

History of Science 202: The Rise of Modern Science
ILS 202: Western Culture: Science, Technology, Philosophy II
Spring 2013

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Lectures: MW 1:20-2:10 pm, 19 Ingraham Hall. Discussions: Thurs. 11:00, 12:05, Mon 11:00, 12:05. Please attend the section you signed up for!

Welcome to HistSci/ILS 202! This course offers an introduction to the history of the sciences between the late seventeenth century and the early twentieth century, with the aim of understanding the varied ways of knowing that have come to be known as “science.” We will ask: What does it mean to know something about nature? How can we be sure this knowledge is secure? And what is this “scientific” knowledge of nature good for, according to people in particular times and places? In pursuing these questions, we will treat such pivotal intellectual developments as Newtonianism, the conservation of energy, and Darwin's theory of evolution. At the same time, we will seek to understand the relationship between these ideas and the broader cultural context in which they took place, paying particular attention to the ways it was possible to “do science” in different times and places. These big, messy, important questions and relationships are among the most important in our culture's history and remain central to understanding the condition of modern Western and global culture today.

Grading:

- 30%: Attendance at lecture and participation in weekly discussion sections, including informal writing, homework exercises, and any other discussion section requirements set by your TA.
- 20% Unit I take-home essay (1200 words), due in your 202 L@UW Dropbox by **10 pm on Tuesday, March 5.**
- 20% Unit II take-home essay (1200 words), due in your 202 L@UW Dropbox by **10 pm on Wednesday, April 10.**
- 30% Unit III take-home essay (1500 words), due in your 202 L@UW Dropbox by **7 pm on Tuesday, May 14.** The final essay will invite you to draw on the course as a whole in your answer.

All formal writings should be **word-processed and double-spaced**. It is a good idea to keep both an electronic and a hard copy for yourself. See “Introductory Study Materials” on Learn@UW for details on policies concerning late papers, plagiarism, learning accommodations, and academic performance.

Books available for Purchase: (A Room of One's Own Books, 315 W. Gorham St)
Peter Bowler and Iwan Morus, *Making Modern Science* (“B&M” in course schedule)
H. G. Wells, *The Time Machine* (Broadview edition only)

All other readings and study materials are posted on the ILS and HS 202 Learn@UW websites (see below). You'll need to read and use them before the class for which the work is listed. We strongly recommend printing the readings. The cheapest way to do this all at once is to download

the three Combined Readings files for each unit from L@UW (posted at Materials>Content>Syllabus, Assignments, and Handouts) and send it to Student Print, Suite 3301, 333 East Campus Mall, stuprint@rso.wisc.edu. They will print it within 2 days and you can pay for it and pick it up then. Or you can print up parts individually, as they are listed online for each due date. We recommend printing out the Study Guides and filling them out by hand. Taking notes (or answering study questions) *by hand* is a proven method for learning material better than just highlighting it.

Course Website. We will be using Learn@UW, an interactive course website, for distributing writing assignments and handouts and for important website links and other information. To access the Learn@UW site for ILS or HistSci 202, follow these two steps:

1. Go to <http://learnuw.wisc.edu>, or access it from the UW home page. Click on “UW Net ID Login,” then at the next screen, type in your WiscWorld username and password to get to the next screen, which is your Learn@UW “portal page.” Notice that on this page there is a red “Help” button in the upper right-hand corner to click on if you have any trouble navigating to the site or getting any of the information. The Help Desk is available to assist you around the clock for navigation issues, so please contact this number: 264-HELP.
2. Once on your Learn @UW portal page, you will see a column called “**My Courses**,” which will list all your UW courses that have a Learn@UW website. Look for “2013 Spring”; you may need to expand that semester by clicking on the “>” button. Click on the link under this heading for ILS or HistSci 202 and you’ll arrive next at the course website.

Note the navigation bar at the top of the page, above the course title banner. Most of the information for the course is listed under the “Content” tab, but you may have use for the other tabs, depending on your situation and how discussion sections are structured.

