Course Description:
The modern world has been shaped and reshaped by science. Our current explanations for some phenomena are nothing like the explanations of just 20 years ago; other explanations have been consistent for 400 years or more. This course traces the history of Europe (primarily) to see how knowledge about the natural world has enabled global agonies and ecstasies of the past 2500 years. It will introduce some of the most beautiful, puzzling and powerful ideas ever imagined. Lecture and section format.

Course Goals:
This course should help you assemble a “big picture” of the history of the modern world. It uses science—knowledge about the natural world—as a theme to guide our exploration of the development of “western civilization.” Along the way, we will explore some of the politics, art, music and economics that have defined western societies. I hope to stimulate you to think broadly, about interconnections between ideas and practice, between knowledge and power, and about how science has developed.

Course Format:
I will lecture on Mondays and Wednesdays. Most Fridays will have discussion sections led by the teaching assistants.

Assignments:
Most weeks, there will be a short (1-2 page) writing assignment, due Wednesday. There will also be a month-long assignment involving observation of the moon. This will be due on October 7th. I will hand out more instructions on a separate sheet.

Exams:
There will be two one-hour exams. The first will be October 19th, covering the first half of the course. The second exam will be on the day of scheduled classes, December 9th. There is no cumulative final. Both exams will give you a chance to synthesize information, demonstrating what you’ve learned and how it fits together. Facts are important, names and dates are the stuff of history; the ability to memorize is a high-school skill, however. The exams encourage you to synthesize the facts you’ve learned into broader stories about the role and development of science across time.

Instructor and Office Hours
I look forward to meeting you. Please come see me during my office hours, Tuesdays 9-11am. I can reached by Email (rogert@sas.upenn.edu) as well.
Schedule:

Unit 1: The Origins of Modern Knowledge---------------------------------

September 7 (Wed): Introduction: What is Science, and When Did It Begin?
September 9 (Fr): Ancient Legacies: The Greco-Roman World

September 12: Lost and Found: The Medieval World
September 14: Scholars and Craftsmen: The Renaissance (Weekly Paper #1 due)
September 16: Section

September 19: Searching for the Ancient, Finding the New: European Exploration in the 15th and 16th Centuries
September 21: The Circulation of Knowledge (Weekly Paper #2 due)
September 23: Section

September 26: Circular Reasoning: The Copernican Revolution
September 28 The New Cosmos: Tycho and Kepler (Weekly Paper #3 due)
September 30: Section

Unit 2: Knowing and Believing---------------------------------

October 3: Revolutionary Politics: The Crime of Galileo
October 5: Living for the Truth: Science in the Catholic Church
October 7: “New Methods for the Truth: Bacon and Descartes” Lecture (No Section) Telescope Assignment Due

October 10: Experimenting and Observing: The Royal Society
October 12: Newton’s World
October 14: Section

October 15th: Fall Break (No Class)
October 19 (Wed) Midterm
October 21 (Fr) No Section; Have fun with your family

October 24: Enlightenment: The Mechanical Spirit
October 26: The Order of Things (Weekly Paper Due)
October 28: Section

October 31: The Tipping Point: French Revolution
November 2: Romantic Science (Need a Weekly Paper Due)
November 4: Section

November 7: Digging and The Meanings of Fossils
November 9: Darwin: The Evolution of Evolution (Weekly Paper Due)
November 11: Section
**Unit 3: Knowledge and Power**

November 14: The Century of Progress?
November 16: Cells and Germs: Rise of Scientific Medicine *(Weekly Paper Due)*
November 18: Section

November 21: Matter and Energy: Theory and Practice
November 23: Revolutions in Physics and Biology

**Thanksgiving Break**

November 28: BIG Science.
November 30: Information: Codes and Chips.
December 2: Section: Cold War History, by Billy Joel *(Weekly Paper Due)*

December 5: Monitoring the Globe.
December 7: Managing the Globe.
December 9: **Second Exam**
Readings

The Ancient World, and The Medieval World


Scholars and Craftsmen: The Renaissance


Searching for the Ancient, Finding the New: Exploration


The Circulation of Knowledge

Circular Reasoning


Tycho and Kepler


Revolutionary Politics: Galileo


“Galileo and the Conflict over Holy Scripture” from Science and Culture, 107-111.


Searching for the Truth: Science in the Catholic Church

Methods for Truth: Descartes and Bacon


**The Royal Society**

"Boyle, Robert (1627-1691)," http://www.chemcool.com/biography/boyle.htm;


**Newton’s World**


**Enlightenment: Mechanical Spirit**


The Order of Things

Notes on the Scala Naturae (the “Great Chain of Being”) made by Dr. Mark Adams.

Romantic Science
Notes on the Works of Jean Baptiste-Pierre-Antoine de Monet de Lamarck made by Dr. Mark Adams.

Text of the Last Movement of Beethoven’s 9th Symphony, (1824) Taken from Friedrich Schiller’s Ode to Joy, (1785).

Digging and The meanings of Fossils


Darwin’s Century


Image: Map -- The Voyage of the Beagle.


Diagram from On the Origin of Species, 1859.

**“The Century of Progress”?**


Excerpts from Mike Davis, *Late Victorian Holocausta*s. (New York: Verso, 2001.)

**Cells and Germs**

**Matter and Energy**

**The Quickening: Revolutions in Biology and Physics**


**Big Science**

Letter: Albert Einstein to President Franklin Delano Roosevelt, 1939.


