

Philosophy of Science (PHIL 20617)

Monday/Wednesday, 2:00–3:15 pm, DeBartolo Hall 149

Instructor: Jeremy Steeger

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Office Hours: Wednesday 11:00 AM to 1:00 PM / Thursday 2:00 to 4:00 PM in Malloy Hall, First Floor Alcove

Class Blog: <https://introphilsci.wordpress.com>

This syllabus is subject to change.

Last updated: October 29, 2018

Course Description: Scientific theories have enjoyed much success. They afford us tremendous power to predict and explain phenomena in the world around us. In light of this power, you might wonder why it is these theories are so successful. This question invariably leads to others. For instance: how much do our chosen theories tell us about the world—must the unseen entities referenced by scientific explanations exist? And just what counts as a “scientific explanation” anyhow? This course will equip you with the tools necessary to begin answering these questions. We will survey classic and contemporary debates in the philosophy of science, including: the reality of unobservable entities posited by theories; the nature of scientific explanation; how we choose between competing theories; and how we confirm existing theories. We will also consider applications to examples from the physical sciences. However, this course is self-contained. No previous familiarity with any particular physical or mathematical theory is required.

Prerequisite(s): A 10000-level or higher philosophy course.

Credit Hours: 3

Indicative Text: *Philosophico-Scientific Adventures*

<http://personal.lse.ac.uk/robert49/ebooks/PhilSciAdventures/index.html>

Author: Bryan W. Roberts

Required Texts: All required texts will be made available online.

Course Objectives:

At the completion of this course, students will:

1. Be familiar with some of the main debates in the philosophy of science.
2. Be knowledgeable about the role of philosophy in science and vice versa.
3. Understand the main issues in general philosophy of science, including: the demarcation problem, scientific realism (and anti-realism), and the natures of laws, causation, confirmation, and explanation.
4. Have a basic understanding of philosophical issues arising in a particular science (quantum mechanics).

Requirements:

- Participation and Attendance (25%)
 - *Class Blog*
 - * Before each class period, you are expected to submit a brief response (100-200 words) to the assigned readings for that day on the class blog.
 - * The response should be posted in reply to the prompt provided on the blog, and it should address at least one of the questions posed in the prompt.
 - * The prompt will be posted on the lecture day *prior* to the lecture day on which the responses are due.
 - * You are encouraged to pose questions of your own, and to respond to questions posed by other students. While this goes without saying, **you are expected to be civil in your conduct and respectful of your fellow students' ideas and discourse.**
 - *Class discussions*
 - * You are expected to contribute to the occasional breakout discussions. You may treat the blog posts as preparations for these discussions.
- Two Essay Assignments (50%)
 - There will be two short, 5–7 page essay assignments for this class.
 - For each essay, you will choose a sub-topic from a “block” to engage with more directly. For the first essay, you must choose a topic from Block 1 or 2; for the second, you must choose a topic from Block 2 or 3.
 - There will be suggested prompts for each essay, but you are not required to choose from these. However: **if you wish to propose your own topic, you must meet with me to discuss it within the week that the prompts are posted.**
 - You may choose *one* essay to revise and resubmit. If you take advantage of this option, you will be given the higher of the two grades received.
- Final Exam (25%)
 - There will be a final exam. The provisional date of the exam is Monday, December 11 from 4:15 PM to 6:15 PM, but this is subject to change.

Course Policies:

- **General**
 - You are required to have done the assigned readings and submitted responses to the blog prior to each class meeting (see below for the list of readings).
- **Grades**
 - Grades in the **C** range represent performance that **meets expectations**; Grades in the **B** range represent performance that is **substantially better** than the expectations; Grades in the **A** range represent work that is **excellent**.

- **Essays and Assignments**

- Students are expected to work independently on essays and assignments. Discussion among students is encouraged, but when in doubt, direct your questions to me.

- **Attendance and Absences**

- Attendance is expected and will be taken each class. You are allowed to miss **1** class during the semester without penalty. Any further absences will result in a deduction from your participation grade.
- Students are responsible for all missed work, regardless of the reason for absence. It is also the absentee's responsibility to get all missing notes or materials.

- **Academic Integrity**

- It is your responsibility to familiarize yourself with the Academic Honor Code (<http://fys.nd.edu/current-students/honor-code/>).

Course Outline:

The weekly coverage is subject to change. When in doubt, consult the latest version of this syllabus (the version on the blog).