Course Objectives:

This course is designed to help you achieve a variety of goals. In terms of content, the basic goals are:

- to learn in some detail how reliable knowledge of nature has been constituted over time (issues of scientific method);
- to learn to view science as a living, changing enterprise made by people responding both to nature and also to their own material needs and belief systems;
- to learn some basic scientific concepts, how they came into being, and how they have mattered in Western culture; and
- to understand how past science—even long-past science—has shaped the world we live in today.

But this course also seeks to improve your ability to think historically and critically about science. This involves developing several skills:

- how to ask good questions about information you encounter;
- how to break down a big question into manageable pieces;
- how to think synthetically, to piece together patterns from diverse pieces of evidence
- how to make and defend critical/analytical arguments.

While the content goals will help you gain greater scientific and cultural literacy, the historical thinking goals will help you develop and cement skills that you can transfer to many other realms. This course is designed to challenge you on both fronts, while also stimulating you to think in new ways about science and its place in Western culture.

Course Schedule

Readings are listed beneath lecture titles for each lecture date. Those marked with * are posted on L@UW.

Week 1: Introductions

1/23: *Course Introduction: Science, Knowledge, and Power*

****Be sure to go to discussion sections this week!****

Discussions 1/24-1/28: Print up and read "Introductory Course Materials" (on Learn@UW) for section.

Unit I: Understanding Nature in the Enlightenment

Week 2: Newton and "Academic" Natural Philosophy

M 1/28: *Experimental Knowledge and the Mechanical Philosophy*

B&M, 23-25, 33-52, 322-326

*Robert Crease, "*Experimentum Crucis*: Newton's Decomposition of Sunlight with Prisms," chapter 4 in *The Prism and the Pendulum*, 59-76

*Newton, "A New Theory about Light and Colours" (1672), as excerpted by William Francis Magie, ed., *A Source Book in Physics* (Cambridge: Harvard U. Press, 1963), 298-305

W 1/30: *Newton's Syntheses*

*Isaac Newton, *Principia* (tr. Andrew Motte, 1729): Book I: "Definitions"; "Laws"; Book III: "Rules of Reasoning"; "General Scholium." Adapted from <http://members.tripod.com/~gravitee/>.

*I. Bernard Cohen, "Franklin's Scientific Style," in idem, *Benjamin Franklin's Science* (Cambridge, MA: Harvard University Press, 1990), 14-17 only (the rest comes next week).

Week 3: Expanding the Framework: Experiment, Explanation, and Utility

M 2/4: *Spreading Enlightenment*

B&M, 367-371 (bottom)

*Dobbs and Jacob, *Newton and the Culture of Newtonianism* (Atlantic Highlands, NJ: Humanities Press International, 1995), 71-95, 123-4

*I. Bernard Cohen, "Franklin's Scientific Style," in idem, *Benjamin Franklin's Science* (Cambridge, MA: Harvard University Press, 1990), 17-30 [filed earlier]

*Letter 3 from Benjamin Franklin to Peter Collinson, Sept. 1, 1747, as reprinted in *Benjamin Franklin's Experiments: A New Edition of Franklin's Experiments and Observations on Electricity*, ed. I. B. Cohen (Cambridge, MA: Harvard University Press, 1941), 179-186.

W 2/6: *Explaining Living Matter*

*Thomas H. Broman, "Matter, Force, and the Christian Worldview in the Enlightenment," in *When Science and Christianity Meet*, ed. David C. Lindberg and Ronald L. Numbers (Chicago: University of Chicago Press, 2003), pp. 85-109.

*Abraham Trembley, *Memoirs concerning the Natural History of the Polyp* (1744). Translated and edited by Sylvia G. Lenhoff and Howard M. Lenhoff, in *Hydra and the Birth of Experimental Biology-1744*. (Pacific Grove, CA: Boxwood Press, 1986). Excerpts from the First and Fourth Memoirs, pp. 1-11, 182-188, Plates 11-13.

