History 204
Ancient and Medieval Science

The idea is like grass.
It craves light, likes crowds,
thrives on crossbreeding,
grows better for being stepped on.

Ursula K. LeGuin
1974

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202-D Woodburn
Also by appointment 293-2421

Required Texts:
G.E.R. Lloyd, Early Greek Science: Thales to Aristotle
G.E.R. Lloyd, Greek Science after Aristotle
David Lindberg, Science in the Middle Ages (SMA)

Books and Articles on Reserve in Colson Hall:
Edward Grant, A Sourcebook in Medieval Science Q153 / .G7
J.-P. Vernant Myth and Thought among the Greeks B178 / .V413 / 1983

This course will deal with a variety of activities that we can consider under the heading of science, ranging from the traditional knowledge of nature embedded in the myths of antiquity to the self-consciously rational science of the Greeks and its development in Rome, Islam, and the Latin West.

We will not so much stress the scientific ideas in themselves as we will deal with the ways in which various approaches to the study of nature served the societies in which they arose, both in a practical utilitarian sense and in the sense of contributing to their broader world-view. In this we will have to examine how and why various institutions, practices, and attitudes that contributed to the transmission and development of knowledge of nature.

Since this course attracts students of diverse backgrounds and levels. I scheduled the class to meet for one three hour period each week so we can
combine elements of a lecture course with those of a discussion course based on both shared and individually assigned readings. I expect that we will spend at least an hour of each session looking in some depth into the shared and individually assigned readings. As will become apparent, scholars disagree in the nature of science in the cultures we will be examining, and even whether some of the topics under discussion merit the name of science. In such a state of expert disagreement, I would hope that students will be able to contribute their own opinions and analyses to the topics under discussion.

When students are presenting their individually assigned books or groups of related readings, they should be ready to present an overview of the texts they have been assigned and showing how (or if) they relate to the general themes of the class. Each graduate student will be expected to discuss five such assigned readings; undergrads will be expected to present three. A short (2-4 typed pages) written critique of the readings, focusing on the adequacy of the authors' theses and use of evidence will be due the day before the class presentation. The oral presentation to the class should add to this critique a summary of the author's main points.

I decided this term not to put the individually assigned readings on reserve. On the plus side, this means you can take them home and have adequate time to prepare; on the minus side, it means that someone else may check them out and you will be out of luck. Be sure to check out your assigned readings well in advance so if they are out you can call them in or arrange with me for an alternate assignment.

For the section on medieval science, a good portion of our time will be spent discussing primary source materials from Grant's Sourcebook in Medieval Science, which is on reserve in Colson Hall. Everyone should be ready to discuss these readings in class.

In addition, students will prepare a term or research paper on one aspect of Ancient or Medieval Science. As a relatively painless means towards this end, you will carry out a brief library exercise that will count as a small part of your grade.

Given the different expectation of performance from undergraduates and graduate students, there will be different grading requirements for students of different levels:

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TENTATIVE SCHEDULE OF CLASSES

Jan 13-15  Introduction, administrative details, the History of Science and its relations to other disciplines.
   The issues raised between the philosopher of science, Karl Popper and the historian of science, Thomas Kuhn center on two questions: first whether science is a social activity, influenced by the various social factors that impinge upon its practitioners or whether it has a purely abstract logical structure and second, whether it is best studied by observing the actual behavior (and misbehavior) of scientists or by considering what scientists ought to do if they are to practice science properly. These issues reflect a fundamental difference between the questions raised by philosophers and historians.

Required readings:
Kuhn, "The Function of Dogma..."
Popper, "Normal Science..."

Jan 20-22  Science in traditional societies and the question of demarcation.
   In preparing for this discussion try to focus on those portions of the readings dealing with the question of whether there is any real distinction between a society's scientific and non-scientific activities. In particular what, if any, are the differences between the thought of "primitives" and of modern scientists.

