

# History 697S/797S. Scientific Revolution: The problem of knowledge in early modern Europe

University of Massachusetts Amherst • Spring Semester 2006 • Class #57471/57472  
Monday 2:30-5, Massachusetts Center for Renaissance Studies  
Course website: <http://people.umass.edu/ogilvie/697S/>

Prof. Brian W. Ogilvie

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E-mail: [ogilvie@history.umass.edu](mailto:ogilvie@history.umass.edu). I will try to respond to e-mail within 24 hours during the week and 48 hours on weekends and holidays. If you need a quicker response, use the telephone.

Office hours: MW 11-12, Tu 4-5, and by appointment.

## **Course description**

In the sixteenth and seventeenth centuries, something important happened to the way Europeans understood the world. This shift in understanding has conventionally been called “the Scientific Revolution.” But some modern scholars deny that such a thing ever happened. In this course we will approach the Scientific Revolution from a broad historiographical perspective, with a focus on the discipline of history of science but drawing also on intellectual history and the history of philosophy. Our trajectory will follow modern interpretations, from the metaphysical and methodological approaches that characterized the early twentieth century, through social and epistemological approaches, to the contextual, cultural approaches that characterize history of science at the beginning of the twenty-first century. By following the changing interpretations of the Scientific Revolution from the beginning of the twentieth century to the present, students will come to better understand both the Scientific Revolution itself and the development of modern history of science. Students may register for this course as a readings course (697S) or a research seminar (797S).

## **Course structure**

This course is a seminar. We will meet each week for about 2.5 hours, with a brief pause about halfway through. Except for the first week, these meetings will be conducted as tutorials: discussion will start from the brief essays that each student will write on the week’s readings. The seminar format places much of the burden of learning on you and your fellow students. Not preparing for discussions will harm them as well as you. A good graduate course teacher does not tell students what to do or think; he or she guides them in the process of education. Much of my work consists in preparing this syllabus carefully and in identifying issues for discussion.

Discussion serves several purposes. First, it helps clarify difficult or obscure points in the readings. Second, it helps you decide between conflicting positions or to reach a synthesis. Third, it allows me to observe how you approach readings and problems. Fourth, it prepares you for thinking on your feet—an important part of academic life as well as life outside the academy.

## **Requirements and grading**

Your grade for this course will be based on the following requirements:

### **1. Attendance and participation in discussion (all students)**

For the reasons mentioned above, attendance and participation are crucial for this course. I expect you to attend. Missing more than one class may seriously affect your grade.

### **2. Brief essays (all students)**

Each week you will be responsible for writing a two-page essay on the week's readings. Essay topics will be assigned for the first few weeks; after that, you will choose them yourself.

### **3A. Five-to-eight-page paper (697S students)**

A 5-8 page paper will be due March 9 at 5 p.m. Details are given below in the calendar. Take a look at the assignment now and keep it in mind as you read the assignments for the first several weeks.

### **3B. Research proposal (797S students)**

A 5-8 page proposal will be due March 9 at 5 p.m. Details are given below in the calendar. You should get started on your research right away; the proposal will be a way-station, not a starting point.

### **4A. Twelve-to-fifteen-page paper (697S students)**

A 12-15 page paper will be due DATE at 5 PM. You will have several weeks to work on the paper, and I will comment on a draft. Details are given below on the syllabus.

### **4B. Twenty-five to thirty-five page research paper (797S students)**

The final course grade will be balanced among these three elements, with the most weighting going to the short papers. A rough breakdown is as follows:

#### 697S

Participation and brief essays: 50%

5-8 page paper: 20%

12-15 page paper: 30%

#### 797S

Participation and brief essays: 30%

Research proposal: 20%

Research paper: 50%

If necessary, however, I will re-weight the elements of the course to your advantage. Grades in graduate courses reflect my professional assessment of your achievements and potential as an apprentice historian. Here is a rough key to their interpretation:

A excellent

A- very good

B+ good

B acceptable

B- marginal

C+ marginal to unacceptable

C unacceptable

In addition to the grade, you will receive written comments at the end of the semester reflecting my assessment.