Week	Content
What is the philosophy of science?	
Week 1	<i>Aug. 23</i> Introduction and Course Overview
Block 1: The Structure of Theories	
Week 2	<p><i>Aug. 28</i> Empiricism Required readings:</p> <ul style="list-style-type: none"> – Ayer, A. J. (1971), ‘The Elimination of Metaphysics,’ <i>Language, Truth and Logic</i> (Harmondsworth: Penguin), 13–29. – Carnap, Rudolf (1959), ‘The elimination of metaphysics through logical analysis’, <i>Logical Positivism</i>, 60–81. <p>Optional Reading:</p> <ul style="list-style-type: none"> – Bright, Liam Kofi (2017), ‘Logical Empiricists on Race,’ <i>Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences</i>, 65: 9–18. <p><i>Aug. 30</i> Demarcation (What is a Scientific Theory?) Required readings:</p> <ul style="list-style-type: none"> – Popper, Karl R. (1963), ‘Science: Conjectures and Refutations.’ – Van Fraassen, Bas C. (1980), ‘Chapter 3: To Save the Phenomena,’ <i>The Scientific Image</i>.
Week 3	<p><i>Sept. 4</i> Revolutions Required reading:</p> <ul style="list-style-type: none"> – Kuhn, Thomas S (1996), <i>The Structure of Scientific Revolutions</i> (Chapter IX). <p><i>Sept. 6</i> Progress, Again Required readings:</p> <ul style="list-style-type: none"> – Lakatos, Imre (1970), ‘Falsification and the Methodology of Scientific Research Programmes,’ in Lakatos, Imre and Alan Musgrave (eds.), <i>Criticism and the Growth of Knowledge</i> (excerpt). – Feyerabend, Paul (1993), <i>Against Method</i>, Sec. 15.

	Block 2: What Theories Tell Us Is Real (Or Not)
Week 4	<p><i>Sept. 11</i> Realism (A Motivation) Required reading:</p> <ul style="list-style-type: none"> – Boyd, Richard N. (1983), ‘On the Current Status of the Issue of Scientific Realism,’ <i>Erkenntnis</i>, 19 (1:3), 45–90. <p><i>Sept. 13</i> Underdeterminaton Required readings:</p> <ul style="list-style-type: none"> – Duhem, Pierre Maurice Marie (1998), ‘Physical Theory and Experiment,’ in Curd, Martin and J. A. Cover (eds.), <i>Philosophy of Science: The Central Issues</i>. – Stanford, Kyle (2016), ‘Underdetermination of Scientific Theory’ (Section 1).
Week 5	<p><i>Sept. 18</i> Anti-Realism Required readings:</p> <ul style="list-style-type: none"> – Laudan, Larry (1981), ‘A Confutation of Convergent Realism,’ <i>Philosophy of Science</i>, 48 (1), 19–49. – Van Fraassen, Bas C. (1980), <i>The Scientific Image</i> (Chapter 2 excerpt). <p><i>Sept. 20</i> Semi-Realism: The Best of Both Worlds? Required readings:</p> <ul style="list-style-type: none"> – Worrall, John (1989), ‘Structural Realism: The Best of Both Worlds?’ <i>Dialectica</i>, 43 (1–2), 99–124. – Chakravartty, Anjan (2017), ‘Scientific Realism’ (Section 2).
Week 6	<p><i>Sept. 25</i> ...Or Neither World (NOA and Locavoracity) Required readings:</p> <ul style="list-style-type: none"> – Fine, Arthur (1986), <i>The Shaky Game: Einstein, Realism, and the Quantum Theory</i>, (excerpt). – Ruetsche, Laura (2015), ‘The Shaky Game+ 25, or: on locavoracity,’ <i>Synthese</i>, 192 (11), 3425–42. <p>Essay 1 Prompts Posted</p> <p><i>Sept. 27</i> Laws Required reading:</p> <ul style="list-style-type: none"> – Chalmers, Alan (1999), ‘Why Should the World Obey Laws?’ <i>What Is This Thing Called Science</i>.

