

HISTORY OF SCIENCE 323 / HISTORY 323
The Scientific Revolution: from Copernicus to Newton

Spring 2005
 1:00pm-2:15pm TuTh
 5231 Social Science

instructor: Florence Hsia
 office: 7137 Social Science
 office hours: 2:30-4:30 Thursdays and by appt.
 phone: 262-3971
 email: fchia1@attglobal.net

COURSE DESCRIPTION

This course investigates the renaissance and revolution in European science that began in 1543 with the heliocentric astronomy of Nicolaus Copernicus and ended with Isaac Newton's death in 1727. We will pay particular attention to issues of tradition and novelty, institutional settings for scientific activity, and the relationship between science and religion. Topics covered will include the Copernican cosmology and the trial of Galileo, the mechanical philosophy, Newton's theory of gravitation, the appearance of new scientific organizations such as the Royal Society of London and the Paris Academy of Sciences, the role of science in European exploration and expansion, and perceptions of the scientist's place in society.

This class also emphasizes the skills of analyzing historical documents and of constructing persuasive arguments about historical questions. It is therefore extremely important that you complete the readings assigned for each class session before coming to class. Please bring the readings – especially those in the Course Reader – to class with you.

COURSE REQUIREMENTS AND GRADING

1. Attend classes.
 2. Prepare assigned readings.
 3. Grades will be based on three (3) take-home essay exams and four (4) short in-class exercises.
- Grades will be calculated using the following rough guidelines:

exam 1 (due in class, Tues., Feb. 22)	~25%
exam 2 (due by 1:00pm, Thurs., March 31)	~25%
exam 3 (due by 12:00pm, Tues., May 10)	~25%
four (4) in-class exercises (March 29/31; April 12, 19, 28)	~25%

Honors students need to complete an honors assignment. Please see me for details.
 Graduate students should also enroll in History of Science 623 (for assignments, see the HoS 623 syllabus.)

COURSE POLICIES

I will make every effort to honor requests for reasonable accommodations made by individuals with disabilities. If you think you may qualify for accommodation, please contact the McBurney Disability Resource Center at 263-2741 <<http://jumpgate.acadsvcs.wisc.edu/~mcburney/>> to establish your eligibility for services. If you require such accommodation, please let me know as soon as possible in the semester. All requests are confidential.

Academic honesty is expected of students at the University of Wisconsin-Madison in compliance with the student code of conduct. All written work that you turn in under your name should be solely your work. Both paper and internet sources must be acknowledged; failure to understand what counts as plagiarism is not an adequate excuse. Plagiarism and other forms of academic misconduct carry penalties. Please feel free to talk to me if you have any questions about how to properly cite sources in your written work.

TEXTBOOKS

- Course Reader (purchase in the History of Science department office, 7130 Social Science)
- Peter Dear, Revolutionizing the sciences, Princeton 2001 (purchase at the University Book Store, 711 State Street)

SCHEDULE OF ASSIGNMENTS AND TOPICS

CR = Course Reader

D = Dear, Revolutionizing the sciences (2001)

- Jan. 18 (T) **introduction**
 Jan. 20 (Th) **scientific renaissance**
 CR, 1-25 Vesalius, On the fabric of the human body (1543), selections
 D, 1-9, 30-33, 37-41 [intro + chap. 2, sections I + III]
- Jan. 25 **the Aristotelian cosmos**
 CR, 26-29 Aristotle, Physics, book II, selections
 D, 10-15 [chap. 1, section I]
- Jan. 27 **the Greek cosmological tradition**
 CR, 30-35 diagrams; Ptolemy, Almagest, bk. I, chaps. 2-4
- Feb. 1 **the Greek astronomical tradition**
 CR, 36-40 Ptolemy, Almagest, book I, chap. 7; planetary models
- Feb. 3 **the renaissance in astronomy**
 CR, 41 Peurbach, New theoricis of the planets (1475), illustration
 D, 15-24, 33-37 [chap. 1, sections II-III + chap. 2, section II]
- Feb. 8 **heliocentrism**
 CR, 43-52 Copernicus, On the revolutions (1543): 'To his holiness' +
 bk. I, intro + chap. 10; diagrams
 D, 33-37 [chap. 2, section II]
- Feb. 10 **the reception of heliocentrism**
 CR, 42-43, 53-59 Copernicus, On the revolutions (1543), prefatory matter;
 Tycho + Kepler, illustrations
 D, 41-45, 74-78, 101-104 [ch. 2, section IV; ch. 4, section III (Kepler); ch. 6, section I]
- Feb. 15 **Galileo and the telescope**
 CR, 60-71 Galileo, Sidereal messenger (1610) + diagrams
 D, 65-73 + 104-8 [ch. 4, sections I-III + ch. 6, section II]
- Feb. 17 **the Galileo affair (I)**
 CR, 72-85 Castelli-Galileo letters (1613) + Lorini's complaint (1615);
 Blackwell, Galileo, Bellarmine and the Bible (1991), app. I-III
- Feb. 22 (Tu) **the Galileo affair (II) <exam 1 due in class>**
 CR, 86-98 Blackwell, appendices VIIA-B; Bellarmine-Foscarini letter (1615)
 inquisition documents (1616) + Vatican letters (1631)
 Galileo, Dialogue on the two chief world systems (1632)
- Feb. 24 **the skeptical crisis**
 CR, 99-102 Descartes, Discourse on the method (1637), selections
 D, 80-84 [ch. 5, section I]
- March 1 **mechanical philosophies**
 CR, 103-104 Descartes, Principles of philosophy (1644/1647), #203-207
 D, 84-86 [ch. 5, section II]

