

PHIL-486: Methodologies of the Sciences

Instructor: Dr. Bryan W. Roberts

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Office Hrs: STO 115A, Tue/Wed 12:30-1:30pm

Course Website: <https://blackboard.usc.edu>

Prerequisites: 300-level philosophy writing course recommended

Semester: Spr 2013

Section: 49489R

Time: Tu/Thu 11-12:15pm

Room: VKC 261

Units: 4

Course Description

Science is chock full with miraculous predictions, shocking revolutions, and utterly strange results few science fiction writers could have ever dreamed of. What makes science so special? This course is a tour of the methodologies and philosophical underpinnings that make modern science work.

The course is organized into a sequence of debates over contemporary issues in the philosophy of science. Do thought experiments transcend empirical ones? What is the logical structure of confirmation by experiment? Are there unobservable entities like quarks and electrons? What is a law of nature and when do we have them? The debates we will discuss include these issues and many more. For each issue, we will study a (typically recent) article on two contrasting sides of a debate, discussing the strengths and weakness of both arguments.

Broadly speaking, the topics that we will cover will deal with the *methodology and reasoning* of science, the *metaphysical implications* of science, or the *conceptual foundations* of the special sciences. The topics may be summarized as follows.

- *Methodology and Reasoning* (The Duhem-Quine Thesis, Confirming scientific hypotheses, Thought experiments, Scientific explanations, Reduction of one theory to another)
- *Metaphysical Implications* (Scientific realism, Laws of nature, Causation, Determinism)
- *Conceptual foundations* (Genes and phenotypes in biology, Minds and modules in psychology, The arrow of time in physics)

Issues in the methodology and reasoning of science ask about what special problems, techniques, and relationships exist in the practice of science. The metaphysical implications of science involve which conclusions can be drawn from a successful scientific theory about the nature of reality. The conceptual foundations of the special sciences involve clarifying the meaning of and relationships between central concepts appearing in a given scientific theory.

Course Objectives

This course will provide an overview of some of the central areas of the philosophy of science, as well as an opportunity to engage in specific contemporary debates within those areas. Students will learn to identify and critically analyze the methodologies, metaphysical implications and conceptual foundations of modern science, through class lectures, discussions, and regular writing assignments. No background in science will be necessary. Students will engage in advanced philosophical analysis and writing, and so prior experience in a logic course and a 300-level philosophy course is strongly recommended.

Textbooks

No textbooks are required for this course. You will be given access to all the readings through Blackboard. However, many of the readings will be taken from the following anthology edited by Christopher Hitchcock, and so you are welcome to buy a hard copy if you don't like digital reading. If you are a philosophy major or would like to dig even deeper into the history and philosophy of science, feel free to pick up the Curd et al. volume as well; I will occasionally assign readings out of this book, although you will have access to these too through Blackboard.

1. (Optional) Hitchcock, Christopher (2004). *Contemporary debates in philosophy of science*, Blackwell Publishing.
2. (Optional) Curd, Martin and J. A. Cover and Christopher Pincock (2012). *Philosophy of Science: The Central Issues*, Second Edition, W. W. Norton & Company.

Course Requirements

Evaluation is on the basis of argument summaries (10%), two presentations (10%), a midterm exam (25%), a term paper (30%), and a final exam (25%).

Argument Summaries

You will be asked to complete 12 argument summaries over the course of the semester, 6 in the first half, and 6 in the second half. Each argument summary should choose an article assigned in class, and (1) state the thesis of the article; (2) summarize the argument of the article in a few bullet points; and (3) offer a few of your own comments on that article (3-5 sentences). Argument summaries must be submitted through Blackboard on the day on the day indicated on the schedule. As long as you complete the assignment, you will receive full credit.

Presentations

Students will each do two 7-minute presentations over the course of the semester, and must sign up for these presentations in the first week. You must sign up for a presentation before the second class meeting begins, by visiting the online signup sheet accessible through blackboard. Presentations can only be given on the day scheduled, so be sure you schedule yourself for a day that you know you will be able to come to class. Your presentation should include a description of the problem, and of the author's thesis and main arguments. Be sure to provide any background information you consider relevant. You should include a few discussion questions for the class, and be prepared to give your opinion.

Midterm and final exams

The midterm will involve short answer questions about the first half of the course material (readings and class discussion); the final exam will involve short answer questions about the second half of the course material. The final exam is not cumulative.

Term paper

The main part of paper should do the following.

1. *Briefly describe a problem in the philosophy of science.* You should choose one of the debates discussed in class; if you would like to address a different problem, please approve it with me first. Your brief description should provide any relevant background context. This part is important, but should not be the bulk of the paper.
2. *Discuss another author's view on this problem, by identifying the thesis of an article read in class, and reconstructing the argument for that thesis.* You should already have this part outlined in one of your notebook entries. State the thesis clearly, and then logically reconstruct the argument in your own words. Be sure you clearly state the premises and then state the conclusion of the author's argument.
3. *Identify what you take to be wrong with the argument.* For example, if the argument is fallacious, then you should explain why. Or, you might argue that one or more of the premises is wrong.
4. *State your own alternative claim about this problem, and provide your own argument for that claim.* You should describe the premises and conclusion of your argument, and say why you think it is more effective than the one you discussed above.

Ten percent of your term paper grade will be satisfied by turning in a "preliminary outline" two weeks before the paper is due. This outline must contain a short (3-5 sentence) description of your topic, together with a statement of the thesis you expect to argue, and a few points that you are considering incorporating into your argument.

