

STS.003 The Rise of Modern Science (HASS-D)

Spring 2009



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Lectures: TR 12, Room 56-114
Sections: R1 and R2, Room 66-144
Stellar site: <http://stellar.mit.edu/S/course/STS/sp09/STS.003>

Description

This course studies the development of modern science from the seventeenth century to the present, focusing on Europe and the United States. Key questions include: What is science, and how is it done? How are discoveries made and accepted? What is the nature of scientific progress? What is the impact of science on society? What is the impact of society on science? Topics will be drawn from the histories of physics, chemistry, biology, psychology, and medicine.

Requirements

This class requires 1) active participation in lectures and weekly recitation sections, 2) a series of written assignments, and 3) a midterm and final exam.

Recitation Sections

Each week's readings must be read prior to recitation section. Active participation in the discussions is required.

Weekly Writing Exercises

There will be a short (roughly 300 words) reading response assignment that must be submitted via the Stellar site by 9 am every Thursday, except the two weeks when papers are due. PDF format is preferred, but DOC and TXT are also allowed.

Papers

There will be two required papers, 1800 and 2400 words. The papers must be submitted via the Stellar site by 11:59 pm on March 15 and May 8.

For bibliography questions, feel free to consult the reference librarian for history of science and technology Michelle Baildon, <baildon@MIT.EDU>, Room 14S-222, x 3-9352.

Another resource is the Writing and Communication Center (12-132), which offers you **free** professional advice from published writers about all types of academic, creative, and professional writing. Go to <http://web.mit.edu/writing> and click on the yellow sunburst. If you cannot find an open appointment slot, do not despair. There are always cancellations on the day of the appointment. Click on the Wait List (the blue strip that says "Is the time that you want already reserved?") Whenever a cancellation occurs on that day, you will be automatically notified by email. Because several people might receive that same message, go online ASAP to schedule that open spot; 96% of clients who want an appointment end up with one if they use the Wait List. If you can't find an appointment, you can drop by the Center and sign up to be a drop-in client and/or try the Online Tutor at <http://web.mit.edu/writing/Center/onlinetutor.html>. The Center's core hours are Monday-Friday, 9:00 a.m.-6:00 p.m.; evening and weekend hours vary by semester – check the online scheduler for up-to-date hours.

Readings

Most readings are available in the Materials section of the Stellar site. Two required books are available for purchase at the MIT Coop, and are on reserve at Dewey Library:

Peter J. Bowler and Iwan Rhys Morus, *Making Modern Science: A Historical Survey* (Chicago: University of Chicago Press, 2005).

Michael Frayn, *Copenhagen* (New York: Anchor, 2000).

Exams

There will be closed-book midterm and final exams, based on material from both lectures and readings. The midterm will be given during the class on March 19.

Grading

Final grades will be based on:

Participation in discussions (15%)

Weekly writing (15%)

Paper 1 (15%)

Midterm (15%)

Paper 2 (20%)

Final Exam (20%).

CLASS SCHEDULE

LECTURES	ASSIGNMENTS
Week 1. The Legacy of the Scientific Revolution	
02/03 1. Introduction: The Rise of Modern Science	<u>Week 1</u>
02/05 2. The Legacy of the Scientific Revolution	no readings
Weeks 2-3. Enlightenment Science	
02/10 3. Science in the Enlightenment	<u>Week 2</u>
02/12 4. Natural History and Colonialism	The Culture of Experiment
02/17 No class (Monday schedule)	<u>Week 3</u>
02/19 5. Enlightenment Chemistry	A New Language of Science
Weeks 4-5. The Nineteenth Century: Organism and Mechanism	
02/24 6. Romantic Science	<u>Week 4</u>
02/26 7. The Science of Life	Science and Life
03/03 8. Thermodynamics and the Industrial Revolution	<u>Week 5</u>
03/05 9. Physics and the Telegraph	Science, Technology, and the Human Body
Weeks 6-7. Evolution	
03/10 10. Darwin and Natural Selection	<u>Week 6</u>
03/12 11. Evolution and Society	Science and Religion
	Paper 1 due March 15
03/17 12. Scientific Medicine	<u>Week 7</u>
03/19 <u>Midterm</u>	no readings

03/24 Spring Break
03/26 Spring Break

Weeks 8-9. Fin-de-Siècle and the Crisis of Objectivity

03/31 13. The Image of Objectivity
04/02 14. Freud and the Science of the Mind

Week 8
Psychiatry and Society

04/07 15. Relativity Theory and Swiss Clocks
04/09 16. Quantum Mechanics and Postwar Culture

Week 9
Interpreting Relativity

Weeks 10-11. Science and War

04/14 17. Science and World War II
04/16 18. Physics and the Cold War

Week 10
Physics and War

04/21 No class (Patriots' Day holiday)
04/23 19. Sputnik and the Origins of the Space Race

