and Summary Presentations
Apr. 6	Presentations
Apr. 8	Presentations and <b>Final Papers Due</b>

# Nanotechnology and Society

Lehigh University  
STS 198

Spring 2007

Science and Technology and Society Program

## Course Overview

Nanotechnology involves the development of tiny amounts of material far smaller than the human eye can detect. A nanometer is 1 billionth of a meter, and a single human hair is approximately 80,000 nanometers wide. Engineered atom by atom to give them unique properties, nanoparticles do not behave like solids, liquids or gases. Instead, they have special properties that include different colors and electronic, magnetic and mechanical properties, which can all be altered at the nanoscale. Because of these unique properties, nanotechnology is supposed to drive a “new industrial revolution,” according to U.S. government officials. One official estimates that by 2015, nanotechnology will play a key role in products that will spur the economy by \$1 trillion per year, requiring two million workers. Besides its impacts on industry, nanotechnology is projected to influence many societal factors including privacy, military and security issues, health and environmental risks, medical technologies, socioeconomic and global concerns.

This course will introduce students to both the societal and technological dimensions of nanoscale science and nanotechnology. It will explore some of the potential benefits expected from this new field including smaller but more powerful computers, internal medical monitoring, new foods, lighter and stronger materials, and new methods of cleaning up environmental pollution. It also will explore some potential risks various groups foresee including health and environmental risks, radically changed warfare because of nanotechnology-based military weapons, and repetition of costly past technological mistakes such as asbestos. Additionally it will help enhance student awareness of potential career opportunities.

Emerging applications of nanotechnology along with opportunities and challenges will be discussed weekly. Specific nano applications will include electronics, medicine and health, consumer products, and the environment. Other dimensions of nanotechnology and society will also be a focus of the course including business opportunities, entrepreneurship, intellectual property, government issues, public perceptions and the future of nanotechnology. A tour of Lehigh’s Nano-characterization Lab will be a highlight of the course activities.

## Course Organization

This course is designed to be a mix of lectures and seminar discussions. **Your participation in class discussion will be an important part of this course and your grade.** You will need to be prepared by doing the assigned readings and attending class. **More than four unexcused absences will lower your final grade one letter.** Since late arrivals disrupt discussions, please try to arrive on time. Leaving and returning to the classroom during discussions also is disruptive and should be avoided. So, please come to class prepared to stay the full time and come on time. There will be two exams and a course project resulting in a final paper.

## Grading

1 <sup>st</sup> Hour Exam	25%
2 <sup>nd</sup> Hour Exam	25%
Project	35% (total)
Oral (team)	5%
Written (individual)	20%
Written (team)	10%
<u>Class Participation</u>	<u>15%</u>
Total	100%

Completion of all course work is required to pass the course.

## Readings

There will be two textbooks for the course, and they will be available in the Lehigh Bookstore:

David M. Berube, *Nano-hype: The Truth behind the Nanotechnology Buzz* (New York: Prometheus Books, 2006)

Linda Williams and Wade Adams, *Nanotechnology Demystified: A Self-Teaching Guide* (New York: McGraw Hill, 2007)

There also will be assigned readings on the Web and links for them will be embedded in your course schedule and directly available on the class Blackboard site. A few other readings will be handouts or placed directly on Blackboard.

An important nanotechnology website and a listserve you should be checking regularly are the National Nanotechnology Initiative, [www.nano.gov](http://www.nano.gov), and the NNI's news site that will give a list of current nanotechnology news items, [www.nano.gov/html/news/current.html](http://www.nano.gov/html/news/current.html). Another good site is the Probing Nanotechnology Project at the Woodrow Wilson International Center for Scholars, [www.nanotechproject.org](http://www.nanotechproject.org).

## The Instructors

Stephen Cutcliffe, Professor, Department of History and Director, Science, Technology and Society Program

Sharon Friedman, Professor, Department of Journalism and Communication and Director, Science and Environmental Writing Program

Andrea Harmer, Director, Web-based Instruction, Center for Advanced Materials and Nanotechnology

Martin Harmer, Professor, Department of Materials Science and Engineering and Director, Center for Advanced Materials and Nanotechnology

Chris Kiely, Professor, Department of Materials Science and Engineering

Wei-Xian Zhang, Associate Professor, Department of Civil and Environmental Engineering

**Course Coordinator:** Stephen Cutcliffe, Email address—[shc0@lehigh.edu](mailto:shc0@lehigh.edu).

Office Hours: MWF, 10-noon; other times by appointment.

## Final Project Instructions

Each student will participate in a team-based research project on a nanotechnology topic not covered explicitly in class. There will be both team and individual grades for this project.

There will be 4 teams consisting of 4-5 students each. Each team will focus on specific nano products or processes in both their technical and societal dimensions. No two projects can cover the same product or process. Each member of that team will be responsible for researching and writing a specific component of the larger team project—similar to a chapter in a larger report. All students on the team will be responsible for planning how the project will be researched and for contributing to and writing the executive summary, introduction, and conclusion of the project report.

Specific parts of the project might include the following:

1. technical description
2. analysis of what organizations/individuals are promoting the technology and why
3. discussion of who will likely benefit from the development and who might lose
4. economic and financial aspects
5. production and worker related issues
6. health/environmental issues
7. social/ethical/political questions
8. media coverage and public perceptions
9. other themes as appropriate

Each project will also include a team-based oral report presented during the last week of class. Students will receive an individual grade for their own specific contribution (chapter) and a shared team grade reflecting the overall quality of the project. There will be peer evaluations of individual efforts on the project by team members that could affect members' team grades.

