

History of Science 202: The Making of Modern Science
ILS 202: Western Culture: Science, Technology, Philosophy II
Spring 2005

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Welcome to 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.” In pursuing this question, we will treat such pivotal intellectual developments as Newtonianism, Darwin's evolution theory, the conservation of energy, and the sciences of the invisible. 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 processes by which scientists and non-scientists have assimilated new information and changed their ideas about nature. We will see how scientific ideas have developed in relation to religious belief systems, on the one hand, and technology, on the other. These big, messy, important 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.

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;
- ☞ 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; and
- ☞ to learn some basic scientific concepts, how they came into being, and how they have mattered in Western culture.

But this course also serves a larger purpose: to improve your ability to think historically 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.

Getting there:

The various parts of the course are designed to work together to help you accomplish these goals.

Lectures not only provide important information but also model the analytical-critical and synthetic skills you will be working on in the course. To get the most out of lecture, read the reading associated with the lecture beforehand; take careful notes; and go over your notes right after lecture to remind you of the big picture and to identify places you might want some clarification on in the next lecture or in discussion section. I will aim to provide lecture outlines on the course website following each lecture (see below) so you can check your notes against the basic structure of the lecture, but you will still need to take good notes.

A note on lecture etiquette: once the lecture begins, you may not read newspapers, use headphones, or otherwise do obviously non-attentive activities. Cell phones must also be turned off. This is a matter of courtesy both to me and to others in the class.

Readings are an essential part of this course. They are designed to complement the lectures, not repeat them. To be fully prepared for lecture and your discussion section, you need to do more than just pass your eyes over all the assigned readings in advance of the relevant class. You should mark sentences or passages that seem significant to you (using a pencil, not a highlighter, if you plan to resell your books at the end of the course); think about the readings as a whole; and consider how they relate to each other and to the lectures. To help you do that, each week a “reading guide” will be posted on the course website containing a set of focus questions for you to think about as you read. It is a good idea to print up the reading guide and jot down your responses to these questions as you read; your teaching assistant may require some responses to be handed in or some other forms of feedback/assessment as part of the discussion participation requirement.

Discussion Sections: This is where the most important learning of the course takes place, for this is your weekly chance not only to clarify confusions but, more importantly, to synthesize the lectures and readings, so you get the big picture. 25% of your grade is based on participation in discussion section. Attendance is the minimum requirement—you are expected to attend every section meeting. More than one absence could affect your grade. To exceed this minimum standard, come prepared with questions and comments about the readings and lectures as well as responses to the reading guide. If you are shy, write down your thoughts in advance; your TA may allow you to use such writings, handed in at class, as part of your participation grade.

Take-home essays: The essay questions ask you to think synthetically, drawing material from different weeks together into a unified picture. Every essay you write should take the form of an argument supporting a thesis. Since all essays are open-book, grading will NOT depend solely or even primarily on the correctness of the facts marshaled for your argument; this correctness is assumed as a base-point. Rather, much of your grade will be based on the persuasive power, sophistication, originality, and succinctness of your argument. (More on this during the course.)

All of these different aspects of the course are reflected in the ***Grading Structure:***

Participation in Discussion Sections 25% (including any writing assignments your TA requires)

Three take-home essay exams of approximately 1000 words each: 25% each. The final essay will ask you to draw on the course as a whole, with some emphasis on the final unit.

MAJOR DUE DATES:

Tues., Feb. 22: 1st essay;

Tues., April 12: 2nd essay;

Mon., May 9: Final essay (due in your TA's mailbox at 12:30 pm)

Your **word-processed, double-spaced** essays are due **at lecture on the due date** unless otherwise specified. It is a good idea to keep both an electronic and a hard copy for yourself.

Nuts and Bolts:

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

1. Open up an Internet browser and go to this website (which you should then save in your "favorite" file): <https://uwmad.courses.wisconsin.edu/> This is your login page for Learn@UW. You will need to type in your WiscWorld username and password to get to your "portal page."
2. Once on your Learn @UW portal page, you will see "My Madison Courses" which will list all your UW courses that have a Learn@UW website. Click on the link under this heading for "History of Science 202" or "ILS 202," and you'll arrive at the course website. Notice that on this page there is information about the "Help Desk" 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, so please contact this number!

Books available for Purchase: (University Book Store or Underground Textbook Exchange):

Margaret Jacob and Betty Jo Teeter Dobbs, *Newton and the Culture of Newtonianism* (abbreviated as "D&J" in reading schedule)

Paul Lawrence Farber, *Finding Order in Nature: The Naturalist Tradition from Linnaeus to E. O. Wilson* ("Farber" in reading schedule)

A. S. Weber, ed., *19th Century Science: An Anthology* ("19thC" in reading schedule)

A *Course Reader* is available for purchase at the Department of History of Science, 7143 Social Science Building.

A copy of all readings is on reserve at College Library.

Academic Performance and Accommodation:

Extensions are only granted if requested before the due date, and only in case of illness or other serious emergency. (A printer failure does not qualify.) All extensions will have a definite new due date established. Papers received after the new due date will be subject to late paper penalties.