Week 11
Cold War Science

Weeks 12-13. Genetics and Society

04/28 20. Eugenics
04/30 21. Molecular Biology

Week 12
Eugenics and Social Control

05/05 22. Genetics
05/07 23. Genetic Engineering

Week 13
Engineering Life
Paper 2 due May 8

Week 14. Science in the 21st Century

05/12 24. The Race for the Human Genome
05/14 25. Course Overview

Week 14
no readings

READINGS

Week 2: The Culture of Experiment

- Bowler and Morus, "The Scientific Revolution," MMS, pp. 23-53.
- Robert Boyle, *New Experiments Physico-Mechanicall, Touching the Spring of the Air, and Its Effects* (Oxford: H. Hall, 1660), excerpts. [Full text available via Early English Books Online via MIT E-Resources]
- Steven Shapin, "Pump and Circumstance: Robert Boyle's Literary Technology," *Social Studies of Science* (1984): 481-520.

Additional Background:

- Bowler and Morus, "The Organization of Science," MMS, pp. 319-340.

Week 3: A New Language of Science

- Bowler and Morus, “The Chemical Revolution,” MMS, pp. 55-78.
- Jan Golinski, “The Chemical Revolution and the Politics of Language,” *The Eighteenth Century* 33:3 (1992): 238-251.
- Antoine Lavoisier, *Elements of Chemistry* (Edinburgh, 1790), from Dover facsimile edition (1965), “Preface,” pp. xiii-xxxvii. [available at <http://web.lemoyne.edu/~giunta/lavpref.html>]
- Carl Linnaeus, *A General System of Nature, Through Three Grand Kingdoms of Animals, Vegetables and Minerals* (London: Lackington, Allen, and Co., 1806), “Preface,” “Introduction,” and “Mammalia.”

Week 4: Science and Life

- Justus von Liebig, “Organic Chemistry Applied to Physiology and Pathology,” in *Animal Chemistry* (Cambridge, 1842; reprint, New York: Johnson Reprint Corp., 1964), 1-23.
- Theodor Schwann, “Theory of the Cells,” in *Microscopical Researches into the Accordance in the Structure and Growth of Animals and Plants*, trans. Henry Smith (London: Sydenham Society, 1839, 1847), 186-215.
- Timothy Lenoir, “Social Interests and the Organic Physics of 1847,” in *Science in Reflection. The Israel Colloquium: Studies in History, Philosophy, and Sociology of Science*, v. 3, ed. Edna Ullmann-Margalit (Dordrecht: Kluwer Academic Publishers, 1988), 169-191.

Additional Background:

- Bowler and Morus, “The New Biology,” MMS, pp. 165-188.

Week 5: Science, Technology, and the Human Body

- James Clerk Maxwell, “The Telephone: The Rede Lecture Delivered to the Senate House of the University of Cambridge, 24 May 1878,” in *Empires of Physics: A Guide to the Exhibition* (Cambridge: Whipple Museum of the History of Science, 1993), 15-27.
- “I am the Edison Phonograph,” the first recorded promotional message on the Edison phonograph, recorded at the Edison Studios, New Jersey, 1906. Reproduced in “Great American Speeches of the 20th Century”, Rhino Records, 1991.
http://commons.wikimedia.org/wiki/Image:Spencer_-_I_am_the_Edison_Phonograph.ogg
- Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham, NC: Duke University Press, 2003), chap. 1, “Machines to Hear for Them,” 31-85.

Additional Background:

- Bowler and Morus, “Science and Technology,” MMS, pp. 391-414.

Week 6: Science and Religion

- Charles Darwin, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (London: John Murray, 1859), chap. 3, “Struggle

for Existence.” [Full facsimile edition available at <http://www.esp.org/books/darwin/origin/facsimile/title3.html>]

- Charles Darwin, *The Descent of Man, and Selection in Relation to Sex*, 2 volumes (London: John Murray, 1871), “General Summary and Conclusion.” [Full text available at <http://etext.library.adelaide.edu.au/d/darwin/charles/d22d/>]
- John Hedley Brooke, “Darwin and Victorian Christianity,” in *The Cambridge Companion to Darwin*, ed. Jonathan Hodge (Cambridge, UK: Cambridge University Press, 2003), pp. 192-213.
- Marc Caputo, “Florida schools to teach evolution as ‘scientific theory’,” *Miami Herald* (20 February 2008); <http://www.commondreams.org/archive/2008/02/21/7208>

Additional Background:

- Bowler and Morus, “The Darwinian Revolution,” MMS, pp. 129-162.
- Bowler and Morus, “Science and Religion,” MMS, pp. 341-366.

Week 7: Midterm

Week 8: Psychiatry and Society

- Barbara Sicherman, “The Uses of a Diagnosis: Doctors, Patients, and Neurasthenia,” *Journal of the History of Medicine and Allied Sciences* 32 (1977): 33-54.
- Sigmund Freud, *The Origin and Development of Psychoanalysis* (1910) [Full text available at <http://psychclassics.yorku.ca/Freud/Origin/>]

Additional Background:

- Bowler and Morus, “The Emergence of the Human Sciences,” MMS, pp. 301-307 (section on psychology).
- Bowler and Morus, “Science and Medicine,” MMS, pp. 439-461.