Students will be given a chance to express topic and team preferences, but to ensure a reasonable balance of student backgrounds and majors, and a mix of different years (freshmen to seniors), the instructors will make the final team assignments. We will do our best to give you one of your top choices.

The oral report shall count for 5% of the final grade and the written paper shall count for a total of 30% of the total grade (20% individual and 10% team). Given its grading weight, this project is an important component of the course and should not be taken lightly. Getting a good head start on identifying a topic, conducting the research, and organizing your findings will be very important. All topics must be cleared with the instructors. *A few possible topics:* A nano-enhanced sports equipment item; a specific medical application; nano coatings—e.g., paint, anti-stain coating; a military application; an information technology enhancement; nano sensors.

### **Tentative Schedule:**

2/1: Review information to look for possible nanotech topics for final project.

2/ 8: Project discussion—come prepared with questions. Turn in a list of topic preferences

2/15: Project team assignments; team meetings for half the class.

3/20: Team Project Interim Report and Questions.

4/24-26: Oral Team Projects Due.

5/2: Written Team Project Due.

## COURSE OUTLINE AND SCHEDULE OF READINGS

### Part 1: Introduction

#### Week 1

Tues., Jan. 16 (Cutcliffe et al)

#### Introduction to course and instructors

Video: *When Things Get Small* <http://www.ucsd.tv/getsmall>

Thurs., Jan. 18 (Cutcliffe)

#### What is Nanotech?

Nanotechnology is often claimed to be the next great “revolution” in science and technology, one that will transform both nature’s basic building blocks—atoms and molecules—and the society that adopts its vaunted products. So, What Is Nanotechnology, and Why Should We Care about Its Societal Dimensions? Is Nanotechnology More or Less Important than Earlier Technologies, Large or Small? What economic and career opportunities are available in this rapidly evolving field?

#### Read:

1. Kristen Kulinowski, “Nanotechnology: From ‘Wow’ to ‘Yuck’?” *Bulletin of Science, Technology & Society* 24 (Feb. 2004): 13-20, <http://bst.sagepub.com/cgi/reprint/24/1/13>
2. *Nano... Demystified*, Ch. 1.;
3. “Promoting Economic Development Opportunities through Nano Commercialization,” David Rejeski, Director Project on Emerging Nanotechnologies, Woodrow Wilson Center, Congressional testimony, 5/4/06, [FULLTEXT5-4-06.pdf \[281.42kb\]](http://www.wilsoncenter.org/document/1/20060504_rejeski)

#### Week 2

#### Benefits and Risks, Large and Small

Nanotechnology promises many new products, processes and improvements, yet many scientists, politicians, and ethicists have begun to raise cautionary questions about possible risks associated with these projected benefits. How useful to society are sunscreens, stain resistant pants, smart paints, and improved tennis balls? Will nano-enhanced drug delivery systems and medical devices extend or improve the quality of our lives?

Tues., Jan. 23 Societal Benefits and Risks (Cutcliffe)

#### Read:

1. Bill Joy, “Why the Future Doesn’t Need Us,” *Wired Magazine* (August 4, 2000) [http://www.wired.com/wired/archive/8.04/joy\\_pr.html](http://www.wired.com/wired/archive/8.04/joy_pr.html);
2. John Seely Brown and Paul Duguid, “Response to Bill Joy and the Doom-and-Gloom Technofuturists,” *The Industry Standard* (April 13, 2000) <http://www.aaas.org/spp/rd/ch4.pdf>;
3. Ray Kurzweil, “Promise and Peril” in *Living with the Genie*, ed. by Alan Lightman. et al. (San Francisco: Island Press, 2003)

Thurs., Jan 25 Societal Benefits and Risks (Friedman)

#### Read:

1. *Nano-hype*, Ch’s. 1 and 2.
2. “Tiny Toxins,” Philip Ross, *Technology Review*, May/June 2006, [http://www.technologyreview.com/printer\\_friendly\\_article.aspx?id=16814](http://www.technologyreview.com/printer_friendly_article.aspx?id=16814)
3. Nanotechnologies: “Tiny Particles promise much but could pose big risk.” [www.nrdc.org/health/science/nano.asp](http://www.nrdc.org/health/science/nano.asp).

### **Week 3: Size Matters**

The Developing Science of Nanotechnology—the Tools of the Trade

Tues., Jan. 30 (Kiely and M. Harmer)

How do scientists define nanotechnology? What effect does particle size have on the properties of a material? How do you make nanoparticles and carbon nanotubes with controlled size and shape? What are the different types of nanomaterials?

Lab demo on making nanoparticles

Read:

1. *Nano... Demystified*, Ch's. 2 and 3.

Thurs., Feb. 1 (Kiely and M. Harmer)

How do you see something that is much smaller than the wavelength of visible light? What would you want to know about a nanomaterial if there was some way of observing objects on the nanoscale?

Read:

1. *Nano...Demystified*, Ch. 4.
2. Look over the nanoproduct list at [www.nanotechproject.org/consumerproducts](http://www.nanotechproject.org/consumerproducts). Start thinking about topics for the final team project.

