

History of Science 322/Medieval Studies 322/History of Science 622
Ancient and Medieval Science (Fall 2005)

Michael H. Shank

Office hours: Friday at 1:30 (Social Science 7135) or by appointment (262-3972;
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Lectures: 8:50 MW in Social Science 6102 (**NOTE ROOM CHANGE—M&W only**)
Undergrad Discussion: F in Social Science 6232 ; graduate students taking HS/MS 322
must be enrolled concurrently in HS 622 (Discussion tentatively set for Friday
at 11 in Social Science 6304).

The following required books were ordered at Underground Textbooks and
University Bookstore:

David C. Lindberg, The Beginnings of Western Science: The European Scientific
Tradition in Philosophical, Religious and Institutional Context, 600 B. C. to A.
D. 1450 (Chicago: University of Chicago Press, 1992) [=BWS below].

Plato, Timaeus, trans. Peter Kalkavage (Newburyport, Mass.: Focus, 2001).

Michael H. Shank, ed., The Scientific Enterprise in Antiquity and the Middle Ages
(Chicago: University of Chicago Press, 2000).

Richard Dales, ed., The Scientific Achievement of the Middle Ages (Philadelphia:
University of Pennsylvania Press, 1973).

Grad students: G. E. R. Lloyd, The Ambitions of Curiosity (Cambridge: Cambridge
University Press, 2002).

Additional readings--articles and excerpts marked by an asterisk* below--are
distributed in photocopy at a cost of \$20 (322)—a per-page bargain (your home printer
is more expensive); for 622, see me. They are available in the History of Science Dept
(Social Science 7143). Cash, or checks payable to "History of Science Dept." **NOTE:**
The reader is not refundable if you drop the course.

Requirements

General: attendance at two lectures per week; participation in the Friday discussion;
completion of the readings in timely fashion (the undergraduate reading load
averages about 85 pages per week, with some weeks lighter than others). Note
that a short reading is not necessarily an easy reading. For this course (and most
others), you should plan on spending on average a minimum of 2 hours outside
of class for every hour in class.

Undergraduates: a take-home midterm essay exam (25%), two article analyses (4
pages each; 20% total), one final synthetic essay take-home exam (30%) with an

in-class short essay (15%); participation in discussion (10%). Extra-credit analyses or projects by special permission.

Honors work is individualized and by special arrangement. I will entertain proposals ranging from additional reading and a literature review of a special topic to a more concrete project (an experimental replication, an observational project, the construction of an instrument, etc.). Talk to me about your interests and ideas.

Graduate students: concurrent enrolment in HS 622 (11 am in 6304 Social Science); attendance at lectures; participation in 622 discussions (20%); two detailed reviews (5-8 pages) of books relevant to the course and totaling 500 pages (or the equivalent) (20% each); oral report on one review (10%); one take-home, 8-10-page final essay (35%). The readings listed under "Grad supplement" are to be completed in time for discussion on the following Friday).

The UW-Madison is committed to creating a dynamic, diverse and welcoming learning environment for all students and has a non-discrimination policy that reflects this philosophy. Disrespectful behaviors or comments addressed towards any group or individual, regardless of race/ethnicity, gender, sexuality, religion, ability, or any other difference are unacceptable in this class.

Note, however, that I have no tolerance for plagiarism or any other form of academic dishonesty, from unattributed borrowings to the purchase or the resubmission of papers. All submitted work for this course must start as your work, develop as your work, and be your work when submitted. The phrases of others must be in quotation marks; their ideas must be credited. When I have found academic dishonesty, I have sought the harshest sanctions available, including expulsion of the guilty from the university without a degree.

Some important dates

Target date for first analytical papers: 10/14

Midterm exam due: October 24

Target date for second analytical paper: 11/14

Grads: review reports on 10/28 and 11/18

Final deadline for all regular written work: Thursday 12/15 at 5 p.m.

Final exam: Wednesday 21 December at 10:05 a.m.

Course Schedule

(odd) Week 1: Where to begin?

F 9/2 Introduction to the course; "Science" in Antiquity as a Problem and a Hot Topic

M—Labor Day

W 9/7 Egypt and Mesopotamia

F 9/9 Discussion, esp. Pingree and Bernal.