## **Books for course**

The following required books are listed in the order we will use them. The books are not on reserve, because I don't expect more than a few students in the course this year. For the same reason, I did not place a book order; you can order books yourself from Amherst Books (downtown) or your favorite bookseller. If you do not want to buy a book, you should check it out from UMass or from one of the four colleges; most of the books are available in at least two of the four colleges. Note that Roger Hahn's book *The anatomy of a scientific institution*, assigned for March 6, is out of print; you will need to get (and possibly share) a copy from the University and college libraries.

- Dear, Peter, ed. *The scientific enterprise in early modern Europe: Readings from "Isis"*. Chicago: University of Chicago Press, 1997. ISBN 0-226-13947-6. Note: the readings in this volume are also available via JSTOR; if you prefer, you can find them there and print them out for class.
- Booth, Wayne C., Gregory G. Colomb, and Joseph M. Williams. *The craft of research*. 2d ed. Chicago: University of Chicago Press, 2003. ISBN 0-226-06568-5.
- Burt, Edwin A. *The metaphysical foundations of modern physical science*. Revised ed. Reprint, New York: Dover, 2003. ISBN 0-486-42551-7.
- Koyré, Alexandre. *From the closed world to the infinite universe*. Baltimore: Johns Hopkins University Press, 1957. ISBN 0-8018-0347-0.
- Merton, Robert K. *Science, technology, and society in seventeenth-century England*. Reprint, New York: Howard Fertig, 2002. ISBN 0-86527-434-7. Note: the original 1938 publication (in *Osiris*) is available via JSTOR.
- Hacking, Ian. *The emergence of probability*. Cambridge: Cambridge University Press, 1975. ISBN 0-521-31803-3.
- Shapin, Steven, and Simon Schaffer. *Leviathan and the air-pump: Hobbes, Boyle, and the experimental life*. Princeton: Princeton University Press, 1985. ISBN 0-691-02432-4.
- Dear, Peter. *Discipline & experience: The mathematical way in the scientific revolution*. Chicago: University of Chicago Press, 1995. ISBN 0-226-13944-1.
- Smith, Pamela H. *The business of alchemy: Science and culture in the Holy Roman Empire*. Princeton: Princeton University Press, 1994. ISBN 0-691-01599-6.
- Daston, Lorraine, and Katharine Park. *Wonders and the order of nature, 1150-1750*. New York: Zone Books, 1998. ISBN 0-942299-91-4.
- Huff, Toby. *The rise of early modern science: Islam, China, and the west*. 2nd ed. Cambridge: Cambridge University Press, 2003. ISBN 0-521-52994-8.
- Heilbron, John. *The sun in the church: Cathedrals as solar observatories*. Cambridge, MA: Harvard University Press, 1999. ISBN 0-674-00536-8.

## **RECOMMENDED**

- Cohen, H. Floris. *The scientific revolution: A historiographical inquiry*. Chicago: University of Chicago Press, 1994. ISBN 0-226-11280-2.
- Turabian, Kate. *A manual for writers of term papers, theses, and dissertations*. 6th ed. Revised by John Grossman and Alice Bennett. Chicago: University of Chicago Press, 1996. ISBN

0-226-81627-3.

Williams, Joseph M. *Style: Toward clarity and grace*. Chicago: University of Chicago Press, 1990.  
ISBN 0-226-89915-2.

## **Course schedule with readings and assignments**

### **February 6: Introduction and overview**

Required reading: Peter Damerow and Jürgen Renn, “Scientific revolution: History and sociology of,” *International Encyclopedia of the Social Sciences* (handout). We will take a break for you to read this handout and reconvene to discuss it.

If you are registered for History 797S, you should see me before the end of class today to arrange a meeting on your research interests.