Remember that a philosophy term paper has a different structure than many other papers. To help you write a better paper, you are encouraged to follow my 7 Steps to a Better Philosophy Paper: <http://www-bcf.usc.edu/~bwrobert/teaching/7StepsToABetterPhilosophyPaper.pdf>. Your grade will depend primarily on the validity, strength, and originality of your thesis and argument, as well as on the clarity of your presentation of the problem.

Course material

Students are expected to read an article before each class session, or two articles a week.

Week 1. Introduction: What is the philosophy of science?

- 1.1 Hitchcock, What is the Philosophy of Science (Hitchcock §0)
- 1.2 Norton, Philosophy in Einstein's Science (Norton)

Week 2. Thought experiments

- 2.1 Brown, Why thought experiments transcend empiricism (Hitchcock §1)
- 2.2 Norton, Why thought experiments do not transcend empiricism (Hitchcock §2)

Week 3. Scientific Realism: The general debate

- 3.1 Leplin, A Theory's Predictive Success can Warrant Belief in the Unobservable Entities it Postulates (Hitchcock §5)
- 3.2 Kukla and Walmsley, A Theory's Predictive Success does not Warrant Belief in the Unobservable Entities it Postulates (Hitchcock §6)

Week 4. Scientific Realism: A case study on caloric

- 4.1 Psillos, Caloric and Resisting the Pessimistic Meta-Induction (Psillos 1999 pg.101-129)

4.2 Chang, Preservative realism and its discontents: Revisiting Caloric (Chang 2003)

Week 5. Laws of nature

5.1 Roberts, There are no Laws of the Social Sciences (Hitchcock §7)

5.2 Kincaid, There are Laws in the Social Sciences (Hitchcock §8)

Week 6. Causation

6.1 Dowe, Causes are Physically Connected to their Effects: Why Preventers and Omissions are not Causes (Hitchcock §9)

6.2 Norton, Causation as Folk Science (Norton 2003)

Week 7. Scientific explanations

7.1 Lipton, What is a good explanation? (Hon & Rakover pp.43-60)

7.2 Salmon, Explanation and Confirmation: A Bayesian Critique of Inference to the Best Explanation (Hon & Rakover pp.61-93)

Week 8. Reduction of one scientific theory to another

8.1 Keller, It Is Possible to Reduce Biological Explanations to Explanations in Chemistry and/or Physics (Ayala & Arp §1)

8.2 Dupré, It Is Not Possible to Reduce Biological Explanations to Explanations in Chemistry and/or Physics (Ayala & Apr §2)

Week 9. Philosophy of biology: Genes and Traits

9.1 Sarkar, Genes Encode Information for Phenotypic Traits (Hitchcock §13)

9.2 Godfrey-Smith, Genes do not Encode Information for Phenotypic Traits (Hitchcock §14)

Week 10. Spring Break

10.1 Spring Break - No Class

10.2 Spring break - No Class

Week 11. Philosophy of psychology: The mind

11.1 Carruthers, The Mind is a System of Modules Shaped by Natural Selection (Hitchcock §15)

11.2 Woodward and Cowie, The Mind is not (just) a System of Modules Shaped (just) by Natural Selection (Hitchcock §16)

Week 12. Philosophy of physics: The Arrow of time

12.1 Price, On the Origins of the Arrow of Time: Why there is Still a Puzzle about the Low-Entropy Past (Hitchcock §11)

12.2 Callender, There is no Puzzle about the Low-Entropy Past (Hitchcock §12)

Week 13. Determinism

13.1 Norton, The Dome: An Unexpectedly Simple Failure of Determinism (Norton 2008)

Week 14. Scientific Confirmation

14.1 Notes on the HD Method

Week 15. The Duhem-Quine Thesis

15.1 Duhem, Physical Theory and Experiment (Curd, Cover & Pincock)

15.2 Laudan, Demystifying Underdetermination

Week 16. Conclusions and Final Exam

16.1 Final Exam Review

16.2 Final Exam

Internet Access

By enrolling in this course, you agree that you will have regular access to the internet that will allow you to submit your coursework online before the due date. In particular, you are responsible for making sure you have enough time to learn how to submit your coursework online, and to troubleshoot any potential problems before the due date. To avoid such problems, *please don't wait until the last minute*. Give yourself extra time in case something goes wrong, and please contact the course instructor or the technology help desk if you need help submitting your work.

How to do well in this course

The techniques you will learn about in this class are some of the most powerful and reliable tools we have to acquire knowledge about the world. But recognize that mastering these techniques requires diligence and practice. Come to class having studied the readings as best you can, take notes in class, and then review the material again when you go home. Discuss the material with your classmates. You are very, very welcome to get in touch with me to discuss difficulties when you run into them. I am available in office hours, and will respond to email within 24 hours. Remember, philosophy takes some time to process. That is normal. The more time you give yourself, the more likely you'll be to succeed.

Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the Student Conduct Code in [Section 11.00](#), while the recommended sanctions are located in Appendix A, <http://scampus.usc.edu/university-student-conduct-code/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at <http://www.usc.edu/student-affairs/SJACS/>.

Disability Services

Students with disabilities are warmly encouraged to contact me about accommodations. Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 am - 5:00 pm, Monday through Friday. The phone number for DSP is (213) 740-0776.