Lindberg, Beginnings, ch. 1; *M. Clagett, "Science in Egypt and Mesopotamia," in Greek Science in Antiquity (Macmillan, 1955), pp. 3-20; O. Neugebauer, "The Study of Wretched Subjects;" D. Pingree, "Hellenophilia and the History of Science," and Martin Bernal, "Animadversions on the Origins of Ancient Science,"--all in Shank, Scientific Enterprise, pp. 21, 30-39, 72-83.

Grad supplement: *Jack Goody and Ian Watt, "The Consequences of Literacy," in Goody, ed., Literacy in Traditional Societies, pp. 27-68; H. von Staden, "Affinities and Elisions: Helen and Hellenocentrism" and Shank, "Introduction," in Shank, Scientific Enterprise, pp. 1-19, 54-71.

Week 2: Presocratics: Thales to Parmenides; Plato

M 9/12 The Milesian natural philosophers and the Pythagoreans

W 9/14 The challenge of Parmenides; Plato

F 9/16 Discussion: Excerpts from Ionians and Parmenides/Plato's Timaeus

Lindberg, BWS, ch. 2; *Thales, Anaximander, Anaximenes, Parmenides from K. Freeman, Ancilla to the Presocratic Philosophers (Harvard UP, 1957), 18-19, 41-46; *B. Farrington, "The Character of Early Greek Science," from Farrington, Head and Hand in Ancient Greece (London: Watts, 1947) *Jean-Pierre Vernant, "The New Image of the World," The Origins of Greek Thought (Ithaca: Cornell UP, 1968); Plato, Timaeus [read #17-#46 middle]=pp. 47-77; skim 52D-57D, 90A-92C, pp. 84-90, 126-130 in Focus edition of the Kalkavage translation.

Grad supplement: *A. A. Long, "The Principles of Parmenides's Cosmology," *G. Vlastos, "Theology and Philosophy in Early Greek Thought," in Furley and Allen, eds., Studies in Presocratic Philosophy, vol. 1. (New York: Humanities Press, 1970), pp. 92-129.

Week 3: Aristotle

M 9/19 Logic, Method, Biology

W 9/21 The Problem of Change

F 9/23 Discussion: Aristotle readings and Horowitz article

Lindberg, BWS, ch. 3; *Marjorie Grene, "On Interpreting Aristotle," A Portrait of Aristotle (Chicago); *Aristotle, Physics, book I (trans. Apostle); *excerpts from Parts of Animals, History of Animals in Cohen and Drabkin, eds., Source Book in Greek Science (Cambridge: Harvard UP, 1948); *Maryann C. Horowitz, "Aristotle and Woman," Journal of the History of Biology 9 (1976) 183-213.

Grad supplement: *W. D. Ross, "The Development of Aristotle's Thought," in Barnes, Schofield, Sorabji, eds., Articles on Aristotle: Science (London: Duckworth, 1975), pp. 1-13.

Week 4: Greek Mathematics and Proof

M 10/3 Arithmetic: Pythagorean ratios/irrational numbers

W 10/5 Geometry: Formal systems: Euclid to Apollonius

F 10/7 Discussion: Mathematics readings

Lindberg, BWS, ch. 4-5; *"Incommensurables," and *"Proclus on the origins of geometry," from Cohen and Drabkin, eds., Source Book in Greek Science (Cambridge: Harvard UP, 1948), pp. 13-14, 33-38; *Euclid, Elements, definitions, postulates, common notions, Book 1, proposition 1.

Grad supplement: *W. Knorr, "Infinity and Continuity: The Interaction of Mathematics and Philosophy in Antiquity," in Kretzmann, ed., Infinity and Continuity in Ancient and Medieval Thought (Ithaca: Cornell UP, 1982).

Recommended: G. E. R. Lloyd, Magic, Reason, and Experience, ch. 2.

Week 5: Greek Astronomy and Cosmology

M 10/10 Athens: Plato, Eudoxus, Aristotle

W 10/12 Alexandria (Egypt): From Eratosthenes to Ptolemy

F 10/14 Discussion: Aristotle and Ptolemy selections

Review Lindberg, BWS, ch. 5; *Aristotle, excerpts from On the Heavens (De caelo) and Physics, from Cohen and Drabkin, eds., A Source Book in Greek Science (Cambridge, Mass.: Harvard University Press, 1974), pp. 200-209; *Ptolemy, Almagest, Book I, pp. 1-9 (trans. G. J. Toomer); B. Goldstein and A. Bowen, "A New View of Early Greek Astronomy," in Shank, Scientific Enterprise, pp. 85-95.