N.B. Today we will meet in Herter 212. Starting next week we will meet at the Massachusetts Center for Renaissance Studies (directions will be given in class).

### **February 13: Metaphysics**

#### Required reading

Burtt, *The metaphysical foundations of modern science*.

Hutchison, “What happened,” in *The scientific enterprise*.

Booth et al., *The craft of research*, Part I.

#### Recommended reading

Cohen, *The scientific revolution*, 21-97.

Essay: Write two pages (500-600 words) on the following subject: Explain Burtt’s title. What does he mean by “metaphysical foundations,” and what is “modern science”? Who was involved in its construction? Think about the narrative of the scientific revolution that Burtt constructs.

N.B. Starting this week we will meet at the Massachusetts Center for Renaissance Studies.

### **February 21 (Tuesday): Cosmology**

#### Required reading

Koyré, *From the closed world to the infinite universe*.

Osler, “Galileo, motion, and essences,” in *The scientific enterprise*.

Booth et al., *The craft of research*, Part II.

#### Recommended reading

Cohen, *The scientific revolution*, 97-150.

Essay: Write two pages (500-600 words) on the following subject: Compare Koyré’s version of the scientific revolution with Burtt’s. How do the metaphysical emphases differ, and to what extent are they the same. Which old characters are missing, and which new ones enter the scene?

## February 27: Sociology

### Required reading

Merton, *Science, technology & society in seventeenth century England*. Originally published in 1938 in *Osiris*; you can download it from JSTOR if you prefer.

Booth et al., *The craft of research*, Part III.

### Recommended reading

Cohen, *The scientific revolution*, 308-321.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

## March 6: Institutions and Patronage

### Required reading

Roger Hahn, *The anatomy of a scientific institution: The Paris Academy of Sciences, 1666-1803* (Berkeley: University of California Press, 1971). Read carefully through p. 158; read the rest quickly.

Westfall, "Science and patronage," in *The scientific enterprise*.

Dear, "Totius in verba," in *The scientific enterprise*.

Schiebinger, "Maria Winkelmann," in *The scientific enterprise*.

Booth et al., *The craft of research*, Part IV.

### Recommended reading

Cohen, *The scientific revolution*, 198-236.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.



## ☞ **March 9 (Thursday): Paper or research proposal due** ☞

5-8 page paper (697S) or research proposal (797S) due by 5 p.m. in my office (Herter 624)

### Paper assignment (697S)

For this paper, discuss the different conceptions of the Scientific Revolution that appear in the readings through this week. To what extent are the conceptions compatible? What kind of historiographical developments can you identify? You may find it helpful to consult contemporary reviews of the books in question.

As you are writing the paper, consider how to apply the concepts in *The craft of research* to your analysis: audience (part 1); topics, questions, problems, and sources (part 2); claims, evidence, warrants, and qualifications (part 3); and organization and style (part 4). These concepts should give you a set of tools for analyzing the works; you should also use those tools in writing your paper.

Your paper should follow the format specified by Turabian (a separate title page is not necessary). Papers that do not follow this format will not be accepted.

### Research proposal assignment (797S)

Write a 5-8 page research proposal for your final paper in this course. Your proposal

should draw on the concepts in part 2 of *The craft of research*: topics, questions, problems, and sources. You should identify a set of questions whose answers will shed light on a significant problem in the history of the scientific revolution. Because this is a research paper, you will need to find primary sources to use as evidence.

It is probably best to begin by examining the sources that are available in the UMass and Four College libraries. An enormous range of printed English sources are available through the EEBO (Early English Books Online) database. The correspondence of many major figures in the Scientific Revolution has been published. If you read any foreign languages, I encourage you to look for sources in them.

Your proposal should include (1) a statement of your topic, questions, and problems; (2) a review of the published scholarship in your area, to show that the problem is significant and that you're not simply going to echo what someone else has already published; and (3) a bibliography of several primary sources that you will use in your research.



