

**Topics**

1. Overview, Inference, Logic
2. Observation
3. Laws and Theories
4. Models and Idealizations
5. Explanation
6. Prediction, Testing, and Confirmation
7. Measurement and Experimentation
8. Conceptual Change and Scientific Revolutions
9. Realism and its Alternatives (if time permits)
10. Odds & Ends

**Texts**

- John Losee, *A Historical Introduction to the Philosophy of Science*, 4th/ed., Oxford, 2001.
- Carl Hempel, *Philosophy of Natural Science*, Prentice-Hall, 1966.
- T. Kuhn, *The Structure of Scientific Revolutions*, University of Chicago Press (Trd); 3rd/edition, 1996.
- Ian Hacking, *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science*, Cambridge University Press, 1983.
- *Stanford Encyclopedia of Philosophy—SEP*; we will make heavy use of this (and of other sites on the internet) <http://plato.stanford.edu>.

**Useful Background**

- I. Bernard Cohen, *The Birth of a New Physics*. *W.W. Norton & Company*; Revised and Updated edition (September 1991) ISBN: 0393300455
- Michael Matthews, ed., *The Scientific Background to Modern Philosophy: Selected Readings*, Hackett, 1989

## Readings

### 1. Overview, Inference, Logic

- We'll develop most of this in class and with handouts.

### 2. Observation

- Hempel, ch 1
- Chris Swoyer, Perception and Preconceptions  
<http://plato.stanford.edu/entries/relativism/supplement1.html>

### 3. Laws and Theories

- Slides (incomplete)  
<http://www.ou.edu/ouphil/faculty/chris/philsci/lawsslides.pdf>
- Losee, ch 9.3
- Hempel, ch 6
- John Carroll's entry on laws in SEP:  
<http://plato.stanford.edu/entries/laws-of-nature/>
- Chris Swoyer, section in 4.3 on laws in paper at  
<http://plato.stanford.edu/entries/properties/>

### 4. Models and Idealizations

- Patrick Suppes, "What is a Scientific Theory?" in S. Morgenbesser, ed., *Philosophy of Science Today*. Basic Books, 1967; 55-67.
- M Scriven, "The Key property of Physical Laws—Inaccuracy," 1961.
- RIG Hughes, "Models & Representation," *PSA*, 1997, pp S325-S336
- Ronald Giere, *Understanding Scientific Reasoning*, Brief Selections. 3rd/ed, Harcourt Brace Javanovich 1991
- Hacking, ch 12.

### 5. Prediction, Testing, and Confirmation

- Losee, chs 16-17.
- Isaac Newton, *Principia*, Rules for Reasoning in Natural Philosophy
- Hans Reichenbach, *Experience & Prediction: An Analysis of the Foundations and the Structure of Knowledge*, 1938, §14 "A Cubical World"
- Hempel, 3-4
- Giere, ch 2.5-2.11
- Jim Woodward, "Data and Phenomena," *Synthese*, 79 (1989); 393-472; Selections.
- John Earman & Wesley Salmon, "The Confirmation of Scientific Hypotheses," M. Salmon ed. *Introduction to Philosophy of Science*, Selections

- Background on Probability, Bayes' Theorem, and Related Notions
  - Chris Swoyer, An introduction to the probability calculus, *Critical Reasoning Manuscript*, chapters 12-14.  
<http://www.ou.edu/ouphil/faculty/chris/critreas/critpdf/crmscreen.pdf>
  - Chris Swoyer, Bayes Theorem & the Psychology of Reasoning  
<http://www.ou.edu/ouphil/faculty/chris/bayes2.pdf>
  - James Joyce, Bayes theorem:  
<http://plato.stanford.edu/entries/bayes-theorem/>
  - Conditional Probability Applet  
<http://www.stat.sc.edu/~west/applets/Venn1.html>
  - Central Limit Theorem Applet  
<http://www.stat.sc.edu/~west/javahtml/CLT.html>

## 6. Measurement and Experimentation

- Hacking, ch 14
- Hacking, ch 9, 10, 16 (11 suggested but not required)
- Chris Swoyer, "Notes on Experimentation in Psychology."
- Web, [http://physics.nad.ru/Physics/English/top\\_ref.htm](http://physics.nad.ru/Physics/English/top_ref.htm)

## 7. Explanation

- Losee, ch 15 The classical (D-N and S-N) accounts:
- Hempel, ch 5
- J. Woodward, <http://plato.stanford.edu/entries/scientific-explanation/>
- Context and the pragmatics of explanation: Bas van Fraassen, *The Scientific Image*. Oxford, 1980, selections from ch 5.
- Causation and Causal Mechanisms, Hacking, ch 2
- Causal Mechanisms and Causal Explanations, Jon Elster, *Nuts & Bolts for the Social Sciences*, Selections.

