Science & Society:
From the Age of Newton to the Age of Darwin

HIS 295-05; Fall 2011
T: 10:00-11:50 am, Th: 10:00-10:50 am; Noyce 2245

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Fall Office Hours:
M, Th, 1:30-3:00 pm
& by appointment

Course Overview

This course examines the rise of modern science from the transformative period of Isaac Newton and the scientific revolution to the time of Charles Darwin (c. 1660-1860). During this key period, science not only emerged as the most authoritative form of knowledge, but also began to exert a powerful influence on the fabric of western society. Over the course of the semester, we will explore how revolutionary developments in the physical, biological and human sciences were connected to profound changes in the social, political, and economic world, such as the emergence of the Enlightenment, industrialization, imperialism, political reform, religious debates, and the growing emphasis on racial and sexual difference.

The course readings focus on the social and historical factors that have shaped how scientific knowledge was constructed; how and why it gained assent; and how different groups have employed this knowledge to serve particular ends. Our goal, therefore, is not simply to understand how science has shaped society, but also to probe how social and ideological factors have structured the world of science itself, conditioning the kind of knowledge it produces. As we shall see, even fields like mathematics or the "hard" physical sciences cannot be fully understood without an appreciation of the social context surrounding them.

The course material is divided into four sections, each exploring a different facet of modern science: experimentation, measurement, conceptual models, and classification. Each, therefore, represents a unique "story" about how a particular set of knowledge-making practices were shaped by social and historical forces, and in turn, how the science they produced transformed different aspects of the world around them. By tracing the historical evolution of experimentation, for example, the readings and documents reveal how the culture of experimental philosophy was tied to the political crisis of order in the seventeenth century, the creation of new social spaces and audiences for scientific information in the eighteenth century, and the mechanical world of the industrial revolution in the nineteenth century. Each section will end with a short paper assignment tailored to the specific issues and documents of that particular section. I will distribute guidelines for each paper at least 10 days before it is due.

Required Texts

The following texts are required and can be purchased at the Campus Bookstore:

- Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, NJ: Princeton University Press, 1985 or 2011).
- Ken Alder, *The Measure of All Things: The Seven-Year Odyssey and the Hidden Error that Transformed the World* (New York: Free Press, 2003).
- Linda Schiebinger, *The Mind Has No Sex? Women in the Origins of Modern Science* (Cambridge, MA: Harvard University Press, 1991)..

Note: There are a number of shorter articles, essays, and primary sources that are also required reading for the course. These will be distributed in a course packet, or made available through the course module on Pioneer Web.

Course Requirements & Policies

Class Sessions & Participation

While the majority of our class time will be devoted to discussing the common readings, I will give a number of short lectures to provide more context, explore particular examples in greater depth, or occasionally to cover an interesting topic that simply could not be fit into the reading schedule. But I want to emphasize that class discussion really forms the core of the course—it provides an opportunity for each student to examine the issues in a critical light, to move beyond just reading "comprehension" to a deeper level of *analysis* in which you identify the essential components of an argument and explore how they relate to one another, and to the larger issues of the course. By sharing our different questions, perspectives and insights, we all have an opportunity to get a better understanding of the past.

It is also important to work on articulating your views to other people. Many times, we think we have a solid grasp of a topic or an argument, but then struggle to "find the words" to explain what we actually mean. This often happens when individuals sit down to write papers, and discover that their command of a topic seems to suddenly vanish as they try to actually formulate their ideas in concrete form. So I strongly urge you to participate fully in our group discussions throughout the semester.

Since class discussion provides our main opportunity to examine and debate the issues that are at the heart of this course, it is crucial that students come to each class fully prepared to engage the questions at hand. This involves not only completing the assigned readings prior to class, but also taking the appropriate time to address discussion questions, to organize your notes accordingly, and to jot down specific examples and passages you want to highlight in class. Remember that effective note taking and class participation will lay the foundation for a focused grasp of the material, and will allow you to succeed when you return to these topics later for your papers.

