

LPS/HIST 60: The Making of Modern Science
Spring Quarter, 2014
M/W/F 10-10:50 SSL 140

The history of science, like the history of all human ideas, is a history of irresponsible dreams, of obstinacy, and of error. But science is one of the very few human activities – perhaps the only one – in which errors are systematically criticized and fairly often, in time, corrected.
-Karl Popper

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or by appointment.

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Office Hours: Friday 1-2, SST 794
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Course Goals and Description:

General outline:

This course will offer a survey of the central historical developments involved in constituting contemporary scientific inquiry. As it is intended for a general audience, it does not presume a intricate knowledge of scientific theories, nor is attaining an intricate technical knowledge the purpose of this course. Though, at times, technical knowledge is covered, such accounts are referenced to the historical framework in which they occur in service of illustrating various larger themes. In addition to these larger themes we will also consider global pictures about the nature of science put forward by such thinkers as Karl Popper and Thomas Kuhn. To explore how well (and in what ways) these views describe the nature of the scientific endeavor, we will proceed through a loosely chronological examination of a number of major historical developments in science, pausing along the way to consider other central recurring themes in the history of science, such as the interactions between science and religion, science and medicine, science and technology, biology and ideology, and science and war. Students should come to class and section having read and given some thought to assigned material. Such preparation will facilitate both a deeper understanding and livelier discussion.

Goals (see web for more detail):

The goals of this course are three fold: history, philosophy, and academic skills.

History:

The historical goal is obtain a more vivid and informed understanding of how things which seem obvious, became so.

Philosophy:

The philosophical goal is to widen your horizons by with regard to what views are possible regarding central topics in the philosophy of science (and to begin to work out your own views).

Skills:

Student do not necessarily already possess the skills that will be necessary to succeed in this class. Students will likely both acquire and refine the ability to identify and summarize written material, the ability to read and interpret primary material from the history of science, and the ability to marshal evidence as part of composing a well-grounded argument.

Texts: Making of Modern Science (MMS); Teaching the Nature of Science (TNOS); Merchants of Doubt (MOD). All other readings will be posted on the class website.

Policies:

- ‡ **Grading:** There are 100 available points. The grade boundaries are at 0, 2.5, and 7.5 (rounded up, e.g. an 87.5 is the lowest possible B+) and are strictly enforced. There will be no curve.

- ‡ **Attendance & Participation:** Exceptionally active, prepared, and intelligent participation in class will improve your final grade beyond what it would otherwise be.

- ‡ **Due Dates & Late Work:** All assignments are due at the beginning of class on Mondays and should be submitted to the eee dropbox by 10 am. Students will have a ten minute grace period after which point the assignment will be considered late. The penalty for turning in an assignment late will be a ten percent deduction per day (or any portion thereof). It is the student's responsibility to ensure that the paper they submit is the correct paper. If the wrong paper is uploaded to the drop box it will be treated as if no paper had been turned in and late penalties will accrue accordingly.

- ‡ **Extensions or alternative test times:** Generally, no changes will be made to the dates listed. Exceptions will be handled on a case by case basis and will not, in any circumstances, be altered without supporting documentation.

- ‡ **Academic Integrity:** All students are expected to be familiar with and abide by the university's policies on academic integrity. Any failure to abide by this policy will result in a failing grade for the course and a letter to the dean reporting the incident.
http://www.senate.uci.edu/senateweb/default2.asp?active_page_id=754

- ‡ **Disabilities and Special Needs:** I am happy to make any accommodations to facilitate student learning. Please see me at the beginning of the quarter to discuss such issues.

- ‡ **Preferred names and Gender Pronouns:** I would like to make every effort to create a safe space. If you have a preferred name or gender pronoun that is not reflected in the roster, please let me know.

- ‡ **This syllabus may be updated as the quarter proceeds. Any such changes will be announced in class as well as by email.**

