

# Philosophy 325: Scientific Reasoning

## -Sample Syllabus-

**Course Description:** What makes science *science*? That is, what separates what we call the sciences from all the other forms of human inquiry? While part of the answer no doubt has to do with the *subject matter* of science, part of it surely has to do with *methodology* or the *style of reasoning* that is employed in the sciences. Or perhaps we would do better to say the *methodologies* and *styles of reasoning* employed in the sciences. In this course, we will explore various aspects of what is usually meant by *the scientific method* (or *scientific methods*) and some of the kinds of reasoning that go into scientific research programs. We will discuss what separates *science* from *non-science* as well as what separates *good* science from mediocre or down-right *bad* science.

In this course, students will gain familiarity with several interpretations of what makes the kinds of reasoning employed in science *scientific* as well as the difficulties with these interpretations. Students will be expected to be able to reason about whether or not particular practices ought properly be referred to as *scientific*, and be able to explain how the distinction between *science* and *non-science* is different from the distinction between *good* and *bad* science. Students will be expected to understand why, and in what contexts, these distinctions matter.

**Required Readings:** The required readings for this class will be located in one of three places; the syllabus will tell you where.

**Required Book:** *The Golem: What You Should Know About Science* 2<sup>nd</sup> Edition, by Harry Collins and Trevor Pinch. Cambridge University Press. Available at the campus Bookstore.

**Course Reader:** A course reader will be available at the campus Bookstore with many of the required readings.

**Online:** Online documents will be in one of two places on the course's website (BlackBoard, see above)

**External Link:** This refers to the **External Links** section of the course's Blackboard CourseInfo site. The reading can be found by logging into the site, clicking the **External Links** button, and then following the appropriate link.

**Online Document:** This refers to the **Documents** section of the course's Blackboard CourseInfo site. The reading can be found by logging into the site, clicking the **Course Documents** button, and then following the link for the appropriate readings.

You should make sure that you have read the required readings carefully before class, and be prepared to read them again after the discussion and class exercises.

### Required Work:

The grade one earns in the class will be based on the following criteria:

Attendance and Participation:	20 percent
Homework, Quizzes, & Response Papers (4 @ 10% each):	40 percent
Short Papers ( 2 @ 20% each):	40 percent
<i>Total:</i>	<i>100 percent</i>

## Sample of Topics Covered and Readings

Sample Topics	Sample Readings
<p>Week 1: Introduction &amp; What is Science? Intro to class, administrative details, etc. Demarcation Criteria: Popper and the idea of falsifiability-as defining science</p>	<p>Popper <a href="#">Conjectures and Refutations</a> (Reader) + Hume <a href="#">Section IV: Sceptical Doubts</a> &amp; <a href="#">Section V: Sceptical Solution</a> (On-Line, External Links)</p>
<p>Week 2: Why Demarcation is not so simple Cases: Is science done that way? Should it be? Poppers ideas, taken too literally, seem to lead not to good science, but to no science.</p>	<p><i>Golem</i>, Chapter 2 (<a href="#">Two experiments that proved relativity</a>) Introduction to parts 1&amp;2 and Part 2 (pgs 27-29 +43-55) <i>Golem</i>, Chapter 4 (<a href="#">The germs of dissent</a>)</p>
<p>Week 3: Why Demarcation Matters Two examples of why it matters if something is, or is not, a science: Creationism in the Schools &amp; Science-in the Courtroom</p>	<p>Laudan <a href="#">Science at the Bar</a> (Reader) &amp; Ruse <a href="#">Pro Judice</a> (Reader), McLean V. Arkansas Board of Education (On Line, Documents) Daubert v. Merrell Dow (On Line, Documents) , Cole <a href="#">The Myth of Fingerprints</a> (Reader)</p>
<p>Week 4: Induction &amp; Falsification: An Extended Example We will spend the week exploring some of the ways in which hypotheses can be generated &amp; tested, though (gasp!) a game</p> <p>Weeks 4-5: Science &amp; explanation Falsification promised an easy way to divide the sciences from the non-sciences; Hemple &amp; Oppenheim provide what they hope will be formal approach to understanding scientific explanation</p> <p>Weeks 5-6: When Things go Wrong Why do mistakes happen? Sloppiness? Poor reasoning? Poor judgment? Are mistakes inevitable? Can good scientists make bad mistakes?</p>	<p>Rules for <a href="#">New Eleusis</a> (On Line, External Links); Review Hume and Popper (see above).</p> <p>Hemple &amp; Oppenheim <a href="#">Studies in the Logic of Explanation</a> (Reader) + Goodman <a href="#">New Riddle of Induction</a> (Reader)</p> <p><i>Golem</i> Chapter 2 (<a href="#">Two experiments...</a>), Part 1 &amp; review introduction (Pgs 27-43)</p> <p><i>Golem</i> Chapter 5 (<a href="#">A new window on the universe</a>) + Gravity Waves on-line readings (Links) + <i>On Being A Scientist</i> , <a href="#">Introduction</a> , <a href="#">The Social Foundations of Science</a> &amp; <a href="#">Experimental Techniques and the Treatment of Data</a> (Online Link)</p> <p><i>Golem</i> Chapter 3 (<a href="#">The sun in a test tube</a>)</p> <p><i>On Being a Scientist</i> <a href="#">Conflicts of Interest</a> , <a href="#">Publication and Openness</a> , <a href="#">The Allocation of Credit</a> &amp; <a href="#">Authorship Practices</a> (Online Link)</p>
<p>Weeks 7-8: Lies, Damned Lies, and... An introduction to the use of statistics in scientific reasoning, including several accounts of the role of statistical reasoning in scientific explanations</p>	<p>Giere Chapter 11 <a href="#">Testing Statistical Hypotheses</a> (selections) (Reader) Giere Chapter 12 <a href="#">Testing Causal Hypotheses</a> (selections) (Reader)</p> <p>Salmon <a href="#">Statistical Explanation and its Models</a> (Reader) Dupre <a href="#">Probabilistic Causality</a> (Reader)</p>
<p>Week 9: Kinds of Science, Kinds of Reasoning?</p>	<p>Carol: <a href="#">Methodological &amp; Epistemic Difference</a> (Reader)</p>