Grad supplement: A. Jones, "The Adaptation of Babylonian Methods in Greek Numerical Astronomy," in Shank, Scientific Enterprise, pp. 97-109; *D. Furley, "The Cosmological Crisis in Classical Antiquity," from his Cosmic Problems: Essay on Greek and Roman Philosophy of Nature (Cambridge: Cambridge UP, 1989) pp. 223-35.

Week 6: Greek Medicine and Biology

M 10/17 The Hippocratic corpus

W 10/19 Alexandrian and Galenic medicine

F 10/14 Discussion: esp. "Sacred Disease," and Galen, "On sects."

Lindberg, BWS, ch. 6; *[Pseudo-Hippocrates], "The Sacred Disease;" *Galen, "On the sects: for beginners" (trans. Walzer and Frede); O. Temkin, "Greek Medicine as Science and Craft," in Shank, Scientific Enterprise, pp. 111-123.

Grad supplement: *G. E. R. Lloyd, "The Criticism of Magic and the Inquiry Concerning Nature," ch. 1 in his Magic, Reason and Experience, (Cambridge UP, 1979), pp. 10-58.

Week 7: Antiquity: Concluding Issues

M 10/17 The Roman Predicament: Greek Science in Decline?

W 10/20 Augustine/The Commentator Tradition

F 10/21 Take-home midterm handed out; discussion of Philoponus and Lindberg.

Lindberg, BWS, ch. 7; *Philoponus excerpts in Cohen and Drabkin, eds., A Source Book in Greek Science (Harvard); D. Lindberg, "Science and the Early Church," in Shank, Scientific Enterprise, pp. 125-146.

Grad supplement: *Augustine, On Christian Doctrine, bk II, ch. 19-42 (trans. Robertson), pp. 55-78.

Week 8: The Emergence of Arabic Science

M 10/24 **Mid-term due in class.** Antiquity: decline as a problem
 W 10/26 Arabic translation and appropriation of Greek science
 F 10/28 Discussion: Science in Arabic society (esp Sabra, "Appropriation" article)

Lindberg, BWS, ch. 8; *A. I. Sabra, "The Appropriation and Subsequent Naturalization of Greek Science in Medieval Islam: A Preliminary Statement," History of Science 25 (1987) 223-243; *A. I. Sabra, "The Scientific Enterprise," in Bernard Lewis, ed., The World of Islam (Thames and Hudson); A. I. Sabra, "Situating Arabic Science: Locality versus Essence," in Shank, Scientific Enterprise, pp. 215-31.

Grads: focus on undergrad readings and begin review reports

Week 9: Arabic Science

M 10/31 Medicine (around Avicenna)
 W 11/2 The Mathematical Sciences in Islam: Optics and astronomy
 F 11/4 Discussion of readings, esp. Musallam.

*Avicenna, excerpts from Canon in Grant, ed., A Source Book in Medieval Science, pp. 715-20; *excerpts from Alhacen, Avicenna and Averroes, from S. Sambursky, ed., Physical Thought from the Presocratics to the Quantum Physicists: An Anthology (London: Hutchinson, 1974); *Basim Musallam, Sex and Society in Islam: Birth Control Before the Nineteenth Century (Cambridge/New York: Cambridge UP, 1983), ch. 1 and 3: Why Islam Permitted Contraception; Conception Theory in Muslim Thought, pp. 10-27, 39-59.

Grad supplement: *G. Makdisi, "Madrasa and University in the Middle Ages," Studia Islamica 32 (1970) 255-264; V. Roberts, "The Solar and Lunar Theory of Ibn ash-Shatir: A Precopernican Copernican Model" in Shank, Scientific Enterprise, pp. 233-37.

Week 10: Early Latin Europe

M 11/7 Agriculture & Medieval Technology: The Lynn White thesis
 W 11/9 Intellectual Struggles
 F 11/11 Discussion: The Lynn White thesis

*L. White, "The Agricultural Revolution of the Early Middle Ages," from his Medieval Technology and Social Change (Oxford UP, 1958); *R. H. Hilton and P. H. Sawyer, "Technical Determinism: The Stirrup and the Plough," Past and Present 24 (1963) 90-100; S. McCluskey, "Gregory of Tours, Monastic Timekeeping and Early Christian Attitudes to Astronomy," in Shank, Scientific Enterprise, pp. 147-61.

