

History 252: The History of Western Science: A Survey  
(Second Semester)

(Tu & Th 11:00-12:15, McIver 228)

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Office hours: Tu & Th, 10:00-11:00, Wed 3:30-4:30, or by appointment

This course attempts to capture some of the major developments in the history of Western science from the end of the Scientific Revolution around 1700 till the twentieth century. Since the scope of the potentially available material is truly vast, severe selection is needed to produce a manageable syllabus. Unfortunately, few good elementary-level texts cover this period, none adequately. I've chosen Charles C. Gillispie's *The Edge of Objectivity: An Essay in the History of Scientific Ideas* as the best available for my purposes and have thus to some extent let myself be guided by his choice of topics. A few additional readings (designated "R" in the syllabus) are on reserve in Jackson Library; they are also accessible on-line as "E-Reserves." See a separate sheet of information about this option. *You should do the assigned reading before the corresponding class.* Before each exam I will make my cleaned-up lecture notes available to you via the library reserves.

The course is designed to give the student an understanding of the historical development of some of the principal ideas and discoveries that have gone into the making of the Western scientific tradition and hence of the modern scientific worldview. The approach it will take is to see scientific concepts and theories as attempts to explain certain striking phenomena in the context of particular beliefs and assumptions about nature and about the nature of scientific knowledge. One might say, roughly speaking, that science begins with the desire to explain particular phenomena, whereas philosophy begins with the desire to explain things in general. (As we'll see, John Dalton's chemical atomism of the nineteenth century differed crucially from early Greek atomism in just this regard.) In addition to looking at *what* things people thought needed explaining and *how* they then tried to explain them, we will pay particular attention to changing notions about the very nature of what counts as an "explanation," an issue closely related to the overall conception of the world put forth by scientists at different times.

For example--and in ways to be illustrated in class--the world of Aristotelian science is pretty much as it appears to be, from the reality of basic qualities like heaviness, to the naturalness of free-fall, to the basically spherical structure of an

earth-centered universe. The world of seventeenth-century corpuscularians, on the other hand--which remained pretty much the generally accepted world of science until the end of the nineteenth century--was as we *imagine* it to be, from the assumption of invisible atoms in motion, to the positing of an idealized principle of inertia in Euclidean space, to its wildly counterintuitive claim that the earth spins as it revolves around the sun. And the world of modern science--of quantum mechanics and relativity, in particular--is radically *unimaginable*, from wave-particle duality, to mass-energy equivalence, to the curved space-time of a universe that expanded with unimaginable rapidity from an unimaginably small and dense space.

Gillispie's book is good, but not easy, and it will be one of my principal goals to make it understandable by giving you appropriate background information and clarifying explanations of important points. I will also hand out a crib sheet expaining the many foreign words and selected technical terms that many of you will not be familiar with. For the rest, *get in the habit of using a dictionary!* Since most of the reading assignments are reasonably short, I expect you to put correspondingly more effort into them.

This course assumes no prior exposure to either science or the history of science--though of course either would be very useful! I will explain such scientific concepts as you need to know, and will begin the course with a summary characterization of names and issues you'll need to be familiar with in order to pick up the historical thread in the eighteenth century.

The written work for the course consists of two exams and a final, each worth a third of your (unadjusted) final grade. The final will be cumulative, but will be weighted toward the last third of the material. I encourage you to ask questions, and significant class participation will be rewarded with an increase in the final grade (up to a full letter grade, though usually less). I expect regular attendance: more than three absences are considered excessive, and may result in a lowering of your final grade (up to a full letter grade, though usually less).

I expect students to have read and understood the section of the *Policies for Students* handbook relating to the UNCG Academic Integrity Policy. Submission of written work implies your acceptance of its provisions.

### *Schedule of Topics and Readings*

(*N.B.* The names listed after the colons in the syllabus that follows are usually to be taken as illustrative, not exhaustive, of what will be covered in that class.)

General Introduction (Jan. 15).

A Few Characterizations of Historically Important Approaches to Scientific Knowledge: Pythagorean, Platonic, Aristotelian, Archimedian, Baconian,

Cartesian (Jan. 17): At some point you may wish to check out the use of these terms in *Edge*, 11-16, 23, 26, 39-40, 57, 74-95, 101, 153, but don't get bogged down at this point: I'll tell you what I think you need to know about them. *You may wish to get a head start on the reading for the next time.*

Scientific Revolution I: Copernicus and Kepler (Jan. 22): *Edge*, 16-30, 99-103.

Scientific Revolution II: Galileo and Newton (Jan. 24): *Edge*, 39-53, 117-122, 134-159; 3-7 are difficult--give them a try, but don't get discouraged if you can't follow everything..

Eighteenth-Century Quantification of Heat: Black and Lavoisier (Jan. 29): *Edge*, 235-241.

Eighteenth-Century Chemistry: Black, Priestley, and phlogiston (Jan. 31): *Edge*, 184-187, 202-209.

Chemical Revolution: Lavoisier (Feb. 5): *Edge*, 209-235; skim 241-250 (*handout*).

Atomism, Physical and Chemical: Boyle and Dalton (Feb. 7, 12): *Edge*, 96-99, 103-108, 251-259 (*handout*).

Buffer Class: For Any Necessary Catching-Up and Review (Feb. 14): No additional reading.

First Exam (Feb. 19).

The Species Question: Linnaeus, Buffon, and Lamarck (Feb. 21, 26): *Edge*, 170-171, 267-277.

Form and Purpose: Natural Theology , Comparative Anatomy, Paleontology (Feb. 28): *Edge*, 149-150 (review), 260-269, 277-291.

Early Nineteenth-Century Geology: Lyell (Mar. 5): *Edge*, 291-302 (*handout*).

Darwinian Evolution (Mar. 7): *Edge*, 303-320, 337-342; skim 342-351.

Spring Break (Mar. 12, 14)

Early Heat Theory: Carnot, Clausius, and the Second Law of Thermodynamics (Mar. 19): *Edge*, 235-241, 352-370, 394-405.

Conservation of Energy: Joule, Mayer, Helmholtz (Mar. 21, 26): *Edge*, 370-394.  
Light: Newton, Young, Fresnel (Mar. 28, Apr. 2): *Edge*, 122-134, 406-435.

Second Exam (Apr. 4).

Early Electricity: Galvani, Volta, Oersted, Ampère, Ohm (Apr. 9, 11): No reading in *Edge*. If I succeed in locating appropriate readings for this topic, I'll either distribute them or put them on reserve; you'll be informed accordingly.

Field Theory: Faraday and Maxwell (Apr. 16): *Edge*, 435-476.

Kinetic Theory, Energetics, Positivism: Maxwell and Mach (Apr. 18): *Edge*, 476-506.

Relativity and Classical Physics (Apr. 23): *Edge*, 506-520.

Quantum Mechanics and Atomic Structure (Apr. 25, 30): Toulmin and Goodfield, *Architecture of Matter* (**R**), 270-296 (296-302 may interest some); Heisenberg, *Physics and Philosophy* (**R**), 30-43.

Final Reflections and Review (May 2): No new reading; course evaluations.

Reading Day (May 8)

Final Exam (Tuesday, May 14): 12:00-3:00