## 8. Conceptual Change and Scientific Revolutions

- Kuhn (most of the book)
- Hacking, Ch 5

## 9. Realism and Some Alternatives

- Losee, ch 13-14 & 18
- Arthur Fine, "Realism and Antirealism,"
- van Fraassen "To Save the Phenomena," *Journal of Philosophy*, 73 (1976); 623-32
- Richard Boyd, Scientific Realism  
<http://plato.stanford.edu/entries/scientific-realism/>
- Nancy Cartwright, *How the Laws of Physics Lie*, Oxford, 1983, selection

- Hacking, ch 16.
- The Science Wars, <http://members.tripod.com/ScienceWars/>

## 10. Odds & Ends

- Richard Feynmann, “Cargo Cult Science”
- The Sokal hoax. See

<<http://www.physics.nyu.edu/faculty/sokal/index.html>>

for a page with links to much of the discussion on both sides.

## Cases Studies

We will have one case study a week, with each of you presenting one. We can't cover all of these and you are encouraged to propose subtractions and additions—but the topics marked with an \* are non-negotiable.

Things to cover in your presentation:

**Description** Briefly describe the theory, law, or model

**Example** Simple illustration of how the theory (etc.) works

**Central Theoretical Concepts** What are they?

- What links them to measurement and observation?

**Abstractions and Idealizations** Abstractions, Idealizations, & Approximations

**Explanation** Examples of phenomena the theory helps explain

**Empirical Support** How is it supported?

**Other Virtues** e.g., simplicity, mathematical tractability, unification, ease of use

**Open Problems** Open problems with account.

In some cases it may be feasible to bring equipment to class to show (very roughly) how various observations and experiments worked. For example, this would be useful for Galileo's study of motion on an inclined plane, Tycho's measurements and recording of the positions of various heavenly bodies, Boyle's law, and rational choice theory (e.g., with class members pitted against each other in prisoners' dilemma situations). We will use these examples as data for our philosophizing and as cases we all know about. Items marked with an \* have found presenters already.

1. \*Aristotle, Losee, Ch 1.
2. Euclid
3. Ockham and Scotus on causal inference.
4. \*Ptolemy, Copernicus, and Kepler, Losee, Ch 2 & Ch 6.  
On Kepler see <http://home.cvc.org/science/kepler.htm>.

5. \*Galileo Laws describing the motion of freely-falling bodies and projectiles. Emphasis on experimentation, analysis of motion into components parts, and use of mathematical laws to describe them. Losee, Ch 7 and Course packet, 428–429 and 438–439. For some animations see
  - <http://www.crs4.it/Ars/arshtml/mathofmotion1.html>
  - <http://www.crs4.it/Ars/arshtml/mathofmotion2.html>
6. \*Newton Newton’s Laws, derivation of Galileo’s law of falling bodies and Kepler’s laws (we’ll expedite things by cheating a bit with the assumption that the motions of the planets are circles), and composition of forces. Losee, Ch 8 and Course packet pp. 428–437 & 439–442.
7. Boyle and the General Gas Laws (Boyle’s Law & Charles’ Law). Course packet, pp. 444-451.
8. Phlogiston
9. \*Darwin and Evolution. Course packet, pp. 477–479;  
<http://www.literature.org/authors/darwin-charles/the-origin-of-species/>
10. Mendel and Genetics. Course packet, pp. 480–482; an English translation of Mendel’s paper may be found at  
<http://www.mendelweb.org/Mendel.html>.
11. DNA: The Double Helix. Course packet, pp. 471–475
12. Models in Population Genetics. Handout; the basic rules for calculating probabilities would also be relevant here.
13. Geology and Continental Drift. Course packet, pp. 483–486.
14. Creationism, <http://www.phy.syr.edu/courses/modules/ORIGINS/origins.html>
15. @Rational Choice Theory, Aggregation and the Micro/Macro Levels. Handouts
16. Social Psychology: The Fundamental Attribution Error. *Critical Reasoning, a User’s Manual*, Ch. 23: “The Power of the Situation,”  
<http://www.ou.edu/ouphil/faculty/chris/critreas/critpdf/crmscreen.pdf>.
17. Behavior Genetics and Schizophrenia
18. Bell’s Theorem