Required Readings:
Elkana, "The Distinctiveness and Universality ..."
Lloyd, Early Greek Science, pp. 1-15

Readings for Assigned Discussions (Thurs, 22 Jan):
Clifford Geertz, Local Knowledge
Claude Lévi-Strauss, The Savage Mind
Bryan Wilson (ed.) Rationality, chaps. 7-12 only.
R. Horton & R. Finnegan (eds.) Modes of Thought, introd., pp. 112-144, 162-305 only.
G. E. R. Lloyd Demystifying Mentalities
Hollis, Martin and Steven Lukes (ed.) Rationality and Relativism, pp. 1-47, 149-305 only.

Jan 27-29  From Mythopoeic Thought to Philosophy of Nature
   The fundamental change in understanding of nature that takes place in Ionian Greece is from the earlier understandings of nature in terms of myth to a critical investigation of nature in non-mythical terms. Our concern here is chiefly with the nature of early Greek scientific thought and the intellectual and social background from which it emerged. We will postpone consideration of the important question of why it happened there for a few weeks.

Required Readings:
Lloyd, Early Greek Science, pp. 16-49
Lloyd, "Popper versus Kirk ... "


Readings for Assigned Discussions (Thurs 29 Jan):
H. Frankfort (et al.), The Intellectual Adventure of Ancient Man
G. S. Kirk  Myth: Its Meaning and Functions in Ancient and Other cultures
F. M. Cornford Principium Sapientiae: The Origins of Greek Philosophical Thought
E. R. Dodds, The Greeks and the Irrational

Feb 3-5  Plato, Aristotle, and the ideal of Certainty
No general history can ignore these two pivotal figures in the development of Western thought. Plato and Aristotle set the rival frameworks within which that thought subsequently developed. An understanding of their principal ideas is essential.

Required Readings:
Lloyd, Early Greek Science, pp. 66-98, 99-124
Lloyd, Greek Science after Aristotle, pp. 8-20

Readings for Assigned Discussions (Thurs 5 Feb):
F. M. Cornford Plato's Cosmology (Concentrate on Plato's text more than on Cornford's commentary)
G. E. R. Lloyd Aristotle, the Growth and Structure of his Thought

Feb 10-12  The Greek Miracle: In Search of an Explanation
Everyone agrees that something remarkable happened in Greek thought somewhere between the Milesian philosophers and Aristotle. There is less agreement on what was really important in the change and why it happened. The kind of answer depends partly on political and economic philosophy, partly on the emphasis placed on technology versus pure science, and partly on understandings of the relation between scientific and religious modes of thought.

BIBLIOGRAPHIC ASSIGNMENT DUE (Tues 10 Feb)

Required Readings:
Lloyd, Early Greek Science, pp. 125-146
Vernant, J.-P. Myth and Thought among the Greeks (pp. 176-189, 212-234)

Readings for Assigned Discussions (Thurs 12 Feb):
Farrington, B.R. Science and Politics in the Ancient World
Vernant, J.-P. The Origins of Greek Thought

Feb 17-19  Ancient Biology and Medicine

Required Readings:
Lloyd, Early Greek Science, pp. 50-65
Lloyd, Greek Science after Aristotle, pp. 75-90, 136-153
Readings for Assigned Discussions (Thurs 19 Feb):
Lloyd, G. E. R. Science, Folklore and Ideology: Studies in the Life Sciences in Ancient Greece
Amundsen, Darrel W. Medicine, society, and faith in the ancient and medieval worlds
Temkin, Owsei Galenism: Rise and Decline of a Medical Philosophy (Cover the whole book, but focus on pp. 1-94)

Feb 24-26 Science in Late Antiquity
As we move into the Hellenistic era, we begin to see that historical investigations here still focus on the internal content of the sciences rather than engaging in external questions of the relations of science to society. (The principle exceptions to this generalization are polemics regarding the relation between the rise of Christianity and the decline of science).

Required Readings:

Readings for Assigned Discussions (Thurs 26 Feb):
Bailey, C., The Greek Atomists and Epicurus
Sambursky, S., The Physics of the Stoics
Taub, Liba, Ptolemy's Universe

Mar 3-5 Some Light on the Dark Ages
The Early Middle Ages (or if you prefer, the late Roman period) has generally been thought of as a time of intellectual decline. While this characterization is generally true, it should be remembered that a conscious effort was made to preserve and transmit portions of ancient science. Perhaps a useful issue to consider concerns the motives for and methods of the preservation of science during the six centuries from Boethius to Gerbert.

