

Western Culture: Science, Technology, Philosophy II
The Making of Modern Science

Spring 2001

3 Credits; N (Natural Sciences), ILS / H (Humanities), Hist. Sci.; E (Elementary)
2 hours lecture (3:30pm TR, 1300 Sterling), 1 hour discussion
Open to freshmen; not open to students who have had Hist. Sci. 204

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Book List (University Bookstore)

Jack Meadows, *The Great Scientists* (New York and Oxford: Oxford University Press, 1987) Required

Rebecca Stefoff, *Charles Darwin and the Evolution Revolution* (New York and Oxford: Oxford University Press, 1996) Required

H.G. Wells, *The Time Machine* (1895) Required

Course Reader (Available from 7143 Social Science)

Assessment

Assessment is through three take-home essays written on selected topics (75% of the total grade), and section participation (25%).

First Take-Home Exam (20%): Distributed February 22; due March 1.

Second Take-Home Exam (25%): Distributed April 5; due April 12.

Final Take-Home Exam (30%): Distributed May 10; due May 18.

Syllabus

Items on the Book List are referred to by name (eg. Meadows, chap. on Newton). The other material is in the Course Reader.

Jan. 23 Introduction and The Natural Machine

Steven Shapin, "Introduction," to *The Scientific Revolution* (Chicago and London: The University of Chicago Press, 1996), pp. 1-14.

Jan. 25 Bacon and Descartes

Selections from Francis Bacon, *The New Organon* (1620), in J. Spedding, R.L. Ellis and D.D. Heath, eds. *The Works of Francis Bacon*, vol. 8, (Boston: Taggard and Thomson, 1863), pp. 59-63, 70-79 and 130-140.

Selections from René Descartes, *Discourse on Method*, in D. Weissman, ed. *René Descartes, Discourse on Method and Meditations on First Philosophy* (New Haven and London: Yale University Press, 1996), Parts 2 and 3, pp. 8-20.

Selection from Shapin, *Scientific Revolution*, pp. 30-57.

Discussion Section: Introductions

Discussing Shapin's Introduction

Jan. 30 Newton's Life

For an overview of Newton's life and achievements see Meadows, chap. on Newton.

Feb. 1 Models for a new Natural Philosophy

Selections from Sir Isaac Newton in H.S. Thayer, ed. *Newton's Philosophy of Nature: Selections from his Writings* (New York, Hafner, 1953), pp. 3-19, 41-55.

On Newton's two great books see John Roche, "Newton's Principia," and Casper Hakfoort, "Newton's Optics: The Changing Spectrum of Science," in John Fauvel, Raymond Flood, Michael Shortland and Robin Wilson, eds. *Let Newton be!* (Oxford: Oxford University Press, 1988), pp. 43-63 and 81-101.

Discussion Section: Framing the Scientific Revolution

Discussing the readings on Bacon and Descartes, and Shapin's overview, from Jan. 25.

Feb. 6 Newton's God

John Brooke, "The God of Isaac Newton," in Fauvel, et al., eds. *Let Newton be!*, pp. 169-183.

Feb. 8 Sites of Science: The Royal Society and the Coffee Houses

L. Stewart, "Public Lectures and Private Patronage in Newtonian England," *Isis* 77 (1986), 47-58.

Discussion Section: Newton in his Time

Selections from the readings from Jan. 30 to Feb. 8.

Feb.13 Experimental Natural Philosophy in the Enlightenment

J.L. Heilbron, "Experimental Natural Philosophy," in G.S. Rousseau and Roy Porter, eds. *The Ferment of Knowledge* (Cambridge: Cambridge University Press, 1980), 357-387.

Feb. 15 The Electrical Fluid

Thomas L. Hankins, *Science and the Enlightenment* (Cambridge: Cambridge University Press, 1985) chap. 3.

Discussion Section: Enlightenment Electricians

Discussing Heilbron and Hankins on Enlightenment physics.

Feb. 20 The Chemical Revolution

Meadows, chap. on Lavoisier and Hankins, *Science and the Enlightenment*, chap. 4.

Feb. 22 Enlightenment and the Romantics

Mary Shelley, *Frankenstein, or, The Modern Prometheus* (New York: Doubleday, 1999), pp. 55-76.

Note: First Take-Home Exam Distributed

Discussion Section: Airs and Gases and the New Chemistry

Focusing on the debate between Priestley and Lavoisier and Lavoisier's rationalization of chemistry, in the readings from Meadows and Hankins.

Feb. 27 Comprehending the Cosmos

Meadows, chap. on Humboldt

March 1 The Unity of Forces

Meadows, chap. on Faraday, and H.A.M. Snelders, "Oersted's Discovery of Electromagnetism," in Andrew Cunningham and Nicholas Jardine, eds. *Romanticism and the Sciences* (Cambridge: Cambridge University Press, 1990), pp. 228-240.

Note: First Take-Home Exam Due

Discussion Section: Mapping Nature

Exploring the role of a search for unity and polarity in nature, in the work of Humboldt, Oersted and Faraday.

March 6 The Brewer's Touch and the Mechanical Equivalent of Heat

Heinz Otto Sibum, "Reworking the Mechanical Value of Heat: Instruments of Precision and Gestures of Accuracy in Early Victorian England," *Studies in History and Philosophy of Science* 26 (1995), 73-106.

