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Winter 2009

CS 272: Science and Society

Tues.-Thurs. 9:30 – 11:18 AM in ML0185

Course Description

Science is everywhere present in our daily lives, often generating controversy and headlines in the news. From arguments over cloning, genetically modified foods or nuclear missile defense, many of the major issues of the day emerge from the worlds of science and technology. This course will address some of these cases in order to explore two larger questions. First, it will help you understand what science is, as both a social and an intellectual enterprise. Second, it will discuss what roles science plays — and should play — in our society. No scientific knowledge is required in order to take this course.

Course Requirements

1) Read the assigned material before class and come prepared to discuss it. Bring your questions, regarding both your understanding of the text and issues you would like to see addressed about the subject. Class participation will account for 10% of your grade.

2) There will be an in-class exercise of some kind every class (with some exceptions). This may be a short group exercise or an individual response paper. The results of this work will be turned in and will account for 30% of your grade. The aim of this work is to get you to actively engage with the course materials and promote in-class discussion.

3) A discussion list will be established for this course on Carmen. You are required to post brief comments/reactions on the readings at least **6** times during the term and are encouraged to do so more frequently. The purpose of this list is to raise the level of class discussion generally while focusing our attention on issues of particular interest to class members. This will account for 10% of your grade. The postings should be completed the evening before class (by 10 PM).

4) At the end of the course there will be a final essay paper. Topics for this paper will be distributed two weeks before the essay is due (on the last day of class, **03/12/2009**). This will account for 50% of your grade.

Course Goals or What will you learn in this course?
Reading skills; writing skills; framing discussion; raising questions, new perspectives on science and technology.

GEC Category: Arts and Humanities: Cultures and Ideas
Arts and Humanities coursework develops students' capacities to evaluate significant writing and works of art, and for aesthetic response and judgment; interpretation and evaluation; critical listening, reading, seeing, thinking, and writing; and experiencing the arts and reflecting on that experience.

This course is a core course in the Societal Perspectives about Science and Technology minor. Information regarding the minors and their requirements may be found online at http://artsandsciences.osu.edu/interdisciplinary.

Readings:
These six books are available at Barnes and Noble and also on reserve (Closed Reserves) at the Science and Engineering Library:

Steven Shapin, *The Scientific Revolution.* (Also available online via library web page.)
H. Collins and T. Pinch, *The Golem: What everyone should know about science.*
H. Collins and T. Pinch, *The Golem at large: What you should know about technology.* (Also on Carmen).
James Watson, *The Double Helix: A personal account of the discovery of the structure of DNA.*
E. Larson, *Summer for the Gods: The Scopes Trial and America's Continuing Debate over Science and Religion.*
Daniel Kevles, *The Baltimore Case: A Trial of Politics, Science, and Character.*

Other readings will be on Carmen.

Schedule of Topics

Note: This is a provisional schedule of topics. The subjects we actually address may differ from these.

1. What is a scientific fact?
Facts are commonly taken to be the bedrock of science, incontestable bits of truth, discovered objectively and shorn of all social or cultural content. Yet, humans have not always thought of nature in terms of "facts." So where did they come

from, and why do we believe in them? We can understand what facts are (and are not) by looking at how they are arrived at, how they sometimes become controversial, and how they can disappear.

- S. Shapin, *The Scientific Revolution (1996)*, 89-117. Available online from the OSU library.
- H. Collins and T. Pinch, *The Golem at Large (1998)*, 7-29. Carmen.
- R. Dawkins, "Arresting Evidence," *The Sciences*, November-December 1998, 20-25. On Carmen.
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2. What is a scientific discovery?

Science makes discoveries, it reveals new things to us in the natural world: things like oxygen, electrons and living coelacanths. The endless parade of new discoveries is part of what has given science its immense cultural value. Looked at closely, however, the process of discovery itself becomes distinctly mysterious. Is there a "logic" of discovery — a method by which discoveries may be attained? If so, what is it? What is the relation between the discovery and its discoverer? Finally, how do we decide that a dramatic new claim is in fact a discovery after all?

- T. S. Kuhn, "The historical structure of scientific discovery," in Kuhn, *The essential tension* (1977), 165-77 (orig. 1962). Carmen.
- H. Collins and T. Pinch, *The Golem: What you should know about science* (2nd Ed., 1998), "A new window on the universe: the non-detection of gravitational waves," 91-107.

3. What is a scientist?

The figure of the scientist is very influential in modern society. But what are the characteristics that define a scientist? Where do they come from and why are they so respected? How have they changed/ are changing over time? To answer these questions we will look at Weber's influential formulation of the scientific ethos. Then we will compare that portrait of the scientist with Watson's self-portrait in *Double Helix*, a modern "warts-and-all" account of science at work.

- M. Weber, "Science as a vocation," in H.H. Gerth and C. W. Mills (eds.), *From Max Weber* (1946), 129-56. On the web at: http://en.wikisource.org/wiki/Science_as_a_Vocation
- J. Watson, *The Double Helix: A Personal Account of the Discovery of the Structure of DNA* (1968), esp. chaps. 7, 10, 21-29.

4. What is a scientific laboratory?

Scientific experiments and tests are commonly carried out in laboratories. The word is an old one, coined in the seventeenth century. It originally referred to an alchemist's study — a place of work (in Latin, *labor*) and a place of prayer (*oratorium*). But today's laboratories are very different places. How do their characteristics affect what takes place there? And how can we be confident that the artificial conditions of the lab properly reflect the circumstances of the "real world" outside? To answer those questions we will consider the fortunes of Louis Pasteur in the 19th century, when he attempted to use laboratories to revolutionize the life sciences of his time. But we will also find out that Pasteur's problems remain with us today in the testing of Genetically Modified Organisms.