“Information: Codes and Chips”


**Monitoring the Globe**

**Managing the Globe**
Assignments

Weekly Assignment 1
Due Date: Sept. 14th

Choose a common household object and write two paragraphs about it. In the first paragraph, describe it in the way that a Platonist would see it. In the second, describe it in the way that an Aristotelian would see it. Your answer should be 1-page long, typed in a 12 pt. standard font (e.g. Times New Roman).

Weekly Assignment 2
Due Date: Sept. 21st

Draw a map of your favorite place. In a paragraph or two, explain who your map is for, and how they should use it. Discuss the choices you made in deciding what to represent, and how to depict it.

Weekly Assignment 3
Due Date: Sept. 28th

[Choose one of the following.]

You are a court astronomer in the sixteenth century, devoted to the Ptolemaic system. Based on this week’s readings, what about Copernicus’s system might you find appealing? Objectionable?

– or –

Copernicus and Ptolemy employ different forms of proof to advance their arguments. Choose a topic that both discuss (e.g. why the universe is spherical). How does their use of evidence differ?

Weekly Assignment 4
Due Oct. 12th, Handed Out Oct. 7th
Choose any animal and describe it, first as you think Descartes would, and then as you think Hooke would.

Weekly Assignment 5
Due Date: Oct. 26th (Handed Out After Midterm on 19th)
In 1771, the Philadelphia clockmaker and astronomer David Rittenhouse completed his famous Orrery, an object which embodies the Enlightenment fascination with clockwork
mechanisms. This Orrery is now in Van Pelt Library. Find it, spend time with it and think about it. Report your thoughts and findings.

Weekly Assignment 6
Due Date: Nov. 9th (Handed Out Nov. 4th)
What are the connections between the city of Philadelphia and the history of fossil-hunting? Do some digging on the web and tell us your more interesting findings.

Weekly Assignment 7
Due Date: Nov. 16th (Handed Out Nov. 11th)
Pick an object in your room for which you know the place it was made. Was it made within a few miles of Philadelphia (or wherever you first got it)? Discuss how it came to be here, with reference to who made it, how it was probably made, and how much energy it took to get to your room.

Weekly Assignment 8
Due Date: Dec. 1st (Assigned Nov. 18th)
One of the most popular musicians of the Cold War, Billy Joel wrote several songs that provide beautiful snapshots of the personal effects of macro-history. In this assignment, we will look at one of them, “We Didn’t Start the Fire,” a 1989 hit. Your TA will assign you two or three references from the song. Please research and write a concise paragraph on each reference. The paragraph should capture the importance and meaning of the reference, putting the event into a bit of context. If relevant, it should also point out any connections between the reference and science and technology.

In section, we’ll pull these references together, listen to the song, and discuss its meaning in 1989 and today.

Project: Observing the Moon Through a Telescope
Due Date: Oct. 7th (Announced Sept 16th)
The first observations of the Moon through a telescope proved shocking to those accustomed to regarding the Moon as a smooth, featureless globe. Over the next three weeks, working in groups, you will have the opportunity experience some of the excitement and challenge of these early observations by viewing the Moon through a telescope similar to those Galileo Galilei and Johannes Kepler utilized for their observations.

Each student will observe the Moon on two or three different evenings each week, and sketch those observations on a log sheet of your own design. Your log will include a total of at least 6 observations. For the first week, simply make your observations without the telescope; see the moon unaided. Note what it looks like, and sketch it. For the second and third weeks, use the telescopes to look at the moon. Your logs can include whatever
observations or reflections you choose to include. Like Galileo, imagine that you are producing something that will be shared publicly and that aims to prove a claim about the moon. Some nights will be cloudy; if you can see nothing, that’s all right. Note it in your log, or describe or illustrate how the moon shines through clouds.

At the end of the log, write a page or two reflecting on the difficulties you experienced, things you found unexpected, or things you learned from the project. The readings on Galileo and Kepler may help you to think about this project more personally.

*Students are encouraged to observe in groups but all students should make their own observations and drawings.*

**Telescopes**

The instruments for this project are simple refracting telescopes patterned on Kepler’s original design. Details may be found at: [http://www.hssonline.org/teach_res/COE/activities/ telescope.html](http://www.hssonline.org/teach_res/COE/activities/ telescope.html). The telescope’s eyepiece is the smaller of the two lens openings, and focus is achieved by extending or collapsing the two cylinders that comprise the telescope. Eyeglass wearers should be able to use the telescope with or without their glasses.

Students will form groups of three-to-five people, and each group will share a telescope. Telescopes are available from your Teaching Assistant, and should be returned at the conclusion of the exercise. If you wish to buy your own telescope, visit: [http://www.starlab.com/index.html](http://www.starlab.com/index.html).

It may be a challenge to focus your telescope and hold it steady. You’ll probably need to experiment. The history of science museum in Florence has parts of Galileo original telescope; you can see how he overcame these same challenges.

**Where to View the Moon**

You may observe the Moon from any convenient location, indoors or out, including: a dimly lit room, your dorm’s lounge, or a campus courtyard or green. *Stay off the roof* — you will not need to be on one to complete this project.

**Safety and Comfort**

If you observe outside at night, stay on campus, be aware of your surroundings, always stay within sight of other people, and observe in a group, if possible. If observing outside in cool weather, dress more warmly than you normally would, as you may be outside, standing still, for longer than you think. Be sure to bring with you: the log sheet; a pencil; an eraser; a flashlight; and something to lean on when writing. Finally, *NEVER LOOK AT THE SUN THROUGH YOUR TELESCOPE!* A number of early modern astronomers went nearly blind from looking at sunspots.