Tour of electron microscopy characterization facilities

### **Part 2: Emerging Applications of Nanotechnology-- Opportunities and Challenges**

### **Week 4: Faster and Smarter Electronics Using Nanotechnology**

Tues., Feb. 6 (Kiely)

What types of electronic devices can we envisage making with carbon nanotubes?

Case Applications: memory, solar cells, batteries.

Read:

1. *Nano...Demystified*, Ch. 9.

Thurs., Feb. 8 (Cutcliffe, Friedman, Kiely, and M. Harmer)

Read:

1. *Nano-hype*, pp. 195-200.

Mini-Assignment: Each student should come prepared to class with one idea written out regarding a possible societal implication of enhanced electronics technologies.

In part of class we will discuss the Final Project Assignment—come prepared with questions and **turn in** a list of three topic preferences for your final term project with your favorite listed as #1.

## Week 5: Better Health through Nanotechnology

Tues., Feb. 13 (M. Harmer)

How will nanoparticles improve the quality and effectiveness of our health care, or do nanoparticles or nanofibers represent a health threat?

Case applications: fighting cancer, 'lab-on-a-chip,' cosmetics

Read:

1. *Nano...Demystified*, Ch's. 5 and 6.
2. National Cancer Institute Announces Major Commitment to Nanotechnology for Cancer Research, <http://nanotechwire.com/news.asp?nid=1108>. Also read one story at <http://nano.cancer.gov>.

Thurs., Feb. 15 (Cutcliffe, Friedman, Kiely, and M. Harmer)

Mini-Assignment: Come to class prepared with one written suggestion about a likely health or ethical issue associated with nano medicine.

Part of class will be devoted to assignments of teams for the final project and brief team meetings.

Read:

1. *Nano-hype*, pp. 200-206; Ch. 9;
2. "Nano, Nano on the Wall," *Business Week*, 12/12/05, [www.businessweek.com/magazine/content/05\\_50/b3963100.htm](http://www.businessweek.com/magazine/content/05_50/b3963100.htm)

## Week 6: Consumer Products with Nanoengineered Surfaces

Tues., Feb. 20 (M. Harmer)

What types of products would benefit from ultra strong nanocomposite materials? Why does incorporating carbon nanotubes or nanoclays into polymers improve their mechanical performance? How easy is it to fabricate nanocomposite materials? Will their use be limited to specialized products or mass-produced consumer goods?

Case applications: Lotus Effect, Gecko feet, colored and scratch resistant surfaces in autos.

Read:

1. *Nano...Demystified*, Ch. 8.
2. Clothing that makes up its own mind, Sally M. Lourenco, *Financial Times*, January 28 2006. [www.ft.com](http://www.ft.com)

Thurs., Feb 22 (Cutcliffe, Freidman, Kiely and M. Harmer)

Mini-Assignment: Come to class prepared with one written suggestion regarding the societal implications of a likely consumer product.

Read:

1. "Nanotech Product Recalled in Germany," Rick Weiss, *Washington Post*, 4/6/06, A 02. [www.washingtonpost.com/wp-dyn/content/article/2006/04/05/AR2006040502149.html](http://www.washingtonpost.com/wp-dyn/content/article/2006/04/05/AR2006040502149.html)
2. "This War against Germs has a Silver Lining," Rhonda I. Runale, *Wall Street Journal*, 6/6/06, D1. Pros and cons about using silver as a bacteriacide in nanomaterials <http://online.wsj.com/article/SB114955908525572199.htm>.
3. "The first federal restrictions on nanotechnology could be coming soon," "NANOWERK," January 3, 2007, <http://www.nanowerk.com/news/newsid=1203.php>

## **Week 7: Energy and Environment**

Tues., Feb. 27 (Zhang)

What are the major applications of nanotechnology with regard to the environment?  
How can the science of nanotechnology enhance environmental quality? What types of nanotechnologies can be used to treat hazardous and toxic wastes and to mitigate environmental changes. What are specific nanotechnology applications for energy sources?

Read:

1. Tina Masciangioli and Wei-xian Zhang, "Environmental Technologies at the Nanoscale," *Environmental Science & Technology* (March 1, 2003): 102-108.

Thurs., Mar. 1 (Zhang)

Mini-Assignment: Come to class prepared with one written suggestion on the implications of nanotechnology for environmental and health risks?

Read:

1. *Nano-hype*, pp. 207-10;

2. *Nano...Demystified*, Ch. 7.

3. EPA Report Looks at Potential Risks, Benefits of Nanotechnology - 02/07/2006.

<http://www.occupationalhazards.com/articles/14679>

### **March 5-9 Spring Break—No Class**

#### **Week 8**

Tues., Mar. 13—Midterm Course Evaluation and Exam Review

Thurs., Mar. 15—**1st Exam**

### **Part 3: Nano and Society**

#### **Week 9:**

#### **The Business of Nanotechnology—Entrepreneurship, Patents and Intellectual Property**

Tues., Mar. 20 (Cutcliffe)

What is the role of entrepreneurship in nanotechnology? Will it become the "new" dot.com?

How are companies involved in nanotechnology doing and what are they producing?

Read:

1. *Nano-hype*, Ch. 7

2. *Nano...Demystified*, Ch. 12.

Thurs., Mar. 22

Final Project Team Progress Reports and Discussion

#### **Week 10:**

Tues., Mar. 27 (Cutcliffe)

#### **Social Issues**

What parts of society should make decisions about what nano-products are produced? Should society assure that the benefits and costs of nanotechnology are shared equally among its members and between nations? If so, how can this be accomplished? What are the workforce needs? What issues of privacy protection are raised by nanotechnology products? What are the risks to the health and safety of those who work in the production of nano-materials? Do military applications of nanotechnology pose risks to civilian society?