<u>Week</u>	<u>Assignment</u>	<u>Purpose</u>	<u>% of Grade</u>
Various	Chapter Summary	Students are to form groups via eee. Sign up will open Wednesday morning of Week 1. Groups are required to contribute to the class Wiki. Each group will summarize the reading assignment for the week, including making additional pages. Together the class as a whole will make an interactive resource that covers course material. The webpage must be finalized two days after the topic is covered.	10%
2	Academic Honesty	The assignment presents students with samples of student writing and the original source material. Students are ask to identify which examples display the ideals of academic honesty. If the student gets any wrong they must submit a correct answer and explanation by the next class to demonstrate they understand academic integrity.	1%
3	Primary Reading Summary	This is the first opportunity for students to interact with primary source material. The purpose of this assignment is to learn to understand primary sources in their own terms. Students should identify the main conclusion of the articles, the argument that supports it, and the assumptions the author makes.	5%
4	Primary Reading Comparison	Building on the previous assignment, students must summarize both articles and contrast the fundamental assumptions of Newton and Descartes.	5%
5	Argument Evaluation	This assignments asks students to evaluate secondary material that purports to be an exposition of primary readings. Students must critically evaluate the narrative put forward by the secondary source.	5%
6	Textbook Assignment	Students will compare the history offered by a standard science textbook to the material covered in class to assess the claims made by Thomas Kuhn regarding the accuracy and function of textbooks in science.	5%
7	Argument topic	Students must meet with either Lindley or Bennett to propose a possible topic for their argumentative essay. Students should come to their meeting with having identified both a topic and possible source material.	4%
8	Argument prospectus	Students should have now read some of the material they will use in writing their post. The prospectus should outline the general arc of the argument and identify which sources they plan on drawing from.	5%
9	N/A	Students should be working on their arguments	N/A
10	Finalize Argument	Student should post their argument to the class wiki and submit a copy to the class dropbox. The argument will consider one of the main themes of the course and argue for a position on this topic using the history of science to support their claims.	30%
11	Critical Discussion	Students should read and evaluate the arguments of their classmates posting well-reasoned critiques/responses to positions.	10%
Final	Exam	The exam will be essay format requiring students to demonstrate the skills emphasized during the course	20%

Unit 1: *Motivations, Influences, and Approach*

Monday, Week 1 (March 31) – no readings

Wednesday, Week 1 (April 2) – MMS, Chapter 1: Science, Society, and History

After this unit students will be able to :

- ❖ Distinguish between presentist (whiggish) and contextualist approaches to the history of science.

Unit 2: *Karl Popper, Falsification, and the Demarcation Problem*

Friday, Week 1 (April, 4) – **Both:** (1) The Science of Why We Don't Believe Science (Mooney) & (2) Popper (1963) *Conjectures and refutations the growth of scientific knowledge* "Conjectures and Refutations"

Academic Honesty assignment due

After this unit students will be able to:

- ❖ Understand Popper's account of science and central theoretical concepts.
- ❖ Demonstrate an understanding of academic codes of conduct

Unit 3: *Religion and Science: Enemies, Allies, or NOMA?*

Monday, Week 2 (April 7) – **Both:** (1) MMS Chapter 5: The Age of the Earth & (2) Gould, S. (1977). On Heroes and Villains in Science" in *Ever Since Darwin* 201-206

Resubmission of Assignment 1 due (if necessary)

Wednesday, Week 2 (April 9) – MMS, Chapter 6: The Darwinian Revolution

Friday, Week 2 (April 11) – Fleeming Jenkin. *Review of Darwin's The Origin of Species*. The North British Review. 46 (June 1867): 277-305.

Class time will be used to workshop papers (bring draft to class)

Monday, Week 3 (April 14) – MMS Chapter: 15: Science and Religion

Primary Reading Summary Assignment due

After this unit students will be able to:

- ❖ Provide a contextualized account of geological theories, the evidence for both Uniformitarianism and Catastrophism, and how sociological factors were reflected in scientific theory choice
- ❖ Provide a contextualized account of the theory of evolution by natural selection and explain why and to what extent the theory was rejected
- ❖ Identify the three main accounts of the relation between science and religion and provide supporting historical evidence for each

Unit 4: *The Organization of Inquiry Since “The Scientific Revolution”:
Is There a Thing Called Science?*

Wednesday, Week 3 (April 16) –

CalTeach students

**TNOS Chapter 12: Debating
Galileo’s Dialogue**

All others

**MMS, Chapter 2: The
Scientific Revolution**

Friday, Week 3 (April 18) – **Both:** (1) Isaac Newton, *De Gravitatione (selections)* &
(2) Renee Descartes, *Principles of Philosophy*:
Part II Art. 4, 10-13,16, 24-31, 36-40, 64; Part III art. 25-30

Class time will be used to workshop papers (bring draft to class)

Monday, Week 4 (April 21) – MMS Chapter: 14: The Organization of Science

Reading Summary and Comparison Due

After this unit students will be able to:

- ❖ Provide a contextualized account of the scientific revolution
- ❖ Compare the ontological commitments of different theories (Newton/Descartes)
- ❖ Describe how the organization of the scientific community has changed over the past 400 years and identify to what extent it makes sense to equate the work performed by gentlemen specialists and that conducted in modern universities.