- March 3 **the Cartesian world**
 CR, 105-10 Descartes, The world (1633/1677), ch. 5-7
 D, 86-100 [ch. 5, sections III-VI]
- March 8 **Newton**
 CR, 111-17 Newton, System of the world (1685), selections
 Newton, Opticks (1706/1717), Query 31, selections
 D, 149-63 [ch. 8, sections I-II, esp. section II]
- March 10 **Newtonianism**
 CR, 118-25 Newton, 'General Scholium' (1713) + theological MS;
 Cotes' preface to the Principles (1713) + Leibniz letters
 D, 163-67 [ch. 8, sections II-III]
- March 15 **monsters and marvels**
 CR, 126-59 Of two woonderful Popish monsters (1586), selections
 Paré, On monsters and prodigies (1573), selections
- March 17 **the Baconian project**
 CR, 160-74 Durston, 'A narrative of a monstrous birth' (1670)
 Bacon, 'Preparative' (1620),
 D, 57-64 [ch. 3, sections III-IV]
- March 19-27 **SPRING BREAK**
- March 29* visit to Special Collections
 March 31* (Th.) visit to Special Collections **<exam 2 due by 1:00pm>**
- April 5 **experimentation (I)**
 CR, 175-83 Galileo, Dialogue on the two world systems (1632)
 Torricelli and Pascal on the Torricelli experiment (1640s)
 D, 131-38 [ch. 7, sections I-II]
- April 7 **experimentation (II)**
 CR, 184-92 Boyle, 'New experiments' (1668)
 D, 138-45 [ch. 7, section III]
- April 12* **exploration**
 CR, 193-98 questionnaires on Spanish America
 D, 123-30 [chap. 6. section V]
- April 14 **the scientific journal**
 reading to be assigned online
- April 19* class presentations
 April 21 **scientific societies (I)**
 CR, 223-29 Woodward, Brief instructions (1696), selections
 D, 111-23 [chap. 6, section IV]
- April 26 **scientific societies (II)**
 CR, 201-8 Cassini, 'Voyages to Cape Verde' (1684)
 D, 111-23 [chap. 6, section IV]
- April 28* **science and the public**
 CR, 209-22 Tachard, A relation of the voyage to Siam (1688)
 CR, 230-51 Fontenelle, Conversations on the plurality of worlds (1686)
- May 3 **science and society (I)**
 CR, 252-64 Bacon, New Atlantis (1627), selections
- May 5 **science and society (II)**
 CR, 265-80 Swift, Gulliver's travels (1735), part 3, selections
- May 10 (Tu) **exam 3 due by 12:00pm (noon)**

The work of Galileo is also important because it established a new method, a new direction for scientific investigations. A careful study of the methods he used will provide an illustration of the basic approach that has subsequently dominated the physical sciences. (J. A. Ripley, *The Elements and Structure of the Physical Sciences* [New York: Wiley, 1964], p. 90)

Galileo's contribution to present scientific thinking was threefold: (1) he was the first to appreciate the value of experiment and might well be called the father of experimental physics; (2) he was able to imagine an ideal situation, such as a frictionless medium, and thereby to explain discrepancies between actual and theoretical results; and (3) he recognized the value of mathematical analysis in the study of physical principles. (E. Hausmann and E. P. Slack, *Physics* [New York: Van Nostrand, 1957], p. 36)

It is generally admitted that the true spirit of modern scientific inquiry had its first clear expression in the work of the gifted Italian scientist Galileo Galilei. . . . Galileo's insistence on systematic observation and experimentation as the essential basis of scientific work is the outstanding characteristic of the science of today. It is often said that he replaced the question "Why?", which Aristotle put to nature, with "How?" (I. M. Freeman, *Physics: Principles and Insights* [New York: McGraw-Hill, 1968], p. 11)

Such examples could be repeated almost indefinitely. On the other hand, one had best not read too many physics texts; otherwise one might get contradictory reports about the nature of scientific method as illustrated by Galileo's work.

At the same time that the pioneer scientists [including Galileo] were trying to get an accurate description of different kinds of motion, they also wondered about the causes and origins of these motions. Not only the "how," but the "why" of motions was sought; for the two aspects of motion, description and cause, are linked to each other. (A. Marantz, *Physics* [New York: Benziger, 1969], p. 98)

Dudley Sharp. Galileo: a philosophical study
(Chicago, 1924)