Read:

1. *Nano-hype*, Ch. 10;
2. "Broader Societal Issues of Nanotechnology," M.C. Roco, *Journal of Nanoparticle Research*, 2003, pp. 181-189. <http://www.springerlink.com/content/x7v2474uw5q7m4t0/fulltext.pdf>

Thurs., Mar. 29 (A. Harmer)

### **Education**

What are the issues that educators face in trying to prepare for the estimated need for two million nanotechnology-related workers by 2015? At what grade level should nanoscale science and engineering be introduced and how should it be introduced for effective learning? What are the ramifications if U.S. science and technology curricula do not keep pace (or are outpaced) with those of our global competitors?

Read:

1. *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, Committee on Prospering in the Global Economy of the 21<sup>st</sup> Century: An Agenda for American Science and Technology, National Academy of Sciences, National Academy of Engineers, Institute of Medicine. (Executive Summary pp.1-9; A Disturbing Mosaic, Chp.1, pp.1-1 to 1-8; Discovery and Application, Chp.1, pp.1-14 to 1-16; Educational Challenges, Chp.3, pp. 3-25 to 3-30 top)
2. "The Value of Science," epilogue in *What Do You Care What Other People Think?* Richard P. Feynman. Norton & Co., 1988.

## **Week 11: Public Perception and Understanding of Nanotech; Communication about Nano**

Tues., Apr. 3 (Friedman)

### **Public Perceptions and Understanding of Nanotechnology**

Have most people in the United States ever heard of nanotechnology and are they aware of nanotechnology's potential for extensive societal impacts? Do they know they are being exposed to nanoproducts already on the market? What are people's perceptions of nanotechnology?

Read:

1. "Informed Public Perceptions of Nanotechnology and Trust in Government," Jane Macoubrie, Project on Emerging Nanotechnologies, WWC. 1/06.
2. Hart Research Report on Nanotechnology, WWC, 9/06. [www.nanotechproject.org/77/Hart](http://www.nanotechproject.org/77/Hart).  
Read the whole report.
3. "What Drives Public Acceptance of Nanotechnology," Steven Currall, et al., *Nature Nanotechnology*, December 2006, pp. 153-55.

Thurs., Apr. 5 (Friedman)

### **Media Coverage of Nanotechnology**

Are newspapers and television providing information about nanotechnology to the public? If so, what type of information do people get and what subjects get covered? Has there been a change over time in this type of information? What about the role of the Web in communicating nanotechnology information to the public and to others in the nano community?

Read:

1. *Nano-hype*, Ch. 11;
2. "Nanotechnology: Risks and the Media," Sharon M. Friedman and Brenda P. Egolf, *IEEE Technology and Society Magazine*, Winter, 2005.
3. "Nanotechnology Doesn't Make News," PhysOrg.com, December 17, 2005, <http://www.physorg.com/news9155.html>

## Week 12: Government Support and Regulation of Risk

Tues., Apr. 10 (Friedman)

### The U.S. Government's Push for Developing Nanotechnology

Why have the U.S. and other governments invested heavily in nanotechnology? What future impacts do they see that will benefit the country and the economy? What approaches exist within different nations?

1. The National Nanotechnology Initiative Supplement to the President's FY 2006 Budget, "NNI Program Overview: Interagency Coordination in Support of National Priorities," Sec. 1:55-62.

[www.nano.gov/NNI-06budget.pdf](http://www.nano.gov/NNI-06budget.pdf).

2. *Nano-hype*, Ch's. 3-5

Thurs., Apr. 12 (Friedman)

### Government Regulation and Legislation about Nanotechnology

How are government agencies dealing with issues of nanoparticle regulation? Why is regulating nano a problem?

Read:

1. *Nano-Hype*, Ch 8

2. "Chance of A Lifetime," Ann Thayer, *Chemical and Engineering Magazine*, May 1, 2006.

<http://pubs.acs.org/cen/coverstory/84/8418nanotechnology.html>

3. "Nanotech: Federal safety research lacks direction -- Science Committee," Lauren Morello, September 22, 2006. <http://www.eenews.net/EEDaily/print/2006/09/22/7>

4. "Berkeley to be first city to regulate nanotechnology," Paul Elias, The Associated Press, Dec 11, 2006. [http://www.examiner.com/printa-450227-Berkeley\\_to\\_be\\_first\\_city\\_to\\_regulate\\_nanotechnology.html](http://www.examiner.com/printa-450227-Berkeley_to_be_first_city_to_regulate_nanotechnology.html)

## Week 13:

Tues., Apr. 17 (Cutcliffe et al)

### A Summary of Where We Have Been

### Where to Next? The Future of Nanotechnology

Read:

1. *Nano... Demystified*, Ch. 14.

2. "Mixed Report on U.S. Nanotechnology Effort," [Barnaby J. Feder](http://www.nytimes.com/2006/09/25/technology/25cnd-nano.html?_r=1&oref=slogin&pagewanted=print), *New York Times*, September 25, 2006. [http://www.nytimes.com/2006/09/25/technology/25cnd-nano.html?\\_r=1&oref=slogin&pagewanted=print](http://www.nytimes.com/2006/09/25/technology/25cnd-nano.html?_r=1&oref=slogin&pagewanted=print)

Thurs., Apr. 19

### Second Exam

## Week 14:

Tues., Apr. 24

Student Oral Team Project Reports

Thurs., Apr. 26

Student Oral Team Project Reports

Final Written Team Projects due Wednesday, May 2 in Prof. Cutcliffe's office.