Grad supplement: Selections from *Isidore of Seville's Etymologiae, in Grant, Source Book in Medieval Science (Cambridge: Harvard UP, 1974); Linda Voigts, "Anglo-Saxon Plant Remedies and the Anglo Saxons," in Shank, Scientific Enterprise, pp. 163-181.

Week 11: The twelfth-century revival

M 11/14 The New Naturalism

W 11/16 From translation to the emerging universities
 F 11/18 Discussion: Dales selections/Alic

Lindberg, BWS, ch. 9; Dales, "The Twelfth Century," pp. 37-60; *Margaret Alic, "The Sibyl of the Rhine," from her Hypatia's Heritage (Beacon Press); *C. Burnett, "Scientific Speculations," from Peter Dronke, ed., A History of Twelfth-Century Philosophy (Cambridge: Cambridge UP, 1988), pp. 151-76.

Grad supplement: undergrad readings, *M. D. Chenu, "Nature and Man: The Renaissance of the Twelfth Century" from his Nature, Man and Society in the Twelfth Century (Chicago: University of Chicago Press), pp. 1-48, and review reports.

Week 12: The Universities Respond

M 11/21 Oxford University and Robert Grosseteste
 W 11/23 Natural Philosophy and Theology at Paris
 F 11/25 Thanksgiving break

Lindberg, BWS, ch. 10; Dales, "Grosseteste and Scientific Method," pp. 61-80; Lindberg, "Science as Handmaiden: Roger Bacon and the Patristic Tradition," in Shank, Scientific Enterprise, pp. 295-313; *Condemnations of 1277, from Grant, ed., Source Book in Medieval Science (Harvard); *Grant, "The Condemnation of 1277, God's Absolute Power, and Physical Thought in the Late Middle Ages," Viator 10 (1979) 211-243.

Grad supplement: *Edward Grant, "Science and the Medieval University," in Kittelson and Pamela Transue, eds., Rebirth, Reform and Resilience: Universities in Transition, 1300-1700 (Columbus: Ohio State University Press); *Shank, "A Female Student in Late Medieval Krakow," Signs 14 (1989) 373-80.

Week 13: Late Medieval Latin Natural Philosophy

M 11/28 Optics/Perspectiva
 W 11/30 The Science of Motion
 F 12/2 Combined Discussion: Grosseteste (Dales)/Condemnations/Lindberg's "Handmaiden" article (last week); Buridan and Oresme (Dales)

Begin Lindberg, BWS, ch. 11-13, esp. 12; Dales, "Studies of the Rainbow" and "Studies of Local Motion," pp. 81-124; M. McVaugh, "Arnald of Villanova and Bradwardine's Law," in Shank, Scientific Enterprise, pp. 363-71; *Joan Cadden, "'Nothing Natural is Shameful': Vestiges of a Debate about Sex and Science in a Group of Late-Medieval Manuscripts," Speculum 76 (2001), p. 66-89.

Grad supplement: Murdoch and Sylla, "The Science of Motion," in D. Lindberg, ed., Science in the Middle Ages (book in Hist. Sci. Dept library and other libraries; I want you to hold the book in your hands and leaf through it). Reports?

Week 14: Specialized Sciences in the Later Latin Middle Ages

M 12/5: Medicine
 W 12/7: Astronomy, Astrology, and Cosmology
 F 12/9 Discussion: Selections in Dales

Finish Lindberg, BWS, ch. 11-13, esp. 11, 13; Dales, "Astronomy," pp. 125-138; *Monica Green, "Women's Medical Practice and Health Care in Medieval Europe," Signs 14 (1989) 39-78; Helen Lemay, "The Stars and Human Sexuality: Some Medieval Scientific Views," Nancy Siraisi, "Taddeo Alderotti and Bartolomeo da Varignana on the Nature of Medical Learning," and Thorndike, "The True Place of Astrology in the History of Science," in Shank, Scientific Enterprise, pp. 239-255, 349-61.

Grad supplement: B. Goldstein, "Theory and Observation in Medieval Astronomy;" and Pamela Long, "Power, Patronage, and the Authorship of Ars: From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age," in Shank, Scientific Enterprise, pp. 205-213, 395-435.