Late paper policy: any piece of writing that you hand in late without an extension will have the following penalties assessed: a quarter of a grade for every working day late. For example, if the paper on its merits deserves a B (3.0 on a scale of 4), after one day it would receive a B/BC (2.75), after two days a BC (2.5), after three a BC/C (2.25), after four a C (2.0). NOTE: LATE TAKE-HOME FINAL EXAMS WILL NOT BE ACCEPTED.

Appealing a grade: If you have questions about a grade, you should first talk to the teaching assistant who gave you the grade. If the problem is not resolved, come talk to me. If we cannot come to a satisfactory conclusion, the next step is for you to speak with the ILS Chair, Prof. Laura McClure. She will attempt to resolve the issue informally and inform you of the appeals procedures if no resolution is reached informally. This set of steps is in line with L & S policy and should be available to you in any course, not just this one.

Access and Accommodation: I will make every effort to honor requests for reasonable accommodations made by individuals with disabilities. (If you think you qualify for accommodation, please contact the McBurney Disability Resource Center [263-2741; <http://jumpgate.acadsvcs.wisc.edu/~mcburney/>] to establish your eligibility for services.) Requests for accommodation can be responded to more effectively if I receive them as

far in advance as possible, preferably at the beginning of the semester. Such requests are confidential.

Religious Observance: If religious holidays or observances conflict with your participation in this course, please come talk to me **well in advance** for us to work out alternative arrangements.

If any other problems arise, either academic or personal, which might jeopardize your performance in the course, you must try to inform Prof. Nyhart after lecture or by the soonest available office hour, or by leaving a message with the History of Science department administrator (262-1406).

Lecture/Reading Schedule

DATE (lec. #)	WEEK and LECTURE TITLES	READING
<i>Week 1:</i>	<i>Introductions</i>	
Jan. 18 (1)	Course Introduction	
UNIT I: SCIENCE AND THE ENLIGHTENMENT		
Jan. 20 (2)	Legacies of the Scientific Revolution	Wilson (Reader); Whewell sections 1-3, pp. 174-177 (19thC)
<i>Week 2:</i>	<i>Newton and his Legacies</i>	
Jan. 25 (3)	The Newtonian synthesis	D&J 1-27, 38-46 D&J 46-65
Jan. 27 (4)	Newton's philosophy: method, matter, and metaphysics	Newton excerpts (Reader)
<i>Week 3:</i>	<i>The Uses of Enlightenment</i>	
Feb. 1 (5)	Spreading Enlightenment: Popularizers and Projectors	D&J 71-95; Desaguliers, <i>Course of Experimental Philosophy</i> (Reader); review Newton corol. 2
Feb. 3 (6)	The Industrial Revolution	D&J, 110-123
<i>Week 4:</i>	<i>Matter and Soul in the 18th Century: New Problems for Natural Philosophy</i>	
Feb. 8 (7)	The nature of matter: from atomic attraction to subtle fluids	D&J, 95-101; Broman, "Matter;" Desaguliers, "Thoughts" (both in Reader)
Feb. 10 (8)	Living matter and the problem of the soul	Trembley (Reader)
<i>Week 5:</i>	<i>Enlightenment Natural History</i>	
Feb. 15 (9)	Collecting, Travel, and Empire	receive 1st essay assignment Iliffe (Reader)
Feb. 17 (10)	Classification as an Enlightenment Project	Koerner (Reader); Farber, ch. 1

UNIT II: FROM NATURAL PHILOSOPHY TO NATURAL SCIENCE

<i>Week 6:</i>	<i>Analogy and Unity</i>	1st essay due at <u>lecture 2/22</u>
Feb. 22 (11)	Romantic Science	Shelley (Reader)
Feb. 24 (12)	The new technologies of transportation and communication	Otis, Secord (Reader)
<i>Week 7:</i>	<i>Unifying Natural History and Natural Philosophy</i>	
Mar. 1 (13)	From Natural History to Disciplinary Science I: Humboldt and Terrestrial Physics	Dettelbach (Reader); Humboldt (19thC)
Mar. 3 (14)	From Natural History to Disciplinary Science II: Biologie at the French Museum	Farber, chs. 2 and 3
<i>Week 8:</i>	<i>"Science" and its Philosophical Bases</i>	
Mar. 8 (15)	The "Scientist" as a Creature of the 19th Century	Somerville (19thC); [Whewell] review of Somerville (website); Whewell, sections 1-5, 9 & 10 (19thC)
Mar. 10 (16)	History and Progress	Comte (19thC); Whewell section 11
<i>Week 9:</i>	<i>The History of the Earth and Life on It</i>	
Mar. 15 (17)	The History of the Earth and Life on It	Greene (Reader)
Mar. 17 (18)	Geological History and the Problem of Method	Lyell (19thC); Whewell (Reader)
SPRING BREAK Mar. 19-27		
<i>Week 10:</i>	<i>Darwin's Theory</i>	
Mar. 29 (19)	The Evolution of Darwin's Theory	Paley (19thC); Young, parts I-IV (Reader)
Mar. 31 (20)	The Theories of Darwin and Wallace	Darwin (19thC); Wallace (19thC); Farber 56-63
		receive 2nd essay assignment
<i>Week 11:</i>	<i>Reception of Darwinism</i>	
April 5 (21)	Darwinism and its Consequences	Young, parts V-end; Farber 63-71
April 7 (22)	Darwinism and Society	Galton (19thC)