## Readings That Help

This section of the *Newsletter* is meant to guide the reader to books or articles that someone recommended to me because they are useful, provocative, or enjoyable—at best, all three. Suggestions of other materials to be reviewed would be most welcome, with or without comments, but I hope you feel free to comment on my opinions as well.

### **Barrett Hazeltine**

Division of Engineering, Brown University

**Billington, David P. and David P. Billington Jr.** *Power, Speed, and Form: Engineers and the Making of the Twentieth Century*. Princeton: Princeton University Press, 2006. Pp. xxv + 270. Hardcover, \$29.95.

This history of technology in America begins with Edison and ends with the DC-3 and streamlining of the Chrysler Airflow car. The book grew out of the senior author's very successful technology literacy course, "Engineering in the Modern World," at Princeton, which attracts both liberal arts students and first year engineering students. Course development was supported in part by The New Liberal Arts program of the Sloan Foundation. The four ideas of structure, machines, networks, and process are the framework of the discussion. Networks encompass electrical engineering, as in the power network of Edison and then Westinghouse, the telephone network of Bell, and the radio network of Marconi and Armstrong. Digital technology does not appear, but the genesis of four of the largest U.S. corporations—General Electric, Exxon Mobil, General Motors, and Ford—gets much attention. A recurring theme is patent protection and management in general. Alexander Graham Bell and the Wright brothers did not care for the business aspect and retired from their companies only comfortably well off. Armstrong, on the other hand, fought hard for his patents and company control and ultimately lost his life. An important aspect of the book is the sidebars that explain the technology seriously, with equations. Several of these sidebars appear to come directly from the patent documents. An instructor could easily expand these

sidebar discussions to give a fuller background of the technology. Another theme is aesthetics in design. Ammann, in his design of the George Washington Bridge, chose short towers and a shallow cable sag for a more graceful appearance. Reinforced concrete gave engineers designing dams and buildings an option of form over mass. The pictures of multiple arch dams and of the Hershey arena are especially striking. A final important theme is the distinction between engineering and science. The essential aspect of engineering is design, while that of science is discovery. Design and discovery, in fact, take place concurrently—contrary to the opinion of some that engineering is an application of existing science. The Billingtons, father and son, write gracefully and lucidly. The engineering stories are inspiring; the business history absorbing but often depressing. All in all, they succeed in showing how the study of engineering design advances the goals of liberal education—intellectual rigor, a concern for the persons and organizations involved, and aesthetic sensibility.

**Slade, Giles.** *Made to Break: Technology and Obsolescence in America*. Cambridge, Mass.; Harvard University Press, 2006. Illus. Pp. vi + 330. Hardcover. \$27.95.

The subtitle is more accurate than the title, which implies the focus will be on how companies profit by deliberately producing goods with short lifetimes. Planned obsolescence does get full attention, but many more aspects of obsolescence are discussed, beginning with the alarming environmental consequences of 100 million cell phones being discarded a year. (The number is for 2005.) One assumes most of these cell phones are still functioning so they are obsolete only in the sense that a customer wants a new feature or style. A cell phone contains many toxins and some parts are reusable, but the cost of disassembly to recycle parts, or at least keep them out of landfills, is more than the perceived value. An aspect of deliberate obsolescence comes out in an exciting spy story concluding with the U.S. allowing the Russians to buy surreptitiously and unknowingly software altered to malfunction after several months. A new technology does not, however, always make an old

one obsolete; FM radio broadcasting did not do away with AM broadcasting. Armstrong's and Sarnoff's battles over patents and general corporate skulduggery make a fascinating chapter. To Sarnoff's chagrin, Armstrong had sold about 500,000 FM receivers before World War II. After the war, Sarnoff prevailed on the FCC to change the FM frequency band so these radios became obsolete; the argument was sunspot interference although none of the users had noticed such and the audio signal in TV uses FM in an adjacent band. An equally exciting chapter deals with the rise of Apple computers, the death of slide rules, and the ascendancy of video games. Xerox's Palo Alto Research Center, in the early 1970s, developed a new computer interface—a desktop with icons, and pull-down menus. Steve Jobs visited and expressed much enthusiasm for the interface. A derivative went into the Macintosh and eventually became Windows. In this rapidly developing industry some products, video games are an example, really do become obsolete in a year or less. On the other hand, manufacturers of long-lived products—the automobile is the usual example, although a computer operating system could also be used—commit themselves to annual, or so, model changes from a fear that their market saturates. (The newest version of Windows was announced last year.) Slade sets up a conflict between engineers, who want to build the best product possible, and marketing people, who want a product that will need to be replaced. Henry Ford was in the engineering camp and stated that a person buying his Model T would never have to buy another car. Of course, if competitors had not made the Model T obsolete, automobiles would not have become as comfortable and fast as they now are. One issue not pursued is whether manufacturers deliberately withheld innovations to make a model obsolete sooner. The final chapter is a plea for technological literacy on the part of the consumer. The particular example is cell phones again—would a consumer who understands the environmental consequences of electronic waste, and the mining hazards of obtaining the polluting substances, be more responsible in purchases and be less likely to consider an older model obsolete? Some of the chapters I could not put down, and I came away having learned much. The reader needs to draw her or his own conclusions about the place of

obsolescence—both a way to make a buck and the route to better products.

