OHSC0: History of Science: Great Ideas, Observations, and Experiments

Course Description
This class approaches the history of science from a philosophical perspective. We will examine exemplars of great scientific reasoning from both the ancient (fall) and modern (spring) periods.

The fall semester investigates the roots of science in the ancient world. Our main philosophical questions will be: What makes a good scientific argument? How do the questions one asks shape the theories that come out of science? How did observation and philosophy interact to produce a group of theories which would dominate science for over a thousand years? Along the way we will learn how to analyze scientific theories in a historical context (and debunk many popular myths about the ancient world). Topics include ancient engineering techniques and practical technology as well as a close investigation of three ancient theories successful enough to dominate their respective fields for more than a thousand years each: Ptolemy's astronomy, Aristotle's Psychology, and Galen's physiology.

The spring semester investigates the development of science from the scientific revolution to the modern period (roughly 1600 – 1900 C.E.). Two main philosophical questions will dominate our discussions. First, what is the relationship between data and theory; what is it that makes a pattern of reasoning about data uniquely scientific? We will examine the answers to this question offered by both philosophers and scientists themselves during the scientific revolution. Second, what does a good scientific theory tell us about the world? This question has become important in 20th century philosophy of science, but we will address it in the context of concrete historical examples. Topics covered include Newton's Principia Mathematica, the development of chemistry from its alchemical roots to Perrin's Nobel-prize winning experiments on Avogadro's number, electromagnetism and the emergence of field theory, culminating in the Michelson-Morley experiment, and various developments in biology, probability, and the social sciences.

Course Objectives
Through the successful completion of this course:
- You will be able to understand basic concepts in history and philosophy of science.
- You will develop skills to critically analyze scientific arguments and reason about the relationship between evidence and theory.
- You will be able to effectively communicate scientific and philosophical ideas in writing and verbal discussion.
- You will develop skills to create and investigate your own research topics.

Required Textbooks

*Great Scientific Experiments: Twenty Experiments that Changed our View of the World*
By R. Harré
Dover Publication, 2002

*The Birth of a New Physics*
By B. Cohen
W. W. Norton & Company; Revised and Updated edition, 1985
HSC Course Reader available online at http://www.study.net
Key Assignments and Grading Policy

In the fall semester, your grade will be based on the following:

- **In class participation**: You are expected to participate in in-class discussions and be part of an active learning environment. This portion of your grade will be determined based on your attendance and regular participation in the discussion including asking and answering questions.

- **Unit Quizzes**: At the end of every unit, a short quiz will be posted on ecollege. You are expected to do these quizzes online through your ecollege account. Quizzes will be on the lecture material for the unit and are not meant to be tricky! To perform well on quizzes, you just need to watch lectures and be attentive to the content—you are encouraged to take notes, and may refer to these when taking the online quiz.

- **Writing Assignments**: There will be three writing assignments. You will be provided with prompts designed to test your understanding of relevant concepts and ability to reason scientifically and philosophically. Students are encouraged to discuss their papers in office hours and may submit drafts for feedback before the due date. Strategies for producing effective papers will be discussed in class.

- **Sundial Project**: You will be asked to construct your own sundial and make observations by using it. You will be asked to write a short report on your sundial.

- **Final Exams**: The final exam will be given at the end of a semester. It will be comprehensive and test your understanding of material covered in lectures and discussions. The exam will be proctored.

In the spring semester, your grade will be based on the following:

- **In-class participation**

- **Weekly exercises**

- **Two writing assignments**:
  - Sample Prompts:
    1. Arguably, Bacon and Descartes represent two responses to the perceived stagnation of the scholastic method of reasoning. What was wrong with scholasticism? How do the responses of Bacon and Descartes differ? Compare and contrast these two responses—in your assessment, which response is more successful? Why?
    2. Newton famously states "I do not feign hypotheses." He clearly perceives himself as engaging in a style of scientific reasoning which produces more secure conclusions than hypothesis-driven science. Characterize Newton's style of reasoning. Critically assess Newton's claims and his methodology—how successful is he at his stated goals of: i) avoiding hypotheses, and ii) producing incontrovertible conclusions?

- **Final Project**: Toward the end of the year, you are expected to do your own research in the history and philosophy of science. The final project consists of three stages: creating your own topic, writing a draft, and revising the draft. For each stage, you will be asked to submit your work.