Class participation accounts for 20% of your overall grade, and like any other assignment for this course, will be evaluated seriously. I assign a participation grade for each and every class session,

and will use the overall average to calculate your participation grade. Before Fall break, I will email you a mid-semester participation grade so that you are aware of where you stand in this respect. But feel free to contact me earlier if you have questions or concerns about how you are doing in class discussions (or about ways to improve your participation).

Class Attendance

Please contact me if a medical or personal issue is preventing your class attendance, and have the relevant office (Health Services or Student Affairs) do the same.

Four Short Papers (3-5 pages)

There are no exams in this class. Instead, you will be required to write 4 concise essays that demonstrate your grasp of the material in each section, and your ability to analyze historical sources in light of these issues. I will distribute the essay prompts and guidelines for each assignment at least 10 days before hand.

Extensions & Late assignments

Late papers will receive a deduction of 1/3 of a letter grade per day. Exceptions may be made for extraordinary medical or personal issues. Each student is also allowed a **one time** extension of five days to turn in a written assignment late without incurring any penalty. You should email me in advance so that I am aware that you plan to use your extension for a particular assignment. Note that the college requires ALL coursework to be submitted by the end of exam week (unless you are taking an incomplete in the class); so nothing will be accepted after this date.

Paper Rewrites

The improvement of writing skills is a major focus of this class, and the written assignments. Accordingly, students will have the *option* of rewriting each paper once & submitting it for a new grade. For more details, see the "Guidelines for Paper Submissions" on Pioneer web.

Disabilities:

If you have specific physical, psychiatric or learning disabilities and require accommodations, please let me know early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Associate Dean and Director of Academic Advising, Joyce Stern, whose office is located in Rosenfield Center (x3702).

Religious Holidays:

The religious observance policy of the college states:

> Grinnell College acknowledges and embraces the religious diversity of its faculty, students and staff. Faculty and students share responsibility to support members of our community who observe religious holidays. Students will provide faculty members with reasonable notice of the dates of religious holidays on which they will be absent, and this notice would be expected to occur no later than the third week of the semester. Faculty members will make reasonable efforts to accommodate students who need to be absent from examinations or class due to religious observance. Students are responsible for completing any part of the course work, including examinations, that they have missed due to religious observance, and faculty members are responsible for giving them the opportunity to do so.

As the policy indicates, I will be glad to work with students to make sure that class requirements do not conflict with religious holidays and observances. But it is your responsibility to let me know in advance when these potential conflicts may occur, so that we can address these issues at the beginning of the semester.

Grades

Grades will be assigned according to the following proportions:

Paper #1	Sept. 23	20%
Paper #2	Oct. 14	20%
Paper #3	Nov. 11	20%
Paper #4	Dec. 14	20%
Class Participation		20%

Class Schedule & Reading Assignments

- Please read the assignments in the order in which they are listed each day.
- Also, please bring a copy of the readings along with your notes to each class so that our discussion can be more focused & grounded (i.e. everyone should be ready to refer to specific examples or passages from the texts, and to examine them together).

Thur (Aug. 25th): **Science in Historical Context**
Reading Due: Bowler, *Making Modern Science,* 1-20

Section I:
The Experimental Life: The Construction and Uses of Pneumatic Knowledge

Week 2: Making Experimental Facts

Tue (Aug. 30th): Shapin and Schaffer, *Leviathan and the Air-Pump*, ch.1-2, 6.

Thur (Sept. 1st): Francis Bacon, *New Atlantis*
Robert Hooke, *Micrographia*

Week 3: The Problem of Order & Authority

Tue (Sept. 6th): Shapin and Schaffer, *Leviathan and the Air-Pump*, ch. 3-4, 7-8

Thur (Sept. 8th): Thomas Sprat, *The History of the Royal Society*
Jonathan Swift, *Gulliver's Travels*

Week 4: Demonstrating the Enlightenment

Tue. (Sept. 13th): Margaret Jacob and Larry Stewart, "Popular Audiences and Public Experiments,"
J.T. Desaguliers, *A Course of Mechanical and Experimental Philosophy*
Schiebinger, *The Mind has No Sex?*, ch. 2.