**Smil, Vaclav.** *Creating the Twentieth Century: Technical Innovations of 1867-1914 and Their Lasting Impact.* Oxford, U.K.: Oxford University Press, 2005. Illus. Pp. ix + 350. Hardcover, £19.99.

The two generations that lived before World War I saw unprecedented technological change—more change in those fifty years than in the preceding 500 years. Changes took place in a remarkable number of different areas—in this book grouped into Electricity—incandescent lights and the electric grid to power them, Internal Combustion Engines—making automobiles possible, New Materials and Syntheses—steel and inorganic fertilizer were probably the most important, and Telecommunications—Marconi used the discoveries of others to implement wireless telegraphy. It is striking both how much the innovations of the period have since been improved and how much of their general form endures—a present day automobile is much refined compared to 1914 models but the basic elements are unchanged. Present-day incandescent light bulbs are similar to Edison's design and only now have a serious competitor—actually the forerunner of fluorescent lights, the mercury discharge lamp, was built in 1900. Smil points out that the invention that probably had the greatest impact on our civilization was the synthesis of ammonia, the basis of an artificial fertilizer. China, which lost 50 million people to famine between 1958 and 1961, now uses more than 200 kilograms/hectare of nitrogen fertilizer; the United States usage is about 50 kg/h. Smil further notes that “roughly half of all nitrogen in China's food comes from inorganic fertilizer.” The book's focus is on the “astounding concatenation of epochal innovations” between 1867 and 1914, but the details of technical advances are equally fascinating. (Smil does not use the word “technology.”) European contributions receive much attention; the basic design of the automobile was a rivalry between German and French manufacturers, well before the Americans got into it. British car developments were held up by a law requiring that vehicles exceeding 6.4 km/h must be preceded by a man with a red flag. At least some inventors, including Edison, made significant

developments in several fields. Tesla's first patent was for an electric motor, his last for a vertical takeoff aircraft. The inventor of a dynamo also did a continuous alcoholmeter used to tax vodka. Diagrams of lesser-known technologies—such as Mergenthaler's typesetter and Burrough's adding machine—hint at the ingenuity of their creators and at how badly the inventions were needed. A quotation from George Orwell sums up a theme: "changes in industrial technique ... and the whole spirit and tempo of life changes." Smil knows much; he shows how nearly all noted inventions were anticipated by lesser-known work—the forerunner of the incandescent lamp was patented sixty years before Edison's patent was granted. The writing has some idiosyncrasies: the article "the" is omitted in places and HVAC is used to mean High Voltage Alternating Current, rather than what I think is more common—Heating, Ventilating, and Air Conditioning. With deep scholarship, important insights, and intriguing stories, this book is a real pleasure to read.

**Sullivan, Nicholas P.** *You Can Hear Me Now: How Microloans and Cell Phones are Connecting the World's Poor to the Global Economy*. San Francisco: John Wiley & Sons Inc., 2007. Pp. xxxvii + 232. Illus. Hardcover, \$29.95.

A startup cell phone company, catering to the bottom of the economic pyramid, has brought telephone service to approximately 100 million people in Bangladesh. (Bangladesh has a population of 148 million, mostly living in villages where telephone service had been essentially nonexistent.) Service is provided through 250,000 "phone ladies" who received a microloan from the Grameen Bank to buy a telephone. The Grameen Bank business model, as often presented, is to lend just enough money for the borrower to buy a cow. The earnings from the cow pay back the loan with enough left to lift the borrower from poverty. The essential insight behind the cell phone company was that a cell phone could act as a cow. Sullivan points out that three forces made this cell phone revolution possible: a scalable technology, a native entrepreneur, and foreign capital. Moore's Law shows that cell phone technology scales. The hero of the story is a Bangladeshi educated in the United States who gave up a successful career as a venture capitalist in New

York to establish the business. The original investor was an American financier and the eventual lead investor a Norwegian telecommunications corporation. The first half of the book is a cliff-hanger involving the rival government owned telephone company and various foreign investors. The second half is most accurately titled "Transformation through Technology." Cell phone service can bring the equivalent of a bank to people without access to traditional banks. Telephone interconnectivity brings village people into the national and global economy. An example is that rural farmers now have the capacity to sell where the price is best. Telephone connectivity also reduces the differences between village and urban lives. The example given is a village woman in difficult labor being able to call her husband to bring a midwife—the child was named Celtel, after the cell phone company. "As a great social leveler, information technology is second only to death." A point made several times is how much more was accomplished through an entrepreneurial venture than by either the government or direct foreign aid. The book ends with a still unfinished effort to bring energy technology to rural villages. Energy is different than information—for one thing it does not scale in the same way. Sullivan presents a firsthand account of how technology can transform lives and how more than technology is needed to accomplish the transformation, and he provides inspiration for a budding engineer or entrepreneur in a well-told story.

**Taleb, Nassim Nicholas.** *Foiled by Randomness: The Hidden Role of Chance in Life and Markets*. Second Edition. New York: Random House, 2005. Pp. xlvi + 316. Illus. Paperback, \$14.95.