### **March 13: Probability and Knowledge**

#### Required reading

Hacking, *The emergence of probability*.

Meinel, "Early seventeenth-century atomism," in *The scientific enterprise*.

#### Recommended reading

Cohen, *The scientific revolution*, 321-377.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

### **March 27: Matters of Fact**

#### Required reading

Shapin and Schaffer, *Leviathan and the air-pump*.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

### **April 3: Experience and Experiment**

#### Required reading

Dear, *Discipline & experience*.

Shapin, "The house of experiment," in *The scientific enterprise*.

#### Recommended reading

Cohen, *The scientific revolution*, 183-198.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

**April 10: The Baconian Sciences**

Required reading

Smith, *The business of alchemy*.

Thomas S. Kuhn, "Mathematical vs. experimental traditions in the development of physical science," *Journal of Interdisciplinary History* 7, no. 1 (1976): 1-31. Also reprinted in *The essential tension: Selected studies in scientific tradition and change* (Chicago: University of Chicago Press, 1977).

Hannaway, "Laboratory design," in *The scientific enterprise*.

Kuhn, "Robert Boyle," in *The scientific enterprise*.

Dobbs, "Newton's alchemy," in *The scientific enterprise*.

Recommended reading

Cohen, *The scientific revolution*, 151-183.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

**April 19: NO CLASS**

April 17 is a University holiday, Patriots' Day. Class has been rescheduled to April 19, but that day I am flying to California to give a lecture at Stanford.

**April 24: Emotion and Cognition**

Required reading

Daston and Park, *Wonders and the order of nature*.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

**May 1: The Scientific Revolution and the Wider World**

Required reading

Huff, *The rise of early modern science*.

Recommended reading

Cohen, *The scientific revolution*, 378-488.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

**May 8: New views on the astronomical revolution**

Required reading

Heilbron, *The sun in the church*.

Westman, "The Melanchthon circle," in *The scientific enterprise*.

Van Helden, "The telescope," in *The scientific enterprise*.

Essay: Write two pages (500-600 words) on some aspect of this week's readings. Be prepared to explain why you chose your subject.

### **May 15: Tying it all together**

#### Required reading

Andrew Cunningham and Perry Williams, “De-centring the ‘Big Picture’: The *Origins of modern science* and the modern origins of science,” *British Journal for the History of Science* 26 (1993): 407-432.

Peter Dear, “What is the history of science the history of? Early modern roots of the ideology of modern science,” *Isis* 96, no. 3 (2005): 390-406.

Essay: Write two pages (500-600 words) assessing the state of the Scientific Revolution as a historical concept at the beginning of the twenty-first century.

### **May 22: FINAL PAPER DUE AT 5 PM IN HERTER 624**

If you are in History 797S, your final assignment is a 20-25 page research paper.

If you are in History 697S, you should choose one of the following assignments:

1. Write a critical review of Steven Shapin, *The Scientific Revolution* (Chicago: University of Chicago Press, 1996), and Peter Dear, *Revolutionizing the Sciences* (Princeton: Princeton University Press, 2001). How do they compare as textbooks? What are their strengths and weaknesses?
2. Write a critique of Cohen, *The Scientific Revolution*, Part Three (chapters 7-8). How accurately does he characterize the history and historiography of the Scientific Revolution? Are there major errors or omissions in his account? How persuasive is his explanation? How does his account (published in 1994) square with the more recent literature in the field with which you are familiar (from this course and from any other reading you have done)?
3. A topic of your choosing, as long as you submit it in writing (e-mail is fine) for me to approve by May 1.

The paper should be 12-15 pages (3600-4500 words) in length, and it should follow the format specified in Turabian (including a title-page and a complete bibliography; abstract and table of contents are not necessary). Keep in mind the rhetorical aspects of your paper, as set out in Booth et al., *The Craft of Research*.

Please feel free to bring me drafts of your final papers, beginning in April. I will get them back to you within a week of receipt, with comments. You may also want to share drafts with fellow students.