Required Readings:
Grant, Sourcebook:
Macrobius. On the Order of the Planets, pp. 27-29
Isidore of Seville. On the Universe, pp. 25-27

Readings for Assigned Discussions (Thurs 5 Mar):
McCluskey, Stephen, Astronomies and Cultures in Early Medieval Europe
Riché, Pierre. Education and Culture in the Barbarian West: Sixth through Eighth Centuries
Stahl, William. Roman Science
White, Lynn, Jr. Medieval Technology and Social Change

Mar 7-15 SPRING BREAK
Mar 17-19  Islamic Science and the Reception of Greco-Arabic Science in the Twelfth Century
The fact that Greek science was not received directly in Western Europe, but was transmitted by Islamic intermediaries, had definite influences on the nature of the science of the Latin Middle Ages. We will consider this process of transmission and its influences.

Required Readings:
Lindberg, David C. "The Transmission of Greek and Arabic Learning" in Lindberg, SMA, PP. 52-90
Grant, Sourcebook:
   al-Khwarizmi. Algebra, pp. 106-111
   Averroes. Dynamics, pp. 253-262
   Gerard of Cremona. List of Translations, pp. 35-38
   William of Moerbeke. List of Translations, pp. 39-41

Readings for Assigned Discussions (Thurs 19 Mar):
   E. S. Kennedy, A Survey of Islamic Astronomical Tables
   David King, Islamic Mathematical Astronomy
   Marie Thérèse d'Alverny, "Translations and Translators" and Guy Beaujouan, "The Transformation of the Quadrivium", in R. L. Benson and G. Constable, Renaissance and Renewal in the Twelfth Century
   Richard Lemay  Abu Ma`shar and Latin Aristotelianism in the Twelfth Century
   Charles Burnett (ed.)  Adelard of Bath: An English Scientist and Arabist of the Early Twelfth Century

Mar 24-26  The Rise of the Universities
The Universities provided the institutional context within which late medieval science was transformed. An understanding of these institutions and their curriculum is essential.

Required Readings:
Kibre, Pearl & Nancy Siraisi  "The Institutional Setting: The Universities," in Lindberg, SMA, pp. 120-144
Grant, Sourcebook:
   University statutes, etc., pp. 42-44

Readings for Assigned Discussions (Thurs 26 Mar):
   Bernard Silvester  The Cosmographia of Bernardus Silvestris
   Stephen C. Ferruolo.  The Origins of the University: The Schools of Paris and their Critics, 1100-1215.
   Baldwin, John.  The Scholastic Culture of the Middle Ages, 1000-1300
Mar 31-Apr 2  Astronomy and Cosmology in the Middle Ages

Astronomy and Cosmology were discussed at both the elementary and more advanced levels. The readings provide a bit of both.

Required Readings:
Pedersen, Olaf "Astronomy," in Lindberg, SMA, pp. 303-337
Grant, Edward "Cosmology," in Lindberg, SMA, pp. 265-302
Grant, Sourcebook:
  John of Sacrobosco.  On the Sphere, pp. 442-451
  anonymous.  The Theory of the Planets, pp. 451-465 (skim for the general approach)
  John of Saxony. Rules for the Alfonsine Tables and worked example, pp. 465-487 (skim, unless you really want to follow through Thoren's arithmetic on the example)
  John Buridan.  pp 275-278

Readings for Assigned Discussions (Thurs 2 Apr):
Lynn Thorndike. The Sphere of Sacrobosco and its Commentators. (skip the untranslated Latin texts)

Apr 7-9  Medicine, Pharmacy, and Biology

It has been noted that western Europeans displayed a greater concern with careful observations and depictions of plants and animals than did the peoples of the Orient. It is in these observations of nature that we see some of the most interesting tensions between empiricism and theoretical analysis.