- B. Latour, "Give me a laboratory and I will raise the world," in K. Knorr-Cetina and M. Mulkay (eds.), *Science Observed: Perspectives on the Social Study of Science* (London: Sage, 1983), 141-70. Carmen.
- C. C. Mann, "Biotech goes wild," *Technology Review*, July/August, 1999. Carmen.

5. Did science slay God?

Ever since its first publication, the Darwinian theory of evolution has been the focus of bitter controversies about science and religion. We will look at how those controversies flared up at the outset, with the development and reception of Darwin's theory in his own day. Then we will move forward in time to consider the Scope's Trial in 1920s Tennessee, at which proponents of evolution clashed head-on with proponents of fundamentalist Christianity. Finally, we will address current arguments about intelligent design in the context of debates about science and secularism.

- Movie: "Inherit the Wind" (1960), to be watched in class.
- E. Larson, *Summer for the Gods: The Scopes Trial and America's Continuing Debate over Science and Religion*, pp. 3-8; 11-30; 60-83; 170-93; 239-246.

6. What is a scientific prediction?

Scientists are supposed to *test* their claims. This is often done by making predictions and then checking whether they come true. But what is the margin of error acceptable when performing such tests? More generally, how much certainty can the public place in scientific predictions, especially of great events that cannot be closely modeled in the laboratory? Major policy issues hang on such questions, as in the case of nuclear waste disposal.

- Collins and Pinch, *The Golem*, "Two experiments that 'proved' the theory of relativity," 27-55.
- G. Polakovic, "Predicting the Big One a Big Zero," *Los Angeles Times*, September 7, 1999, A1, A6. Carmen.

- J. Wheelwright, "For our Nuclear Wastes, there's Gridlock on the Way to the Dump," *The Smithsonian*, May 1995, 40-50. Carmen.

7. What is a scientific instrument?
Scientific tests and predictions often rely on instruments. The manufacturing of scientific instruments is an enterprise centuries old, but in the last hundred years or so the scope, scale, size and expense of such instruments has increased dramatically. As we depend more and more on such machines, we need to ask the simple question: what comes first, the instrument or the science?

- P. Galison and A. Assmus, "Artificial Clouds, Real Particles," in D. Gooding, T. Pinch, and S. Schaffer (eds.), *The Uses of Experiment* (1989), 225-69. Carmen.
- J. Oberg, "Why the Mars Probe Went Off Course." *Spectrum*, December 1999. Carmen.

8. Does science need policing?
It is fairly common to hear science characterized as an ethical enterprise ``— one with its own norms of conduct, which are enforced by the scientific community itself. Thus many people believe science is less subject to fraud than most human activities, and that when such misconduct occurs, it is quickly rooted out by the very process of testing that makes science what it is. If this is so, what are the norms of science? What effect do they have on the practice of scientific work? And, perhaps most importantly, who makes sure they are observed? To address these questions, we will look at a classic description of the scientific ethos as moral and self-sufficient — a description written against a background of strident interventionism by Stalinist and Nazi states. We will then examine two recent cases where that ethos has been questioned: the so-called "Baltimore case," in which Congress insisted on imposing outside oversight of laboratory practices; and the Wen Ho Lee case, in which the world of Los Alamos — a world in which the openness of science did not obtain — was put on embarrassing display.

- R.K. Merton, "The Normative Structure of Science," in Merton, *The Sociology of Science: Theoretical and Empirical Investigations* (1973), 267-78. [First published in 1942].
- D. Kevles, *The Baltimore Case: A Trial of Politics, Science, and Character* (1998), 19-46; 198-265.
- Dan Stober, Ian Hoffman, *A Convenient Spy: Wen Ho Lee and the Politics of Nuclear Espionage* (2002), 36-44; 96-102; 128-139; 179-190; 332-349.

9. Who owns science?

Scientific knowledge if often held to be the common property of all of humanity. But it turns out that knowledge *can* be made a subject of property, at least temporarily: this is what patents and copyrights are for. But where should the property rights over scientific knowledge stop? And if science becomes a business, dedicated to the pursuit of patents, how can its reputation for disinterested research be preserved?

- J. Boyle, "The Intellectual Land Grab," in Boyle, *Shamans, Software, and Spleens: Law and the Construction of the Information Society* (1996): 125-30. Carmen.
- M. Pollan, "Playing God in the Garden," *New York Times, 10/25/1998,* magazine, 44-92 (discontinuous). Carmen.
- J.R. Brown, "Privatizing the University — the New Tragedy of the Commons," *Science* 290 (December 1, 2000). Carmen.

10. How certain does science need to be to warrant action?
There is no more controversial science today than that of global warming. On the one side, most of the scientific community affirms that human pollution is at least exacerbating an increase in temperature across the planet and that this could lead to major environmental and social effects. On the other, skeptics — some of them prominent scientists — argue that the evidence for this remains sketchy, statistical (rather than causal) and interpretative. Here we look at the problems raised by this dispute, in particular about the statistical character of many scientific "facts."

- B. Lomborg, "The truth about the Environment," *Economist,* August 4, 2001. Carmen.
- "Misleading Math about the Earth," *Scientific American,* January 2002, 61-71. Carmen.