UNIT III: SEARCHING FOR NEW UNITIES: ENERGY AND MIND

<i>Week 12:</i>	<i>Energy and Entropy</i>	2nd essay due at <u>lecture</u>
April 12 (23)	Work and Worldview: The Conservation of Energy	Smith (Reader); Cormack and Ede 265-276 (Reader)
April 14 (24)	The Animal Machine: Force and Physiology	Helmholtz (19thC); Russett (Reader)

<i>Week 13:</i>	<i>Body and Mind</i>	receive final essay question
April 19 (25)	The Experimental Ideal	Farber 72-80; Bernard (19thC)
April 21 (26)	Mental Physiology and Spirit Phenomena	Wallace, "Spiritualism" and "A Defence" (Reader); Carpenter (Reader)
<i>Week 14:</i>	<i>Living in a(n Im)material World: Particles, Rays, and the Ether</i>	
April 26 (27)	The Physics and Philosophies of the Ether	Wynne (Reader)
April 28 (28)	Detecting New Phenomena: X-Rays, Radiation, Electrons	finish Ede and Cormack (Reader); Röntgen (19thC); Curie (19thC)
<i>Week 15:</i>	<i>Wrapping It Up</i>	
May 3 (28)	Science ca. 1914	Millikan (reader)
May 5 (29)	The Big Picture: Taking the long view	

Final essays due Monday May 9 at 12:30 pm.

Late take-home essays will not be accepted.

Grading Scale for Essays:

- A For outstanding essays only. Thesis and argument are clear, thought-provoking, and based on correctly understood facts; material used to support the argument synthesizes ideas from different parts of the course (readings, lectures, discussions from different weeks); relationships drawn between facts and ideas are sophisticated, subtle, and/or original. Writing is grammatically correct and succinct. The argument flows well from point to point, without any puffery or wasted words.
- AB: For very good essays that for some reason fall short of the criteria listed above. For example, the argument may be murky in one place; information may be presented that doesn't directly or clearly contribute to the argument; writing style may be awkward here and there, or flawed by one or two consistent (if minor) grammatical errors.
- B: Your basic okay grade. The essay may pursue a straightforward but not especially deep or sophisticated argument; it is okay as far as it goes, but doesn't penetrate the material very far. It may have a flash of brilliance that is unfulfilled, counterbalanced by minor grammatical problems, a weakness in argumentation, and/or a significant misunderstanding of events or chronology.
- BC: The essay shows some of the basics of the ideal essay, but is weakened by a lack of serious think-work or writing problems. It may make superficial connections without offering sufficient evidence to make the connections plausible or persuasive, or it may have what is in principle a good argument supported by incorrect facts or chronology. Alternatively, it may provide a fairly solid argument with minor flaws, from which the reader is repeatedly distracted by awkward or ungrammatical prose.
- C: A grade signifying some serious problem in essay-writing. It may deliver facts without a recognizable thesis or argument; it may wander away from the point; or it may be a thoughtful attempt so weakened by writing problems (grammar, punctuation, word choice) that it is difficult for the reader to understand a crucial point you are trying to make.
- D: A marginal grade. There may be enough in here to show you have attended a few lectures and/or done some of the reading, but the essay indicates no effort at synthesis or thinking on your own, or else shows a serious misunderstanding of the nature of the material and/or the assignment. Also used for essays that are just barely coherent.
- F: For unacceptable essays. An essay may be judged unacceptable if it contains plagiarism (see below); if it consists primarily in content inappropriate to the question or the material for this course; if it shows a complete misunderstanding of the course content; or if the writing fails to meet standard college-level requirements of basic communication in English.

The A-F system translates on your transcripts into a 4-point scale, where A = 4, AB = 3.5, B = 3, BC = 2.5, C = 2, D = 1, and F = 0. On any given assignment, you may receive a grade that is different from one of these, reflecting a penumbra around each grade (e.g., the "B" grade might range between 2.76 and 3.25). Thus you can tell if your paper is at the high, middle, or low end of the grade range for any given assignment.

Plagiarism: plagiarism is a serious breach of academic integrity and may be grounds for failure on the assignment plagiarized (take-home exam or paper). If you use 3 or more words in a row from another source, it must be placed in quotation marks and footnoted. Otherwise, it is plagiarism. For more on what constitutes plagiarism and how to avoid it, consult the Pocket Manual by Diana Hacker or see the UW Writing Center's handout "Quoting, Paraphrasing, and Acknowledging Sources" (online at: <http://www.wisc.edu/students/plagiarism.pdf>). It would also be wise to review the UW's student guide on academic misconduct (at: <http://www.wisc.edu/students/amsum.htm>).

