Phil/Chem/Hist.380 — Ancient and Modern Science
Instructor: Henry Mendell — Class: SH 172
Work Telephone: (323) 343-4178 — Time: MW 10:50-12:30
email: hmendel@calstatela.edu — Office: E&T 422
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): MW 9:30-10:30, 3:10-4:10
(by appointment)

Required Reading:
Books

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)

Xeroxes (presently in the packet)
Henry Mendell, Handout on Babylonian and Egyptian Mathematics
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.
From Plato. Republic. Trans. G.M.A. Grube. Revised Reeve. . In Plato, Complete Works (ed. John Cooper; Indianapolis: Hackett, 1997).
Republic VI 507B-VII 541B
From Plato. Timaeus. Trans. Donald Zeyl. In Plato, Complete Works (ed. John Cooper; Indianapolis: Hackett, 1997).
Plato, Timaeus 30E-47E
From Aristotle. The Complete Works of Aristotle. The Revised Oxford Translation. 2 vols. Ed. Jonathan Barnes. Bollingen Series, vol. 71. Princeton: Princeton University Press, 1984.
Physics II ch. 7-9
On the Heavens (De caelo) II 13-14.
Henry Mendell, Handouts on Babylonian mathematics and astronomy, Egyptian mathematics, Eudoxus and Callippus
Selections from Simplicius, *Commentary on Aristotle's Books on the Heavens* and Geminus, *Introduction*

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

Requirements: five 1 page maximum discussion of a question,typed and double spaced, (each 1/12 grade), one paper proposal, also 1/12 grade, and one term paper based on the paper proposal, 1/2 grade. The questions will be normally assigned on Wed. to be handed in on Mon. It is possible that the number of short papers will be reduced to four, in which case their value and the value of the paper proposal will increase to 1/10 of the final grade.

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 rebelled, 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 seventeenth century European science. What characterizes the modern science of Galileo, Descartes, and Newton? Crudely put, seventeenth century natural philosophy explains natural phenomena by means of mathematical models in which a major goal is to reduce all qualities to primary geometrical qualities. 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; Greek science is explanatory and usually foundationalist. In addition, those viewpoints among the Greeks which best survived tended to be teleological (the universe as well-crafted) and anti-reductionist (qualites 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 mostly unknown Babylonian, Eudoxus, Aristarchus, Apollonius, Hipparchus, Ptolemy.

Another issue is the status of a scientific theory. Most people are raised to believe that scientific theories are supposed to be true. What is entailed by this? What are the rational components of ancient science? the empirical components. A modern view is that scientific theories need only account for what we can observe and that it does not make sense to speak of the truth of scientific theories beyond this. We shall also consider whether any of the thinkers we examine hold to such a view.

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 what makes some theory a scientific theory. Ironically, in class we shall focus on the astronomical examples in Kitcher's discussion. We shall then switch back to the ancient world 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.

We shall then turn to Copernicus, Galileo, Kepler, Descartes, and Newton 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	Reading
6 Jan.	What is History of Science?	
8 Jan	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.
13 Jan.	Falsification and more of the five parables	
15 Jan.	No Class	Think about term paper
20 Jan.	No Class	Dream about goodwill (you may not have many more such opportunities for a good while)
22 Jan.	Egyptian Mathematics	Packet: Notes on Egyptian Mathematics
27 Jan.	Babylonian Mathematics	Packet: Notes on Babylonian Mathematics
29 Jan.	Basic Concepts of Astronomy	Packet: Notes on Basic Concepts of Astronomy
3 Feb.	Babylonian Astronomy	Packet: Notes on Babylonian Planetary and Eclipse Theory
5 Feb.	Early Greek Science and explanation	Packet: Enuma Elish Lloyd, EGS, chs. 1-4.
10 Feb.	Greek Medicine and Rhetoric	Packet: Hippocrates, The Nature of Man and The Sacred Disease Lloyd, EGS ch. 5, Recommended: Lloyd, GSAA ch. 6., 9
12 Feb.	The teleological reaction	Packet: selections from Plato, Republic vi-vii and Timaeus Lloyd, EGS ch. 6.
17 Feb.	Astronomy in the Academy	Lloyd, EGS ch. 7 Recommended: Packet: Discussions of Eudoxus and Callippus, selections from Simplicius and Geminus
19 Feb.	Aristotle on Nature and Foundational Systems	Matthews: Aristotle, Physics ii 1-3 Packet: Physics ii 7-9 Lloyd,EGS, ch 8.
24 Feb.	Foundational systems	Matthews: Aristotle, Posterior Analytics A 1-2, 13 Packet: Aristotle, Posterior Analytics A 10 Lloyd, EGS, ch 8. GSAA ch. 4 Packet: selections from Euclid, Elements i and xii (available also on the web)
26 Feb.	Aristarchus and Apollonius	Packet: Notes on Apollonius Lloyd, GSAA ch. 4, 5
3 March	Ptolemy and his Medieval successors	Lloyd, GSAA ch. 8
5 March	Copernicus and Osiander; Kepler	Matthews, ch. 2 Packet: Osiander
10 March	Experimentalism and Rationalism (two views): Bacon, Galileo, Descartes	Matthews, Ch 3, 4, 5
12 March	Subject Continued	
14 March	Newton	Matthews, ch. 7
17 March	Term Papers Due (10:45-1:15)	Discussion