

Phil/Chem/Hist.380

Instructor: Henry Mendell

Work Telephone: (323) 343-4178

email: hmendell@calstatela.edu

Class URL: <http://www.calstatela.edu/faculty/hmendel/Classwork/Phil%20380/Phil.380.html>

Easy path to get there: <http://www.calstatela.edu/faculty/hmendel>
schedule (on the left below the picture)
Phil./Hist./Chem. 380

Office Hours (check web site for cancellations): Th 11:50-12:55 and 4:10-5:10
(by appointment)

Ancient and Modern Science

Class: FA 223

Time: TuTh 9:50-11:30

Office: E&T 422

Required Reading:

Books

Carl Hempel, *Philosophy of Natural Science* (Englewood Cliffs: Prentice-Hall, 1966).

Philip Kitcher, *Abusing Science* (Cambridge: MIT, 1982)

G.E.R. Lloyd, *Early Greek Science: Thales to Aristotle* (New York: W.W. Norton, 1970)

G.E.R. Lloyd, *Greek Science after Aristotle* (New York: W.W. Norton, 1973)

Michael Matthews, *Scientific Background to Modern Philosophy* (Indianapolis: Hackett, 1989)

Xerox Packet (presently in the packet)

Henry Mendell, Handouts on Babylonian, Egyptian, and Greek Mathematics and Science

From Hippocrates of Cos. Hippocratic Writings. Trans. E. Chadwick, W.N. Mann et al. Ed. with intro. G.E.R. Lloyd. Harmondsworth: Penguin, 1978.

"The Nature of Man," 260-271.

"The Sacred Disease," 237-251.

Available from the Library On-Line Reserve (in the order we will be using them):

Karl Popper, *Conjectures and Refutations* (London: Routledge, 1963), pp. 33-9.

Thomas Kuhn, "The Nature and Necessity of Scientific Revolutions," ch. 9 of *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962, 1970), pp. 92-110.

Ernan, McMullin, "The Goal of Natural Science," Proceedings of the American Philosophical Association 58 (1984): 37-64.

The Creation Epic (Enuma Elish) Pritchard, James B. Ancient Near Eastern Texts: relating to the Old Testament. 3rd ed. with supplement. Princeton: Princeton U. Press, 1969 (1st ed. 1954), 60-73, 501-503.

Hippocrates of Cos, "The Nature of Man," From Hippocrates, Hippocratic Writings (trans. E. Chadwick, W.N. Mann et al.; ed. with intro. G.E.R. Lloyd; Harmondsworth: Penguin, 1978), 260-271.

Hippocrates of Cos, "The Sacred Disease." To be made available.

Plato. Republic VI 507B-VII 541B. From Plato, Republic (trans. G.M.A. Grube. Indianapolis: Hackett, 1974).

Plato, Timaeus 21A-41D. From Plato, Timaeus (trans. Donald Zeyl, Indianapolis: Hackett, 2000).

Thomas Kuhn, "Objectivity, Value Judgment, and Theory Choice" in *The Essential Tension* (Chicago: University of Chicago Press, 1977), pp. 320-339.

Aristotle, On the Heavens (De caelo) II 13-14. The Complete Works of Aristotle. The Revised Oxford Translation. 2 vols. Ed. Jonathan Barnes. Bollingen Series, vol. 71. Princeton: Princeton University Press, 1984, pp. 482-9.

Introduction to the first edition of Nicholas Copernicus, On the Revolutions
by Andreas Osiander (from Nicholas Copernicus, On the Revolutions,
trans. and comm. by Edward Rosen, Baltimore: Johns Hopkins University
Press, 1978).

Recommended:

CD-ROM for studying ancient mathematics and astronomy prepared by the instructor, for use on Macintosh.

Requirements: four 1 page maximum discussion of a question, typed and double spaced, (each 9% grade), one paper proposal, also 9% grade, and one term paper based on the paper proposal (30% grade), and one final exam in class (25%). The questions will be normally assigned on Wed. to be handed in on Mon.

Important: It is your responsibility to preserve all your papers (normally on disk). Papers do get lost.

Important: Plagiarism is a dire offense. Any occurrence of plagiarism will result in an F for the course.

Overview

How do modern conceptions of science differ from ancient conceptions. Modern natural philosophy (as it was called until recently) emerges from the intellectual 'revolutions' of seventeenth century Europe. There are two principal influences on seventeenth century science on which scientists of that period build and against which they rebel, scholasticism and Greek mathematics and astronomy as developed by Arab and European philosophers and scientists in the Middle Ages. Scholasticism is a philosophical approach which primarily involves an attempt to create a system built on the philosophy of Aristotle and to harmonize that interpretation of Aristotle with some other philosophical or religious system, whether Plato (Simplicius), or Islam (Averroes), or Judaism (Maimonides), or Christianity (Aquinas). Our goal in this course will not be to examine scholasticism or Medieval science. We shall rather be concerned with the more distant contrasts of ancient Greek and contemporary science. How do we conceive science today. How did ancient Babylonians, Egyptians, and Greeks conceive it. As time permits we will also discuss seventeenth century European science. What characterizes the modern science of Galileo, Descartes, and Newton? Crudely put, seventeenth century natural philosophy as it develops into modern science explains natural phenomena by means of mathematical models in which a major goal is to reduce all qualities to primary geometrical qualities and later algebraic relations. In seventeenth century science, one only admits non-geometrical qualities as are necessary (e.g. gravitational force).