Thur (Sept. 15th): Society of Arts Documents
American Philosophical Society Documents

Week 5: **Experiments in Industrialization**

Tue (Sept. 20th): Margaret Jacob and Larry Stewart, "Practicality and the Radicalism of Experiment,"
Mokyr, "The Intellectual Origins of Modern Economic Growth,"

Thur (Sept. 22nd): TBA

Fri (Sept. 23rd): *First Paper Due 5:00pm*

Section II:
Quantifying the World: The Science & Politics of Measurement

Week 6 Weights, Measures, & Instruments

Tue (Sept. 27th): Alder, *The Measure of All Things*, pp. 1-105.

Thur (Sept. 29th): Clifford Conner, "How was Nature Mathematized,"
Schiebinger, *The Mind has No Sex?*, ch. 3.

Week 7 Precision, Error & Objectivity

Tue (Oct. 4th): Alder, *The Measure of All Things*, pp. 107-261.

Thur (Oct. 6th): Alder, *The Measure of All Things*, pp. 263-350.

Week 8 Remaking the World

Tue (Oct. 11th): Bruno Latour, "Give Me a Laboratory and I Will Raise the World,"
Simon Schaffer, Late Victorian Metrology and Its Instrumentation,"
Bruno Latour, "Centers of Calculation,"

Thur (Oct. 13th): James Scott, "Nature and Space,"

Fri (Oct. 14th): *Second Paper Due 5:00 pm*

Fall Break (October 17th-21st)

Section III:

Theorizing the Laws of Nature: How Scientists Conceptualize the World

Week 9 Mathematics as the new Language of the Universe

Tue (Oct. 25th): Thomas Kuhn, "Mathematical versus Experimental Traditions in the History of the Physical Sciences,"
Alexandre Koyré, *From the Closed World to the Infinite Universe*

Thur (Oct. 27th): Isaac Newton, *Mathematical Principles of Natural Philosophy*
Newton, *Optics*

Week 10 Theology & Politics

Tue (Nov. 1st): J.E. McGuire, "Force, Active Principles, and Newton's Invisible Realm,"
James Jacob and Margaret Jacob, "The Anglican Origins of Modern Science,"
Margaret Jacob, *Newtonians and the English Revolution*

Thur (Nov. 3rd): J.T. Desaguliers, *The Newtonian System of the World*

Week 11 Placing Theories in Historical Context

Tue (Nov. 8thd): Adrian Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London* (Group A) Desmond, Darwin's Sacred Cause
Adrian Desmond, *Darwin's Sacred Cause: How a Hatred of Slavery shaped Darwin's Views on Human Evolution* (Group B)

Thur (Nov. 10th): Peter Dear, "Dynamical Explanation: The Aether and Victorian Machines,"

Fri (Nov. 11th): *Third Paper Due 5:00 pm*

Section IV:
Putting things in Order: The Power of Classification

Week 12 Ordering the World

Tue (Nov. 15): Michel Fourcault "the Order of Things,"
Peter Dear, "A Place for Everything: The Classification of the World,"

Thur (Nov. 17th): Linneaus, *System of Nature*

Week 13 Categorizing People

Tue (Nov 22nd): Ian Hacking, "Biopower and the Avalanche of Printed Numbers,"

Thanksgiving (No Thursday Class)

Week 14 Gender and the Sexual Order

Tue (Nov. 29th): Schiebinger, *The Mind has No Sex?*, ch. 6-8.

Thur (Dec. 1st): Schiebinger, *The Mind has No Sex?*, ch. 9-10.

Week 15 Science and the Measure of Man

Tue (Dec. 6th): Stephen Jay Gould, *The Mismeasure of Man*

Thur (Dec. 8th): Michael Adas, *Machines as the Measure of Men*

Fourth Paper Due Wednesday, December 14th, 5:00pm