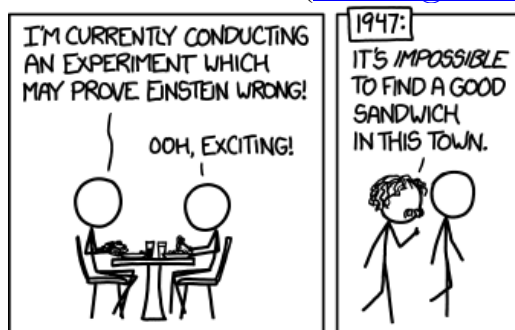


Ether, Atoms, Particles and Politics: The Physical Sciences in Modern Society History of Science 129v, Fall 2014

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xkcd.com

Course Description

This course surveys the history of the physical sciences from the late eighteenth century to the present. The course will cover major events and themes in the history of the physical sciences, placing particular emphasis on the interaction between the physical sciences and social and political changes. Students will work with primary sources and will also gain familiarity with some of the most important secondary sources in the history of physics, chemistry, and the earth sciences. Topics include the Chemical Revolution, thermodynamics, the Industrial Revolution, quantum mechanics, the atomic and hydrogen bombs, plate tectonics, and cold fusion.

Course Objectives

- 1) Learn about the major events in the history of the physical sciences.
- 2) Think about how the physical sciences affected society, and how society affected the physical sciences.
- 3) Practice evaluating primary sources, secondary sources, and competing historical accounts.
- 4) Become familiar with some major books and articles in the history of the physical sciences.

Required books

- Trevor Levere, *Transforming Matter: A History of Chemistry from Alchemy to the Buckyball* (Baltimore: Johns Hopkins University Press, 2001).
- Mary Jo Nye, *Before Big Science: The Pursuit of Modern Chemistry and Physics, 1800-1940* (Cambridge: Harvard University Press, 1996).

All other reading will be available as PDF downloads on the course iSite (available through my.harvard.edu, login required) or through Harvard's library resources (links on the course iSite).

Schedule of Lectures and Readings

Week 1 – Introduction

September 2: Introduction/Course expectations

September 4: The Physical Sciences during the Scientific Revolution

- Levere, Chapter 1: “First Steps: From Alchemy to Chemistry?” and Chapter 2, “Robert Boyle: Chemistry and Experiment”
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Week 2 – Chemical and political revolutions in the eighteenth century

September 9: Chemical Revolution 1 – Lavoisier vs. Priestley

- Levere, Chapter 5: “Different Kinds of Air” and Chapter 6, “Theory and Practice: The Tools of Revolution”
- Frederic Holmes, *Lavoisier and the Chemistry of Life: An Exploration of Scientific Creativity* (Madison: University of Wisconsin Press, 1985), Introduction and Chapter 8, “Fixing the Composition of Fixed Air”

September 11: Chemical Revolution 2 – Atomism

- Levere, Chapter 7: “Atoms and Elements”
 - Nye, Chapter 2: “Dalton’s Atom and Two Paths for the Study of Matter”
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Week 3 – Chemical and social revolutions in the nineteenth century

September 16: Industrial Revolution

- Eric Hobsbawn, *Industry and Empire: The Birth of the Industrial Revolution* (London: The Penguin Group, 1999 [1968]), Chapter 3, “The Industrial Revolution, 1780-1840,” pp. 34-56.
- Lee T. Wyatt, *The Industrial Revolution* (Westport, Conn: Greenwood Press, 2009), Chapter 4, “The Industrial Revolution in Great Britain.”
- Karl Marx and Friedrich Engels, *Communist Manifesto*, Part One, “Bourgeois and Proletarians.”

September 18: Organic chemistry, classroom space, and the Revolutions of 1848

- Levere, Chapter 8: “The Rise of Organic Chemistry”
 - William H. Brock, *Justus von Liebig: The Chemical Gatekeeper* (Cambridge: Cambridge University Press, 1997), Chapter 2, “Organic Analysis and the Giessen Research School”
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Week 4 – Science and society in Victorian Britain

September 23: Victorian Physics and Victorian Religion

Paper 1 is due today!