March 8 The Conservation of Energy

For an overview of energy physics see Crosbie Smith, "Energy," in R.C. Olby, G.N. Cantor, J.R.R. Christie, and M.J.S. Hodge, eds. *Companion to the History of Modern Science* (London: Routledge, 1990), pp. 326-341, and for the argument for simultaneous discovery see T.S. Kuhn, "Energy Conservation as an Example of Simultaneous Discovery," in Marshall Clagett, ed. *Critical Problems in the History of Science* (Madison: University of Wisconsin Press, 1959), pp. 321-356.

Discussion Section: Touch and Scale in the Development of Energy Physics

Situating Sibum's study of Joule in the context of scientific and industrial interest in energy

March 10-18 Spring Recess: No Class

March 20 Lamarck's Zoological Philosophy

Selections from Jean-Baptiste Lamarck, *Zoological Philosophy: An Exposition with Regard to the Natural History of Animals* (1809) in A.S. Weber, ed. *19th Century Science: An Anthology* (Peterborough, Ont.: Broadview Press, 2000), pp. 49-66.

March 22 Lyell's Principles of Geology

Selections from Charles Lyell, *The Principles of Geology* (1830) in Weber, ed. *19th Century Science*, pp. 98-120.

Discussion Section: Darwin's Predecessors

Drawing on selections from Lamark and Lyell to discuss evolution, natural history and geology in the nineteenth century

March 27 Charles Darwin's search for a Vocation

Meadows, chap. on Darwin and Steffoff, pp. 1-57

March 29 Darwin's Theory of Evolution

Selections from Charles Darwin, *On the Origin of Species* (Cambridge, MA: Harvard University Press, 1964), pp. 1-6, 80-87, 126-130, 459-490.

Discussion Section: The Origin of Species

Reviewing the concept of evolution and artificial and natural selection in the readings from Darwin himself, Meadows and Steffoff

April 3 The Scientific Reception of Darwin

Steffoff, pp. 58-116.

April 5 Darwinian Matters

Reading as for April 3.

Note: Second Take-Home Exam Distributed

Discussion Section: Debating Darwin

Focusing on the scientific and popular reception of Darwin's theory.

April 10 Evolution and the Social Order

Diane Paul, *Controlling Human Heredity: 1865 to the Present* (Amherst, NY: Humanities Press, 1995), pp. 22-49.

April 12 Statistics and Society

Ian Hacking, "Probability and Determinism, 1650-1900," and Theodore M. Porter, "Natural Science and Social Theory," in R.C. Olby, et al. *Companion to the History of Modern Science* (London: Routledge, 1990), pp. 690-701 and 1024-1043.

Note: Second Take-Home Exam Due

Discussion Section: Knowledge and Social Control

Exploring the role of statistics in the human sciences, and in particular the rise of eugenics, through the readings of Hacking, Porter and Paul.

April 17 Electricity and Magnetism: Telegraphy and the Empire

Bruce J. Hunt, "Doing Science in a Global Empire: Cable Telegraphy and Electrical Physics in Victorian Britain," in Bernard Lightman, ed. *Victorian Science in Context* (Chicago and London: The University of Chicago Press, 1997), pp. 312-333.

April 19 Standards and Networks

Simon Schaffer, "Empires of Physics," in Richard Staley, ed. *The Physics of Empire: Public Lectures* (Cambridge: Whipple Museum, 1994), pp. 87-113.

Discussion Section: The Physics of Empire

Discussing the role of telegraph networks in maintaining Empires – and producing a new physics

April 24 Science in the United States

On physics, geology and engineering in the U.S. see Daniel J. Kevles, *The Physicists: The History of a Modern Scientific Community in America* (Cambridge, MA and London: Harvard University Press, 1995), pp. 25-74.

April 26 Rowland, Michelson and Gibbs: Pure and Practical Physics in the U.S.

H.A. Rowland, "The Highest Aim of the Physicist," (1899) in Spencer R. Weart, ed. *Selected Papers of Great American Physicists* (New York: American Institute of Physics, 1976), pp. 91-103.

Discussion Section: Science in the United States

Discussing Kevles's overview and the careers of Rowland and Michelson in particular

May 1 H.G. Wells's Time Machine: Degeneracy and Social Physics

H.G. Wells, *The Time Machine*

May 3 Einstein's Theory of Relativity

Meadows, chap. on Einstein, and for a succinct overview of relativity see John Stachel, "The Theory of Relativity," in R.C. Olby, et al. *Companion to the History of Modern Science* (London: Routledge, 1990), pp. 442-457.

Discussion Section: Cultures of Time and Space

Focusing on Wells's eugenic vision, and reviewing the key innovations of Einstein's relativity

May 8 The Chemist's War

On science in the wars of the twentieth century see Everett Mendelsohn, "Science, Scientists, and the Military," in John Krige and Dominique Pestre, eds. *Science in the Twentieth Century* (Amsterdam: Harwood Academic, 1997), pp.175-202.

May 10 Einstein and the Legacies of the Great War

For Einstein's response to the social environment see Fritz Stern, "Einstein's Germany," in G. Holton and Y. Elkana, eds. *Albert Einstein: Historical and Philosophical Perspectives* (Princeton, NJ: Princeton University Press, 1982), pp. 319-343.

Note: Final Take-Home Exam Distributed

Discussion Section: Modern Science

Discussing Mendelsohn on science and war and Stern on Einstein

May 18 Final Examination Due