Greek natural science itself did not emerge from nothing. It depended, at the very least, on Babylonian astronomy and mathematics and Egyptian medicine, although these are very different in character from Greek science. Very crudely, Babylonian science, in particular, is descriptive and predictive; early Greek science is explanatory and usually foundationalist, but rarely predictive. In addition, those viewpoints among the Greeks which best survived tended to be teleological (the universe as well-crafted) and anti-reductionist (qualities cannot usually be reduced to geometrical qualities). We shall examine a variety of very different viewpoints, especially those of Democritus, 'Hippocrates,' Plato, and Aristotle. The focus of the course, however, will be on ancient astronomy, and the ideas of the Babylonians, Eudoxus, Aristarchus, Apollonius, Hipparchus, and Ptolemy.

In this course, we shall begin by examining a contemporary view of modern science. Kitcher's study is actually a defense of evolution, a non-mathematical science. However, he provides a lucid account of many general features which contemporary philosophers of science point to when they try to explain

examples in Kitcher's discussion. Ancillary to Kitcher's introduction, we shall look at three others texts, a brief discussion by Karl Popper of his views that scientific theories must be falsifiable, an excerpt from Kuhn's *The Structure of Scientific Revolutions*, where Kuhn famously argues that in scientific revolutions conversion from the old scientific theory to the new cannot solely be based in rational arguments that determine one theory to another, an essay from his *Essential Tension*, where Kuhn lays out objective criteria for debate between advocates of an old and new theory. Additionally, we will look at two chapters from Carl Hempel's introduction to the philosophy of science, where he explains very clearly the hypothetical-deductive method in science.

We shall then switch back to the ancient world, first with a survey of Egyptians mathematics, Babylonian mathematics and astronomy, and then with Lloyd's survey of early Greek science. Plato's dialogue, *Timaeus* and selections from Aristotle's *Physics* and *Posterior Analytics* will provide us with two views of what a scientific theory is supposed to accomplish. We shall interlace this discussion with examinations of ancient astronomical theories and mathematical practice, especially the planetary systems of Eudoxus and Hipparchus, and Ptolemy.

Time permitting, we shall then turn to Copernicus, Bacon, and Galileo in order to see what they keep, what they modify, and what they reject. This is an ambitious project, so we might not get all the way there.

Topics (with approximate times of arrival; some topics will be cut at the end):

Date	Topic and written assignments	Reading
28 March	What is history of science? What is science?	
30 March	Philosophy of 20th Century Science, the problem of induction and five parables from the history of astronomy	Kitcher, ch. 1-3 (ch. 1 if you are having difficulty with the scientific background), recommended ch. 4-5. Also , Karl Popper (library reserve on line)
4 April	Falsification and more of the five parables	Hempel, ch. 1 and 2.
6 April	More of the five parables	Kuhn (library reserve on line)
11 April	Egyptian Mathematics	Packet: §§6-8, Egyptian Mathematics
13 April	One pretty view of three conceptions of science (Babylonian, Greek, Synthesis) First Paper Due	McMullin (library reserve on line)
18 April	Babylonian Mathematics	Packet: §§9-10, Notes on Babylonian Mathematics
20 April	Basic Concepts of Ancient Astronomy	Packet: §§11, Notes on Basic Concepts of Astronomy
25 April	Babylonian Astronomy	Packet: §§11-14, Notes on Babylonian Planetary and Eclipse Theory
27 April	Myth, Early Greek Science and explanation	Packet: Genesis On-line reserve: The Creation Myth (read tablet 1, but the whole text is recommended) Lloyd, EGS, chs. 1-4.
2 May	Greek Medicine and Rhetoric Second Paper Due	On-line reserve: Hippocrates, The Nature of Man and The Sacred Disease Lloyd, EGS ch. 5.

4 May	The teleological reaction	Packet: selections from Plato, Republic vi-vii and Timaeus Lloyd, EGS ch. 6.
9 May	Astronomy in the Academy PAPER PROPOSALS DUE = 3rd paper	Lloyd, EGS ch. 7 Recommended: Packet: Discussions of Eudoxus and Callippus, selections from Simplicius and Geminus
11 May	Aristotle on Nature	Matthews: Aristotle, Physics ii 1-3 Lloyd, EGS, ch 8-9.
18 May	Foundational systems	Matthews: Aristotle, Posterior Analytics A 1-2, 13 Lloyd, EGS, ch 8. GSAA ch. 4 Packet: selections from Euclid, Elements i and xii (available also on the web)
23 May	Observation and Argument Fourth Paper Due	Packet: Aristotle, De caelo B 13-14, Packet §§25 (Cleomedes), Recommended: Online: Archimedes, Sandreckoner 1
25 May	Aristarchus, and Apollonius, and Observation vs. Theory	Lloyd, GSAA ch. 4, 5 Recommended: Packet §§26 Fifth Paper Due
30 May	Ptolemy and his Medieval successors Fifth Paper Due	Lloyd, GSAA ch. 8
1 June	Copernicus and Osiander; Kepler; Experimentalism: Bacon, Galileo	Matthews, chs. 2-4 On-line reserve: Osiander
8 June	Final Exam (10:45-1:15) and Papers Due	