PHIL 220: Philosophy of Science

Mondays and Wednesdays, 3–4:22 PM  |  255 Olin Science
Course Blog: http://philsci.blogs.bucknell.edu/

Description of Subject Matter & Methods of Instruction

What divides science from pseudo-science? What is it to “explain” phenomena? How do the sciences generate not only knowledge, but understanding of natural and social processes? Is there a distinctive “scientific method” by which science provides us with knowledge of the general features of nature? What propels scientific revolutions? Can we make sense of progress in science? How should democratic societies go about ordering their research priorities? These are the sorts of questions philosophers ask about science. By exploring them in this course, we’ll work to develop a deep and general understanding of the particular human pursuit we call ‘science.’

Course meetings will involve a blend of lecture and discussion; but since philosophy is best learned by doing philosophy, discussion will be our primary mode of interaction in the course. Your course grade will be based on your contribution to the discussion, your performance on regular short writing assignments and longer essays, and the group project. The prerequisite for the course is PHIL 100; however this prerequisite may be waived for students (especially from the sciences) willing to work a certain level of abstraction.

Learning Goals

In successfully completing this course, you should:

• Gain a deep understanding of the debates about scientific methodology;
• Gain a deep understanding of key epistemological issues in science (e.g., the justifiability of induction, the nature of evidence, and the role of theory in observation);
• Gain a sophisticated understanding of science as a social phenomenon and institution;
• Become familiar with important metaphysical debates in the philosophy of science (e.g., realism/anti-realism);
• Develop your skill in constructing and evaluating argumentation;
• Gain a general appreciation of the fundamental ambiguities and complexities involved in the human attempt to answer questions about knowing, valuing, and living.

Instructional Materials and Sources

Steven French, Science: Key Concepts in Philosophy (Continuum); Thomas Kuhn, The Structure of Scientific Revolutions, 4th Ed. (Chicago); and supplementary readings distributed in PDF from the course blog. Please also acquire something in which to keep a journal (e.g., a moleskin notebook, a suitable iPad app, or what have you — see below).

Methods of Evaluation

Your final grade will be based the various weighted components described below. Please note that you will determine about half of your grade by your regular, everyday effort. It will thus be quite important to stay current. Note as well what the different letter grades represent. According to the Course Catalog (http://www.bucknell.edu/catalog.xml), an ‘A’ means ‘Superior achievement’, a ‘B’ means ‘High pass’, a ‘C’ means ‘Pass’, a ‘D’ means ‘Low pass’, and an ‘F’, of course, stands for ‘Failing work.’ Unless you’re some kind of savant, it’s highly unlikely that you can produce ‘superior work’ (or even B-level, good, but uninspired work) without putting time and effort into your studies.

This is a W2-designated course. We will often use writing (in various forms and in various outlets) to develop our ideas about course topics. Writing will also itself be a subject of instruction. Take this seriously and you will both become better writers and come to appreciate more deeply how the process of writing is often conducive to careful thinking. I won’t lie: doing this will require a good amount of work, but I will strive not to make it onerous. Nothing in this course is busywork — if it seems like busywork, I would encourage you to reflect on how you are approaching it and/or come speak with me. I rely on student feedback to refine my assignments each term (and sometimes during the term). So here’s what I’ll ask you to do and why (and how much doing well at it will contribute to your final grade). There are a lot of moving pieces, but you’ll get the hang of it. Any questions: don’t be shy; just ask. (For a handy summary, see Figure 1.)

Participation & Outside Preparation (20%). Since much of our time in class will be spent discussing some conceptually difficult and occasionally abstract questions and issues, it is crucial that you come prepared. What does “coming prepared” mean? It means not only passing your eyes over the reading assigned for that day, but (at minimum)
making a serious attempt to critically engage with it and coming to class ready to share the fruits of your labors. Your journal and reflection papers (see below) will constitute part of this preparation. You should also not limit yourself to reading what I require. I will often post further “optional reading” for each topic that I think you’d benefit from looking at. I also subscribe to two quality scientific journals: Nature and Science. They may be found in the Philosophy Department lounge, where you’re welcome to browse them. Nature also publishes a weekly podcast that I’d like you all to listen to regularly. If you want to understand science at a deep level, you need to maintain some minimal familiarity with what’s going on in science right now. During class, I expect you to be a willing participant. Break the ice. Ask questions. Respond to your peers. Own up to your confusion/puzzlement. In short: be ready to do some philosophy!

Regular Journal (0%). “0%?!” Okay, let me explain: I want you to try something for a term. I’m not grading you on it; but I think you should do it anyway. I’d like you to try keeping a journal while you read and for occasional short free-writes we’ll do in class (in addition to notes, doodles, diagrams, flowcharts, &c.). I’ve recently taken this up and it’s changed my writing life. So I feel that I owe it to you to spread the word. Think of this not only as a notebook: it’s an idea-book, a question-book, a safe place where you can work out your thoughts. Used well, it will become a nursery for later more polished written and spoken contributions.