Week 15: An Assessment of Medieval Science

M 12/12: Character of late-medieval science

W 12/14 Manuscript & printed books (Special Collections, 9th fl. Mem. Library)

Lindberg, BWS, ch. 14; Dales, "Conclusion," pp. 170-176; *John Murdoch, "The Analytic Character of Late Medieval Learning: Natural Philosophy Without Nature" from L. Robertson, ed., Approaches to Nature in the Middle Ages, pp. 171-213.

Grad supplement: Dales, "Fringes of Science;" Brian Copenhaver, "Did Science Have A Renaissance?" in Shank, Scientific Enterprise, pp. 373-93.

Final exam: Wednesday 21 December at 10:05 a.m. (but always double-check time and place!).

The Short Analytical Papers of Articles

1. The assignment is **not** a research paper on the topic of the article to be analyzed. Rather, it focuses on the article itself (pick one you find interesting). The goal of the assignment is to discover the main point of the assigned article, and to understand the author's subsidiary claims, arguments, and evidence. Your writing about these issues will clarify your own thinking and sharpen your analytical and critical skills. To do the job properly, you should (re)read the paper at least two days before the paper is due and think about it. Our brains work also while we sleep, but they tend to simmer rather than boil--and simmering requires time.

2. **Main thesis.** Both while you are reading and after you have read the piece, you should try to isolate the author's main thesis. In a well-written article, the introduction and conclusion often provide precious clues about the matter, but not always. What is the author trying to demonstrate? what is the one main idea that the author wants you to remember? what are (if any) the two or three related subsidiary points?

In the opening section of your paper, express in clear and condensed form the author's own point of view. Get inside the author's head and outline/summarize/clarify in your own words the ideas and emphases expressed in the text. Ideally, your attitude at this point is one of understanding--you are representing someone else's views as best you can (regardless of whether or not you disagree with them). Criticism is not appropriate yet.

3. Analysis. The second part of the paper will analyze the author's argument(s). This stage involves paying close attention to the structure and flow of the article. Among the questions you should consider (and perhaps address in your paper, if they help clarify what the author is up to):

How does the author defend the thesis? Is the author simply making a positive case? or is the author also criticizing earlier literature on the subject?

What assumptions (implicit or explicit) does the author bring to bear on the argument?

How has the author structured the case presented here?

What kind of evidence does the author use?

Finally, recognizing notable difficulties you face in trying to understand the article is an important part of analysis. Think about these difficulties: you may solve some of them, but others may remain unsolved. That's OK. You may (or not) wish to bring up all of these difficulties in your write-up, but do think about them.

4. Criticism/evaluation. After the increased understanding gained from analyzing the article, you are now in a position to go one step farther, and evaluate the effectiveness of the argument. Does the article in fact do what the author intended it to do? Does it convince you that the thesis is plausible? correct? wholly correct? correct in part? correct, but not for the reasons the author provided? Dead wrong? Be measured in your criticisms; avoid even the appearance of trying to "trash" the article when you strongly disagree with it; always give arguments/reasons for your disagreements.

If you noticed apparent inconsistencies, are they apparent only? are they due to hidden assumptions? if so, can you draw the latter out?

Note that "analysis" and "criticism/evaluation" tend to overlap (they may not be separate sections in your paper).

5. Miscellaneous advice: When writing in the analytical vein, try to be clear and direct (rather than allusive or subtle); you are supposed to get behind/dissect the author's allusions or subtleties. Expository and analytical writing is one specific genre of writing that strives for transparency (unlike some poetry or creative writing, for example). Use the active voice whenever possible; avoid the unnecessary (or repeated) use of impersonal turns of phrase "There is/are..." "It is..." Sentences that you cannot read in one breath are too long.

In this kind of work, avoid quotations (they take up precious space); use restatement and paraphrase instead. The point of the assignment is to grapple with the author's viewpoint by presenting it in your own words. The analysis will, of course, be your own analysis. Paraphrases must be your own. (If a quotation is absolutely necessary, I am not suggesting that you eliminate quotation marks, of course!) Because of the peculiar nature of the assignment, you may use page numbers in parentheses instead of footnotes.

If possible, field-test your analysis. Get a friend who is unfamiliar with the article and the course to read the paper. If s/he is not able to understand something, clarify it.