Required Readings:
Talbot, Charles H. "Medicine" in Lindberg, SMA, pp. 391-428; see Lindberg's cautionary note 2, p. 423.
Stannard, Jerry "Natural History" in Lindberg, SMA, pp. 429-460
Grant, Sourcebook:
  Frederick II On the Art of Hunting with Birds, pp. 657-681.
  Albertus Magnus On the Oak Tree, pp. 699-700
  Rufinus On Simple Medicines, pp. 778-785
  Bernard of Gordon Mathematical Pharmacy, pp. 789-791
  Guy de Chauliac Bubonic Plague, pp. 773-774
  anonymous Interpretation of the Pulse, pp. 745-748

Readings for Assigned Discussions (Thurs 9 Apr):
Siraisi, Nancy G. Medieval & Early Renaissance Medicine.
Riddle, John M. Contraception and Abortion from the Ancient World to the Renaissance.
Apr 14-16  Robert Grosseteste: Optics, Theology, and Scientific Method in the Middle Ages

Robert Grosseteste, a central figure in the assimilation of Aristotle's works has been variously interpreted. Southern sees Grosseteste as combining an idiosyncratic combination of scientific and theological concerns. Crombie has maintained Grosseteste's interpretation of the new logical works of Aristotle were the dominant factor in the conscious development of an experimental scientific method in the Thirteenth centuries. Lindberg sees explicit statements of methodology less important than his actual work in optics.

Required Readings:
Robert Grosseteste, On Light (Handout)
Grant, Sourcebook:
Robert Grosseteste Optical writings, pp. 384-391
Roger Bacon The Nature of Light, pp. 393-394
-------- The Psychology of Visual Perception, pp. 407-410

Readings for Assigned Discussion (Thurs 16 Apr):
Crombie, A. C. Robert Grosseteste and the Origins of Experimental Science, 1100-1700
McEvoy, James The Philosophy of Robert Grosseteste
Southern, Richard Robert Grosseteste: The Growth of an English Mind in Medieval Europe

Apr 21-23  The Condemnations of 1277 and their Influence on Medieval Science

One of the principle disputed questions in the history of medieval science has been the issue of the importance of Etienne Tempier's and Robert Kilwardby's condemnations of a number of theses held by important Aristotelian philosophers. Grant and Duhem maintained, in differing degrees, that the condemnations had a liberating influence by allowing speculations about various unorthodox interpretations of Aristotelianism. Murdoch and Wallace oppose this position.

Required Readings:
Wallace, William "The Philosophical Setting of Medieval Science" in Lindberg, SMA, pp. 91-119
Grant, Sourcebook:
Condemnation of 1277, pp. 44-51
Motion in a Void, pp. 335-342
On the Possible Rotation of the Earth, pp. 494-510
On an Extramundane void, pp. 554-562

Readings for Assigned Discussion (Thurs 23 Apr):
Leff, Gordon The Dissolution of the Medieval Outlook
Apr 28-30  The "Science of Mechanics" in the Middle Ages

Medieval philosophers dealt with mechanical problems within a
general Aristotelian framework of the study of change. In that sense
they didn't really have a science limited to mechanics. Yet within that
context, they developed many important insights into the motion of
bodies.

Required Readings:
Murdoch, John and Sylla, Edith. "The Medieval Science of Motion", in
Lindberg, *SMA*
Brown, Joseph  "The Medieval Science of Weights", in Lindberg, *SMA*
Grant, *Sourcebook:
  Nicole Oresme  The Configuration of Qualities and Motions, pp.
    243-253.
  John Buridan  The Impetus Theory of Projectile Motion, pp.
    275-280.

Readings for Assigned Discussion (Thurs 30 Apr):
Maier, Anneliese  *On The Borders of Exact Science.*
Clagett, Marshall  *The Science of Mechanics in the Middle Ages* (section
  on Dynamics)
Clagett, Marshall  *The Science of Mechanics in the Middle Ages* (section
  on Kinematics)

Thurs May 7  Final Exam (11:00 AM - 1:00 PM)