Taleb presents a short but elegant discussion of probability—randomness—in the real world, especially in the world of securities trading. One insight is that things tend to even out, regress to the mean, so a string of successful trades will eventually be followed by a sequence of unsuccessful ones. When one is successful, one (and gullible others) believes he or she is gifted; when one is unsuccessful, one blames it on luck. Most people know about the thought experiment of putting a very large number of monkeys in front of typewriters for a very long time. Eventually, although the odds are absurdly low, one monkey will type out the *Iliad*.

The important question is whether we should bet our life's savings on whether that monkey would next type out the *Odyssey*! An analysis of the characteristics of millionaires is less useful than it might appear because we do not know what happened to others with the same characteristics. Monte Carlo simulations give intuitions that equations do not. One lesson from simulations is that rare events will happen. To quote David Hume, "No amount of observations of white swans can allow the inference that all swans are white but the observation of a single black swan is sufficient to refute that conclusion." A recurring theme is the irrationality of much thinking. By any rational measure, a person with a net worth of \$2 million is well off, but if we have

\$2,000,000 and our neighbors have \$10,000,000, we are poor; if we suffer a loss and wealth drops from \$2,200,000 to \$2,000,000, we are poor. Although a study of randomness would show that it is likely for most people to have days when their investments rise in value, when such happens, as noted above, the typical reaction is affirmation of one's judgment. It is difficult to avoid the dictates of emotions. A trick the author uses to avoid being swayed by persuasive financial commentators is to have the TV on in the trading room, but the sound completely off—the pundit looks ridiculous, not intimidating. The final lesson is to recognize your emotions but resolve to control your behavior in response to both successes and misfortunes.

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**Klein, Ursula and Lefevre, Wolfgang. *Materials in 18<sup>th</sup> Century Science: A Historical Ontology*. Cambridge, Mass.: MIT University Press, 2007. Bibliog. + Index + Pp. 305. Hardcover, \$45.00/L27.95.**

This book is an outstanding contribution to the intellectual history of chemistry, which continues to be the most difficult of the natural sciences to bring into the mainstream of the history and philosophy of science. The authors focus not on materials per se, but on the ideas underlying, and the issues raised by, the classification, characterization, analysis, and synthesis of materials: natural substances, chemical substances, and plants. The perennial philosophical problem of universals takes concrete form in the struggle, from the mid-17<sup>th</sup> to the mid-19<sup>th</sup> centuries, to define elements and compounds and to characterize the processes of chemical analysis and synthesis. What did people think happened when a substance was repeatedly transformed into specific "elementary" products and then synthesized out of those products, directly or by way of a series of intermediate processes? It is not self-evident that the "elements" existed as such in the compound substance, retaining a kind of virtual identity and regaining it upon synthesis, or perhaps were transformed by synthesis, losing their identity, and then produced anew by the process of analysis. Was the original substance itself restored upon synthesis or was it "born" anew?

There are important metaphysical as well as epistemological issues at stake in this struggle, and the question of the virtual existence of "elements" in compounds has interesting correlates in Leibniz' philosophy (*petites perceptions*) and in Rameau's theory of music with its unheard but present ground notes. Similarly, the epistemological and metaphysical issues associated with taxonomy and nomenclature take on concrete form as the number of chemical substances dealt with multiplied in the course of the 18<sup>th</sup> century. Lavoisier's chemical revolution is embedded in a century-long conceptual context far broader than the familiar oxygen versus phlogiston story. We see again the wisdom of Walter Friedlander's dictum that every revolution becomes an evolution when the pieces are put together properly.

The final section of the book describes the failure of attempts to apply the maturing concepts of the new, late 18<sup>th</sup>-century chemistry to plants. Why it failed becomes evidence against Foucault's periodization of Western intellectual history in terms of "epistemes," as in *The Order of Things*. The writing style unfortunately makes this book a harder read than it ought to be, but it is provocative and rewarding, and chemistry's claim to being a science in the 18<sup>th</sup> century is, Kant's dismissal of it notwithstanding, strongly reinforced.

## OPEN FORUM

### Call for Papers/Conference Announcements

#### Commonplace Yet Extraordinary: Design Histories of Everyday Objects

Hagley Museum and Library

Wilmington, Delaware

May 16, 2008

The theme of this symposium, sponsored by The Center for the History of Business, Technology, and Society at the Hagley Museum and Library, will be the histories of design processes that created everyday objects, such as appliances, tools, equipment, and miscellaneous things commonly used in homes, offices, factories, and public spaces. Biographies of everyday objects are a burgeoning area of study in design history, and are well-supported by Hagley's growing collection of designers' papers, including those of Raymond Loewy, Marc Harrison, Thomas Lamb and Richard Hollerith.

Scholars pursuing innovative research in this area are invited to submit paper proposals for this symposium scheduled for Friday May 16, 2008. Proposals on motor vehicles, clothing, furniture, or buildings are discouraged. Papers should be historically grounded and should analyze the interactions between designers, producers, and users. Perspectives from history, art history, design history, sociology, material culture studies, as well as other disciplines are welcome. Paper proposals are due by **December 1, 2007** and should consist of a short cv and an abstract of no more than 500 words. Send proposals to Carol Lockman, [clockman@Hagley.org](mailto:clockman@Hagley.org) Fax: (302) 655-3188; or Hagley Museum and Library, P.O. Box 3630, Wilmington, Del. 19807.

Presenters' travel expenses will be covered by Hagley.