- Nye, Chapter 4: “Thermodynamics, Thermochemistry, and the Science of Energy”
- Crosbie Smith, *The Science of Energy: A Cultural History of Energy Physics in Victorian Britain* (Chicago: University of Chicago Press, 1998), Chapter 6: “Everything in the Material World is Progressive”
- Selected primary sources on the prayer gauge debate

September 25: The Age of the Earth – physics vs. biology?

- Joe Burchfield, *Lord Kelvin and the Age of the Earth* (Chicago: University of Chicago Press, 1990 [1975]), Chapter 3: “Kelvin’s Influence”
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Week 5 – The periodic table and radioactivity

September 30: Textbooks, Russian imperialism, and the periodic table of the elements

- Michael Gordin, *A Well-Ordered Thing: Dmitri Mendeleev and the Shadow of the Periodic Table* (New York: Perseus Books, 2004), Chapter 2, “The Elements of the System”

October 2: X Rays and Radioactivity: the new alchemy?

- Susan Quinn, *Marie Curie: A Life* (New York: Perseus Books, 1995), Chapters 7-8
 - W. C. Röntgen, “On a New Kind of Rays,” trans. Arthur Stanton, *Nature* 53 (23 January 1896): 274-276.
 - A.A.C. Swinton, “Professor Röntgen’s Discovery,” *Nature* 53 (23 January 1896): 276-277.
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Week 6 – A new worldview

October 7: Ether theory and Einstein’s relativity

- Nye, Chapter 3: “The Electromagnetic View of Nature and a World of Ether”
- Albert Einstein, “On the Electrodynamics of Moving Bodies,” pages 1-6 – *Read to get a sense of what Einstein is arguing; don’t worry if you find the details confusing.*

October 9: Quantum mechanics and the new atom

- Abraham Pais, *Niels Bohr’s Times, in Physics, Philosophy, and Polity* (Oxford: Clarendon Press, 1991), Chapter 8, “Bohr, father of the atom” and Chapter 19, “We are suspended in language,” pp. 420-436
 - Nye, Chapter 6, “A New Chemistry, a New Physics,” pages 171-188
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Week 7 – Nuclear fission

October 14: MIDTERM

October 16: The atom splits

- Ruth Lewin Syme, *Lise Meitner: A Life in Physics*, Chapter 10: “The Discovery of Nuclear Fission,” pp. 231-259
 - Nye, Chapter 7: “Nationalism, Internationalism, and the Creation of Nuclear Science, 1914-1940”
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Week 8 – The Manhattan Project and Hiroshima

October 21: The Manhattan Project and opportunity in science

- Henry DeWolf Smyth, *Atomic Energy for Military Purposes* (Palo Alto: Stanford University Press, 1989 [1945]), Chapter 13, “General Summary.” Available online at http://www.atomicarchive.com/Docs/SmythReport/smyth_xiii.shtml
- Leon Gortler and Stephen J. Weininger, “Chemical Relations: William and Lawrence Knox, African American Chemists,” *Chemical Heritage Magazine*. Online at <http://www.chemheritage.org/discover/media/magazine/articles/28-2-chemical-relations.aspx?page=1>

October 23: The aftermath of Hiroshima

- John Hersey, *Hiroshima* (New York: Vintage Books, 1989 [1945]), Chapter 1 and Chapter 4
 - Michael Gordin, *Five Days in August: How World War II Became a Nuclear War* (Princeton: Princeton University Press, 2007), Chapter 1, “Endings”
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Week 9 – Chemistry and physics meet biology

October 28: Chemistry and molecular biology

- Selections from James Watson, *The Double Helix*
- Brenda Maddox, *Rosalind Franklin: The Dark Lady of DNA* (New York: HarperCollins, 2002), Chapter 12, “Eureka and Goodbye”
- Soraya de Chadarevian, *Designs for Life: Molecular Biology after World War II* (Cambridge: Cambridge University Press, 2002), Chapter 3, “Reconstructing Life”