Unit 5: *Science and Technology: Which Came First, the Chicken or
the Illumina Genome Analyzer?*

Wednesday, Week 4 (April 23) – MMS, Chapter 4: Conservation of Energy

Friday, Week 4 (April 25) – J.D. Bernal (1953) Heat and Energy

Class time will be used to workshop papers (bring draft to class)

Monday, Week 5 (April 28) –

Argument Evaluation due

CalTeach students

**TNOS Chapter 11:
Rekindling Phlogiston**

All others

**MMS Chapter 3: The
Chemical Revolution**

Wednesday, Week 5 (April 30) – MMS Chapter 17: Science and Technology

After this unit students will be able to:

- ❖ Provide a contextualized account of the transition from phlogiston to oxygen theories of combustion including shifts in goals and methods of inquiry.
- ❖ Evaluate an argument that relies on primary source material
- ❖ Describe the various theoretical commitments that supported a commitment to the conservation of energy (Calteach students are not responsible for this)
- ❖ Identify the three main accounts of the relation between science and technology and provide supporting historical evidence for each

Unit 6: *The Historical Turn: A Decisive Transformation in our View of Science?*

Friday, Week 5 (May 2) – Hacking (1983): The Rationality of Science After Kuhn

Monday, Week 6 (May 5) – Kuhn (1962) *The Structure of Scientific Revolutions*

Chapter 4: Normal Science as Puzzle Solving

Chapter 6: Anomaly and the Emergence of Scientific Discovery

Textbook Assignment Due

Wednesday, Week 6 (May 7) – Kuhn (1962) *The Structure of Scientific Revolutions*

Chapter 9: The Nature and Necessity of Revolutions

After this unit students will be able to:

- ❖ Describe the central ways in which Kuhn's account of science differs from Poppers
- ❖ Explain Kuhn's account of normal science (including Paradigms, puzzle solving, and quazimetaphysical commitments)
- ❖ Explain Kuhn's account of revolutionary science (including crisis, anomaly, and incommensurability)

Unit 7: *Another Brick in the Wall: Should we be Teaching the Nature of Science?*

Friday, Week 6 (May 9) – TNOS, Chapter 2, History as a tool
TNOS, Chapter 3, Myth-conceptions

Monday, Week 7 (May 12) – TNOS, Chapter 4, How not to teach the history of science
TNOS, Chapter 5, Pseudohistory and Pseudoscience

Argument topics must be approved by today

Wednesday, Week 7 (May 14) – TNOS, Chapter 6, Sociology too
TNOS, Chapter 7, Kettlewell's missing evidence

Friday, Week 7 (May 16) – TNOS, Chapter 8, Teaching lawless science
TNOS, Chapter 9, Nature of science in an age of accountability

After this unit students will be able to:

- ❖ Describe the difference between science as a process and science as a body of knowledge
- ❖ Identify different ways of incorporating history into science education and explain what is at stake in the way that science is taught
- ❖ Critically evaluate their own education and how this has impacted their view of science.

Unit 8: Are Biases like A**holes: Can a Scientist be Objective?

Monday, Week 8 (May 19) – MMS Chapter 8: Genetics

Argument Prospectus Due

Wednesday, Week 8 (May 21) – MMS Chapter 18: Biology and Ideology

After this unit students will be able to:

- ❖ Provide a contextualized account of the Mendel's research and its reception
- ❖ Describe the influence of social stereotypes on scientific accounts of heredity
- ❖ Explain the extent to which Social Darwinism was dependent on Darwin's theory.

Unit 9: *BIG science: Is There a Thing Called "Science" Revisited*

Friday, Week 8 (May 23) – MMS Chapter 10: Continental Drift

Monday, Week 9 (May 26) – NO CLASS

Wednesday, Week 9 (May 28)- MMS Chapter 11: Twentieth Century Physics

After this unit students will be able to:

- ❖ Describe the influence of government funding (esp. military) on science
- ❖ Provide an account of how the scale of science has changed over the past century and articulate what implications such a massive scale has for the nature of science.

Unit 10: *Industry-funded Science and Public Policy: Whose Science is REAL Science*

Friday, Week 9 (May 30) – MOD Chapter 1, Doubt is our Product

Monday, Week 10 (June 2) – MOD Chapter 3, Sowing the Seeds of Doubt: Acid Rain

Final Argumentative Essay Due

Wednesday, Week 10 (June 4)- MOD Chapter 5, What's Bad Science? Who Decides?
The Fight over Secondhand Smoke.

Friday, Week 10 (June 6) – MOD Chapter 6, The Denial of Global Warming

Monday, Week 11 (June 9)- Final Exam

Critical Discussion Ends

After this unit students will be able to:

- ❖ Describe how science has been brought into public policy debate as an arbiter of truth and specify to what extent it has been so employed
- ❖ Describe the effect that such policy debates have had on the practice of science
- ❖ Define "junk science" and take a stance on whether it can be objectively identified or if the term is merely used to undermine a political opponent.