Week 9: Interpreting Relativity

- Albert Einstein, “On the Electrodynamics of Moving Bodies,” in Arthur Miller, *Albert Einstein’s Special Theory of Relativity: Emergence (1905) and Early Interpretation (1905-1911)* (Reading, Mass.: Addison-Wesley, 1981), pp. 392-396 (an excerpt).
- Peter Galison, “Einstein’s Clocks: The Place of Time,” *Critical Inquiry* 26 (Winter 2000): 355-389.
- Loren R. Graham, “The Reception of Einstein’s Ideas: Two Examples from Contrasting Political Cultures,” in *Albert Einstein: Historical and Cultural Perspectives*, ed. Gerald Holton and Yehudah Elkana (Princeton: Princeton University Press, 1982), pp. 107-136.

Additional Background:

- Bowler and Morus, “Twentieth-Century Physics,” MMS, pp. 253-276.

Week 10: Physics and War

- Michael Frayn, *Copenhagen* (New York: Anchor, 2000).
- *Farm Hall Transcripts*, edited by Charles Frank (Berkeley: University of California Press, 1993), pp. 70-91.
- Henry DeWolf Smyth, *A General Account of the Development of Methods of Using Atomic Energy for Military Purposes Under the Auspices of the United States Government, 1940-1945 (1945)*, “Preface,” “The Work on the Atomic Bomb,” “General Summary,” and “War Department Release on New Mexico Test, July 16, 1945.” [Full text available at <http://www.atomicarchive.com/Docs/SmythReport>]

Additional Background:

- Bowler and Morus, “Science and War,” MMS, pp. 463-486.
- Links to four academic symposia discussing Frayn’s play:
<http://ohst.berkeley.edu/publications/copenhagen/index.html> (scroll down)
- Documents relating to the 1941 Bohr-Heisenberg meeting; available at <http://www.nba.nbi.dk/release.html>

Week 11: Cold War Science

- Lawrence Badash, “From Security Blanket to Security Risk: Scientists in the Decade after Hiroshima,” *History and Technology* 19 (September 2003): 241-256.
- *In the Matter of J. Robert Oppenheimer: The Security Clearance Hearing*, edited by Richard Polenberg (Ithaca: Cornell University Press, 2002) (an excerpt).
- David Kaiser, “The Postwar Suburbanization of American Physics,” *American Quarterly* 56, no. 4 (2004): 851-888.

Additional Background:

- Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993) [can be accessed via Google: search Google for the title and click on the link to <http://www.earthscape.org/p3/leslie/index.html>]

Week 12: Eugenics and Social Control

- Charles B. Davenport, “The Effects of Race Intermingling,” *Proceedings of the American Philosophical Society* 56 (1917): 364-368.
- *Buck v. Bell*, U.S. Supreme Court, 274 US 200 (1927). [Also available at <http://www.eugenicsarchive.org/eugenics/>]
- “An Act to Provide for the Sexual Sterilization of Inmates of State Institutions in Certain Cases,” Virginia Code chapter 394, 20 March 1924. [Also available at <http://www.eugenicsarchive.org/eugenics/>]

- Daniel J. Kevles, “International Eugenics,” in *Deadly Medicine: Creating the Master Race* (Chapel Hill: University of North Carolina Press, for the Holocaust Memorial Museum, 2004), pp. 40-59.
- Gregory M. Dorr, “Assuring America’s Place in the Sun: Ivey Foreman Lewis and the Teaching of Eugenics at the University of Virginia, 1915-1953,” *Journal of Southern History* 66 (May 2000): 257-296.

Additional Background:

- Bowler and Morus, “Biology and Ideology,” MMS, pp. 415-438.

Week 13: Engineering Life

- Michael Rogers, “The Pandora’s Box Congress,” *Rolling Stone* 189 (19 June 1975), 37-40, 42, 74, 77-78, 82.
- Paul Berg, David Baltimore, Sydney Brenner, Richard O. Roblin, Maxine F. Singer, “Asilomar Conference on Recombinant DNA Molecules,” *Science* 188 (6 June 1975): 991-994.
- Everett Mendelsohn, “Frankenstein at Harvard: The Public Policies of Recombinant DNA Research,” in *Transformation and Tradition in the Sciences*, ed. Everett Mendelsohn (Cambridge: Cambridge University Press, 1984), pp. 317-335.
- Dorothy Nelkin and M. Susan Lindee, “Preface to the Second Edition,” “The Supergene” in *The DNA Mystique: The Gene as a Cultural Icon*, 2nd edition (Ann Arbor: University of Michigan Press, 2004), xi-xxviii, 192-205.

Additional Background:

- Bowler and Morus, “Genetics,” MMS, pp. 189-212.