Week 4: Global Adventuring

M 2/11: Voyaging, Travel, and Natural History

- *Mary Terrall, "Heroic Narratives of Quest and Discovery," *Configurations: A Journal of Literature, Science, and Technology* 1998, 6: 223-242
- *Londa Schiebinger, "Exotic Abortifacients: The Global Politics of Plants in the 18th Century," *Endeavour*, 24(3), 2000, 117-121
- *Richard Holmes, *The Age of Wonder* (NY: Random House, 2008), 1-21, 33-35, 38-40
Trace the *Endeavour* voyage at http://southseas.nla.gov.au/journals/maps/01_world.html

W 2/13: Ordering Nature

- *Paul Farber, *Finding Order in Nature* (Baltimore: Johns Hopkins University Press, 2000), 6-21
- *Carl von Linné, *Philosophia botanica*, tr. Stephen Freer. (Oxford University Press, 2003), 219-226, 328-35
- Visit Linnaeus' reconstructed garden at:
<http://www.linnaeus.uu.se/tradgardsvandring/indexEng.php>
Be sure to click around its different parts.
- *ILS discussion sections: herbarium exercise.

Week 5: The (First) Industrial Revolution

M 2/18: Culture(s) of Improvement

- *Robert Friedel, *A Culture of Improvement*, ch. 13, "Artisans, Philosophes, and Entrepreneurs," 235-254, 555-556
B&M, 391-398

W 2/20: The Science and Technology of Power

- B&M, 398-403
- *Bruce Hunt, *Pursuing Power and Light: Technology and Physics from James Watt to Albert Einstein* (Baltimore: Johns Hopkins University Press, 2010), 4-13, 19-24

Week 6: Science in the Age of Revolutions

M 2/25: Analytical Chemistry as Natural Philosophy

- *Peter R. Dear, *The Intelligibility of Nature* (Chicago: U. of Chicago Press, 2006), 39-44, 67-89

UNIT 1 ESSAY COVERS MATERIAL THROUGH 2/25

Unit II: The New Unities of Science, 1790-1890

W 2/27: Between Enlightenment and Romanticism: Alexander von Humboldt and Global Physics

- *Michael Dettelbach, "Humboldtian Science," In *Cultures of Natural History*, ed. N. Jardine, J. A. Secord and E. C. Spary (Cambridge, England: Cambridge University Press, 1996), 287-304.

Week 7: Unifying the Sciences

M 3/4: Romantic Science

- *Walter D. Wetzels, "Aspects of Natural Science in German Romanticism," *Studies in Romanticism*, 1971, 10: 44-59.
- *Holmes, *Age of Wonder*, 314-317, 325-330
- *Mary Shelley, *Frankenstein* (New York: New American Library, 1982), 42-68.

UNIT I ESSAY DUE TUESDAY 3/5 in L@UW Dropbox by 10 pm

W 3/6: *From "The Sciences" to "Science"*

*[William Whewell], "On the Connexion of the Physical Sciences. By Mrs. Somerville." [book review]. *Quarterly Review*, 1834, 54-68 (selections)

*Laura Snyder, *The Philosophical Breakfast Club*, 1-8, 134-157, 384-387.

Week 8: The Conservation of Energy

M 3/11: *Work and Waste: The Conservation of Energy in Britain*

B&M, 79-95

*[Henry Roscoe], "Thermo-Dynamics," *Edinburgh Review*, Jan. 1864, 243: 1-26

W 3/13: *The Animal Machine*

*Anson Rabinbach, "Transcendental Materialism: The Primacy of *Arbeitskraft* [Labor Power]," in idem, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (Berkeley: University of California Press, 1990), 45-68, 309-316.

Week 9: Science in the Second Industrial Revolution

M 3/18: *Electricity and Empire*

B&M, 403-407

*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: University of Chicago Press, 1997), 312-333

W 3/20: "Nature, Aided by Chemistry": *Light, Color, and Coal*

*Robert Friedel, *A Culture of Improvement*, 341-354

SPRING BREAK 3/25-3/31

Week 10: Improving Life

M 4/1: *Pasteur and the Agricultural Origins of "Germs"*

*David V. Cohn, "The Life and Times of Louis Pasteur," <http://www.foundersofscience.net>. (Go to this website, click on "Pasteur," and scroll down to see the illustrations in color.)