Weekly Reflection Writing/ Blog Post(s) (20%). Each week, I will post on the course blog a series of questions and issues to think about as you read. Your reflection papers might respond to one or two of these. Or you might address something else that seems important (perhaps you read or heard something interesting in Nature/Science or in some other academic context that bears on course matters?). Or you may ask a question of your own, so long as has some substance to it. Generally speaking, I’d like your responses to come in at somewhere around 200–400 words (i.e., about a page). I should get at least one a week, though you may submit more if you like. Grades will be assigned on a simple 0-3 basis (0= “missing/insufficient”, 1= “acceptable”, 2= “good”, 3= “really excellent!”) and only your best twelve will count. (See the course blog for more information about formatting/submitting these and for examples of past successful reflection papers.) At some stage, I may commission you to work up an especially good reflection into a post for the course blog. I will aim to have everyone contribute to the course blog once or twice during the course of the semester.

Essay(s) (40%). The formal writing component in this course will probably seem a little untraditional, but I hope that you’ll see its advantages. In the course of the term, I will assign two short essays (~1,000–1,500 word) that you will revise and rework (with the help of commentary from me and your peers). You will be graded only for your effort on these essays. You will then consult with me about a plan for your final essay (~2,000–2,500 words) — either reworking/expanding one of your previous papers or forging into new territory. You will again have the opportunity to receive comments on a draft before submitting an essay which, by this time, you can be reasonably confident will be successful. This final essay will comprise the majority of your grade for this component of the course.

The Box Project (20%). Throughout the term, small groups will compete with one another to unravel a puzzle that has perplexed and enthralled dozens of students before you: “What’s in that cardboard box?” In so doing, you will reflect on our study of the methodology, sociology, psychology, and philosophy of science. Each group will maintain a blog on which your travails with the box and reflections upon them can be documented. Your grade will be based on this online group document, not on your ultimate success in divining the secrets of the box. Further details will be explained as needed.

Other Course Policies & Information  ☒ READ THIS, PLEASE!

Office Hours. You are invited and encouraged to supplement your in-class learning by visiting me in my allotted office hours or at some other time that suits us both. You do not need to have any specific mission to accomplish. Feel free to drop by or make an appointment.

Civility. We only have three-or-so hours a week to spend with one other. Class time is special time. Please do not distract yourself — or others, or me — with electronic marvels such as smartphones, laptops, beepers, ham radios, &c. Don’t fall asleep right in front of me. Failing to keep your impulses in check will have serious consequences for your participation grade (moreover, I reserve the right to summarily fail seriously delinquent students from the course).

Policy on Late Work. Late submissions of the reflection papers will not be accepted (unless you have an extended illness or condition that warrants a letter from the Dean). Other late work will be docked by five percentage points per day late (e.g., a piece of work that earned a 92% would receive an 87% instead).

Sources and Academic Honesty. I expect you to abide by Bucknell’s Honor Code (http://www.bucknell.edu/x1324.xml). In particular, unless otherwise instructed, your written work must correctly cite all materials used (including primary sources, textbooks, materials from the internet, and lectures). I will not hesitate to refer students who plagiarize
Figure 1: Writing Food Chain for PHIL 220
or commit any other form of academic dishonesty to the University Board of Review (http://www.bucknell.edu/x1337.xml).

**Accommodations for the Disabled.** If you have a disability that may affect your performance in this course, please talk to me (either by email or in person) at your earliest convenience and I will make every effort to accommodate your needs. If you have not yet spoken with the appropriate Associate Dean about your disability (http://www.bucknell.edu/x7759.xml), please do so as soon as possible. Accommodations will need to be sanctioned by their office.

**Topic Schedule**

The following is just a start of a sketch of the topics I would like to pursue — for current detail, consult the course blog. Since we are few in number, I am happy to take into account your preferences for certain subjects in formulating the course.

**Weeks 1–3 (August 22nd–September 5th)**
- Historical, Sociological, and Philosophical Perspectives on Science
- The Role of Creativity
- Modeling the Scientific Method (and its difficulties)
- Heuristics and Analogies

**Weeks 4–5 (September 10th–19th)**
- The Verification Model of Confirmation
- The Paradoxes of Confirmation (Ravens, Quine-Duhem
- The Inductivist Model of Confirmation
- Inductive Skepticism (Hume's Problem, Goodman's Problem)

**Weeks 6–7 (September 24th–October 3rd)**
- The Evolutionary Model of Science
- The Demarcation Problem
- Can we draw a line between Science and Non-Science?
- Case Study: the Puzzle of the Missing Solar Neutrinos
- Case Study: Creationism and Intelligent Design in the Courtroom

**Fall Break: October 6th–9th**

**Weeks 8–10 (October 11th–25th)**
- The Structure of Scientific Revolutions
- Values and Objectivity in Science

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