October 30: Radioisotopes and medicine

- Angela Creager, *Life Atomic: A History of Radioisotopes in Science and Medicine* (Chicago: University of Chicago Press, 2013), Chapter 5, “Dividends”
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Week 10 – The Nuclear Age

November 4: The Nuclear World

- Selections from Herman Kahn, *On Thermonuclear War*
- Watch “Duck and Cover” at <https://archive.org/details/DuckandC1951>
- Ray Bradbury, “There Will Come Soft Rains”

November 6: The USSR, Britain, France, China and India build a bomb

- Michael Gordin, *Red Cloud at Dawn* (New York: Farrar, Strauss and Giroux, 2009), Chapter 4: “First Lightning”
 - John Wilson Lewis and Xue Litai, *China Builds the Bomb* (Stanford: Stanford University Press, 1988), Chapter 1: “China’s Quest for Security”
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Week 11 – Cold War physical sciences

November 11: Big Science and the Cold War physics bubble

- Peter Galison, *Image and Logic*, selections from Chapter 5, “Bubble Chambers: Factories of Physics”
- David Kaiser, “Cold War requisitions, scientific manpower, and the production of American physicists after World War II,” *Historical Studies in the Physical Sciences* 33 (2002): 131-159.

November 13: Plate tectonics

- Jacob D. Hamblin, “Science in isolation: American marine geophysics research, 1950-1968,” *Physics in Perspective* 2 (2000): 293-312.
 - Selections from Thomas Kuhn, *The Structure of Scientific Revolutions*
 - Marie Tharp’s autobiographical essay, available online at <http://www.who.edu/sbl/liteSite.do?litesiteid=9092&articleId=13407>
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Week 12 – Physical science and physical pseudoscience

November 18: Aryan physics

- Selections from Klaus Hentschel and Ann M. Hentschel, eds., *Physics and National Socialism: An Anthology of Primary Sources* (Basel: Birkhäuser Verlag, 1996).

November 20: Catastrophists and hippies

Paper 2 is due today!

- David Kaiser, *How the Hippies Saved Physics*, (Chicago: U of Chicago Press, 2012), Chapter 5, “New Patrons, New Forums”
- Michael Gordin, *The Pseudoscience Wars: Immanuel Velikovsky and the Birth of the Modern Fringe* (Chicago: U of Chicago Press, 2012), Introduction: “Bad Ideas”
- Russell Targ and Harold Puthoff, “Information transfer under conditions of sensory shielding,” *Nature* 251 (18 October 1974): 602-7.
- [David Davies], “Investigating the paranormal,” *Nature* 251 (18 October 1974): 559-560.

Week 13 – Fusion, fraud, or faulty experiment?

November 25: Cold Fusion

- Harry Collins and Trevor Pinch, *The Golem: What everyone should know about science* (Cambridge: Cambridge University Press, 1993), Chapter 3: “The sun in a test tube: the story of cold fusion” pp. 57-77.
 - James McAllister, “Competition Among Scientific Disciplines in Cold Nuclear Fusion,” *Science in Context* 5 (1992): 17-49.
 - TIME Magazine, “Fusion Illusion” (1989)
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Week 14 – Into the twenty-first century

December 2: The Higgs Boson and scientific discovery in the twenty-first century

- Watch Jorge Cham, “The Higgs Boson Explained,” <http://www.phdcomics.com/comics.php?f=1489>
- *The Economist*, “Science’s great leap forward” (7 July 2012): <http://www.economist.com/node/21558254>
- *The Economist*, “Gotcha!” (17 March 2014): <http://www.economist.com/blogs/babbage/2014/03/astrophysics>
- Megan Garber, *The Atlantic*, “‘One of the Greatest Discoveries in the History of Science’ Hasn’t Been Peer-Reviewed—Does It Matter?” (19 March 2014): <http://www.theatlantic.com/technology/archive/2014/03/one-of-the-greatest-discoveries-in-the-history-of-science-hasnt-been-peer-reviewed-does-it-matter/284488/>

Your final examination will be held during the exam period.

Good luck and enjoy the break!