*Louis Pasteur, *Studies on Fermentation: The Diseases of Beer, Their Causes, and the Means of Preventing Them*, tr. Frank Faulkner and D. Constable Robb (1879)

W 4/3: "Scientific" *Medicine and Public Health*

B&M, 439-441, 446-450

*Bert Hansen, "America's First Medical Breakthrough: How Popular Excitement about a French Rabies Cure in 1885 Raised New Expectations for Medical Progress," *American Historical Review*, 1998), 373-418.

Receive unit 2 question

Unit III: Progress and the Historical Sciences

Week 11: The History of Life on Earth

M 4/8: *The Earth Acquires a History*

B&M, 103-115, 341-3, 347-354

*Mott T. Greene, "Genesis and Geology Revisited: The Order of Nature and the Nature of Order in Nineteenth-century Britain" in David Lindberg and Ronald L. Numbers, eds., *When Science and Christianity Meet* (Univ. of Chicago Press, 2003), 139-159, 302-304

W 4/10: *Change, Progress, and the History of Life*

B&M, 115-124, 132-143

*Charles Lyell, *Principles of Geology*, vol. 1 (1830) (selections)

**HistSci sections meet in Memorial Library; ILS sections: Geology Museum exercise

UNIT 2 Essay due Wed. 4/10 in Learn@UW Dropbox by 10 pm

Week 12: Darwin's Theory

M 4/15: *The Evolution of Darwin's Theory*

B&M, 143-149

*Sandra Herbert and David Norman, "Darwin's Geology and Perspective on the Fossil Record," in *The Cambridge Companion to the "Origin of Species,"* Michael Ruse and Robert J. Richards, eds. (Cambridge: Cambridge University Press, 2009), 129-152

W 4/17: *Darwin's Theory and Its Consequences: The Great Gestalt Shift*

B&M, 149-157

*Charles Darwin, *On the Origin of Species* (1859) chapter 4, "Natural Selection" (excerpts) from Mark Ridley, ed., *The Darwin Reader* (2ed) (W. W. Norton, 1996), 101-126

Week 13: Darwinism and Society

M 4/22: *Religious Responses to Darwinism*

B&M 149-157, 161-2, 354-62 [figure out what goes where]

*"Adam Sedgwick (1785-1873)" in David Hull, *Darwin and His Critics* (Chicago: University of Chicago Press, 1983), 155-170

*Darwin Correspondence Project: letters to and from Adam Sedgwick (2525, 2548, 2555, all in 1859), Asa Gray (2767, 2814, 3342, dated 1860-61). From:

<http://www.darwinproject.ac.uk/>

W 4/24: *Evolution, Race, and Intelligence*

B&M, 420-431

*John Carson, *The Measure of Merit: Talents, Intelligence, and Inequality in the French and American Republics, 1750-1940* (Princeton: Princeton U. Press, 2007), 75-97, 308-316

*A. S. Weber, "Sir Francis Galton" in *Nineteenth Century Science: An Anthology* (Toronto: Broadview, 2000), 345-347

*Francis Galton, "The Comparative Worth of Different Races," from *Hereditary Genius: An Inquiry into Its Laws and Consequences* (1869), pp. 30, 325-337

Week 14: Looking Forward

M 4/29: *Evolution and Degeneration*

H. G. Wells, *The Time Machine*, 55-112, 157-168

W 5/1: *The End of Nature? Entropy and the Cosmological Future*

H. G. Wells, *The Time Machine*, 112-156, 225-234

Week 15: Looking Backward

M 5/6: *Science at the Brink*

*Alfred Russel Wallace, *The Wonderful Century: Its Successes and Its Failures* (London: Swan Sonnenschein and Co., 1898), pp. 150-156, 367-379

W 5/8 *The Big Picture: What does it all mean?*

receive final essay questions

***Final essay due May 14 by 7 pm in your 202 Learn@UW drop-box.**