### Job Announcement

Science, Technology and Society

Sarah Lawrence College

Sarah Lawrence College invites applications for a tenure-track position in Science, Technology & Society, beginning fall 2008. This appointment is a chair endowed by the Marilyn Simpson Trust. Candidates should have expertise in interdisciplinary science studies, and their work should focus on the political, economic, and social issues arising out of the developments of modern science and technology. Teaching and research interests may include the ethical, social, and policy implications of biotechnology, engineering, environmental sciences, information sciences, cybernetics, or other emerging areas. We are seeking a candidate with teaching experience, a strong commitment to undergraduate teaching and a Ph.D. in STS, history, sociology, anthropology, or some other appropriate field. Interested candidates should send a cover letter, vita, letters of reference and two course syllabi by **September 1, 2007** to: STS search, c/o Rosemary Weeks, Faculty Assistant, Sarah Lawrence College, 1 Mead Way, Bronxville, N.Y. 10708.

Located in Westchester County, 25 minutes by train from midtown Manhattan, Sarah Lawrence is a small liberal arts college with a unique pedagogy based on small classes and individual tutorials. For information on Sarah Lawrence College, our curriculum, teaching methods, and philosophy of education, please visit our web site at <http://www.sarahlawrence.edu>. Sarah Lawrence has a strong commitment to the principle of diversity. In that spirit, we especially welcome applications from under-represented groups.

## FORTHCOMING MEETINGS AND CONFERENCES

**August 14-19, 2007.** *Fashioning Technology: Design from Imagination to Practice.* The International Committee for the History of Technology's 34<sup>th</sup> Symposium. Copenhagen, Denmark. For more information, visit: [www.icohtec2007.dk](http://www.icohtec2007.dk) **For details, see STS Newsletter #143, page 19.**

**October 11-13, 2007.** *Ways of Knowing.* Annual Meeting of the Society for Social Studies of Science. Montreal, Canada. For more information, visit: <http://www.4sonline.org/meeting.htm> **For details, see STS Newsletter #143, page 20.**

**October 17-21, 2007.** *SHOT 50: Looking Back; Looking Beyond.* Society for the History of Technology. 50<sup>th</sup> Anniversary Meeting. Washington, D.C. Contact: <http://www.historyoftechnology.org>

**November 1-4, 2007.** Annual Meeting. History of Science Society. Arlington, Va. Contact: HSS executive office: [info@hssonline.org](mailto:info@hssonline.org) phone: (352) 392-1677.

**November 2-3, 2007.** *Sound in the Era of Mechanical Reproduction.* The Center for the History of Business, Technology and Society. Wilmington, Del. Contact: Carol Lockman, Hagley Museum and Library, P.O. Box 3630, Wilmington, Delaware 19807; Phone: (302) 658-2400 ext. 243; fax: (302) 655-3188; e-mail: [clockman@Hagley.org](mailto:clockman@Hagley.org) **For details, see STS Newsletter #143, page 21.**

**February 6-9, 2008.** *Science Futures.* Centre for the History of Knowledge (ETH Zurich and University of Zurich) and The Swiss Association for the Studies of Science, Technology and Society (STS-CH). University of Zurich. Zurich, Switzerland. Contact: Martina Merz, Institute of Sociology, University of Lucerne, Bruchstrasse 43/45, PO Box 7456, CH-6000 Lucerne 7; Phone: ++41 / 41 228 7020; Email: [martina.merz@unilu.ch](mailto:martina.merz@unilu.ch) Conference website: <http://www.zgw.ethz.ch/sts.html>

**February 21-23, 2008.** *Managing the Unknown: Natural Reserves in Historical Perspective.* Conveners: German Historical Institute, Washington, D.C., and Research Institute of the Deutsches Museum, Munich, Germany. German Historical Institute. Washington, D.C. Contact: Bärbel Thomas, German Historical Institute, 1607 New Hampshire Avenue, N.W., Washington, D.C. 20009.

**March 12-16, 2008.** *Agents of Change: People, Climate, and Places Through Time.* Annual Meeting. American Society for Environmental History. Boise, Idaho. Contact: [www.ASEH.net](http://www.ASEH.net)

**April 10-12, 2008.** Annual Meeting. Business History Conference. Sacramento, Calif. Proposal deadline: Sept. 24, 2007. Contact: Dr. Roger Horowitz, Secretary-Treasurer, Business History Conference, P.O. Box 3630, Wilmington, DE, 19807. Phone: (302) 658-2400; Fax: (302) 655-3188; E-mail: [rh@udel.edu](mailto:rh@udel.edu)

**May 16, 2008.** *Commonplace Yet Extraordinary: Design Histories of Everyday Objects.* The Center for the History of Business, Technology, and Society. Hagley Museum and Library. Wilmington, Del. Contact: Carol Lockman, [clockman@Hagley.org](mailto:clockman@Hagley.org) Fax: (302) 655-3188; or Hagley Museum and Library, P.O. Box 3630, Wilmington, Del. 19807. **For details, see page 18.**

**October 9-12, 2008.** Society for the History of Technology. 50<sup>th</sup> annual meeting celebration continued. Lisbon, Portugal. Contact: : <http://www.historyoftechnology.org>

**November 6-9, 2008.** Joint Annual Meeting. History of Society and Philosophy of Science Association. Pittsburgh, Pa. Contact: HSS executive office: [info@hssonline.org](mailto:info@hssonline.org) phone: (352) 392-1677.