Week 7	<p><i>Oct. 2</i> Fundamentalism Required reading:</p> <ul style="list-style-type: none"> – Cartwright, Nancy (1996), ‘Fundamentalism vs. the Patchwork of Laws,’ in Papineau, David (ed.), <i>The Philosophy of Science</i>, 314–326. <p>Optional reading:</p> <ul style="list-style-type: none"> – Hofer, Carl (2003), ‘For Fundamentalism,’ <i>Philosophy of Science</i>, 70 (5), 1401–12. <p><i>Oct. 4</i> Causation 1 (Hume and Counterfactual) Required reading:</p> <ul style="list-style-type: none"> – Hitchcock, Christopher (2008), ‘Causation,’ in Curd, Martin and Stathis Psillos (eds.), <i>The Routledge Companion to Philosophy of Science</i>.
Week 8	<p><i>Oct. 9</i> Probability 1 (No readings)</p> <p><i>Oct. 11</i> Probability 2 Required readings:</p> <ul style="list-style-type: none"> – Galavotti, Maria Carla (2008), ‘Probability,’ in Curd, Martin and Stathis Psillos (eds.), <i>The Routledge Companion to Philosophy of Science</i>. – Gillies, Donald (2000), ‘Varieties of Propensity,’ <i>British Journal for the Philosophy of Science</i>, 51 (4), 807–35.
Week 9	Fall Break
Week 10	<p><i>Oct. 23</i> Mathematics Optional readings:</p> <ul style="list-style-type: none"> – George, Alexander and Daniel J. Velleman (2002), ‘Introduction,’ in George, Alexander and Daniel J Velleman (eds.), <i>Philosophies of Mathematics</i> (Malden: Blackwell). – Shapiro, Stewart (2000), ‘A Potpourri of Questions and Attempted Answers,’ <i>Thinking about Mathematics: The Philosophy of Mathematics</i>. <p>Essay 1 Due</p> <p><i>Oct. 25</i> Causation 2 (Process, Bayes Nets, Skepticism) Required reading:</p> <ul style="list-style-type: none"> – Norton, John D (2003), ‘Causation as Folk Science,’ <i>Philosophers’ Imprint</i>, 3 (4), 1–22.

Block 3: How Science Works	
Week 11	<p><i>Oct. 30</i> Induction (and Its Problems) Required reading:</p> <ul style="list-style-type: none"> – Goodman, Nelson (1983), ‘The New Riddle of Induction,’ <i>Fact, Fiction, and Forecast</i>. <p>Optional reading:</p> <ul style="list-style-type: none"> – Sankey, Howard (2008), ‘Scientific Method,’ in Curd, Martin and Stathis Psillos (eds.), <i>The Routledge Companion to Philosophy of Science</i>. <p><i>Nov. 1</i> Induction (A Second Try) Required reading:</p> <ul style="list-style-type: none"> – Sober, Elliott (1994), ‘No Model, No Inference: A Bayesian Primer on the Grue Problem,’ in Stalker, Douglas (ed.), <i>Grue! The New Riddle of Induction</i> (225–240). <p>Optional reading:</p> <ul style="list-style-type: none"> – Norton, John D (2003), ‘A Material Theory of Induction,’ <i>Philosophy of Science</i>, 70 647–70.
Week 12	<p><i>Nov. 6</i> Virtues (Bayes Meets Kuhn) Required reading:</p> <ul style="list-style-type: none"> – Salmon, Wesley C. (1990), ‘Rationality and Objectivity in Science or Tom Kuhn meets Tom Bayes,’ in Savage, C. Wade (ed.), <i>Scientific Theories</i>, 175–204. <p style="text-align: center;">Essay 2 Prompts Posted</p> <p><i>Nov. 8</i> Explanation 1 (DN and Statistical-Relevance) Required reading:</p> <ul style="list-style-type: none"> – Woodward, James (2002), ‘Explanation,’ in Machamer, Peter and Michael Silberstein (eds.), <i>The Blackwell Guide to the Philosophy of Science</i>, 37–54. <p>Optional reading:</p> <ul style="list-style-type: none"> – Salmon, Wesley C. (2006), ‘The Second Decade (1958-67): Manifest Destiny—Expansion and Conflict,’ <i>Four Decades of Scientific Explanation</i>.

Week 13	<p><i>Nov. 13</i> Explanation 2 (Mechanistic and Unificationist) Required reading:</p> <ul style="list-style-type: none"> – Machamer, Peter, Lindley Darden, and Carl F. Craver (2000), ‘Thinking About Mechanisms,’ <i>Philosophy of Science</i>, 67 1–25. <p><i>Nov. 15</i> Idealization Required reading:</p> <ul style="list-style-type: none"> – Norton, John D. (2012), ‘Approximation and Idealization: Why the Difference Matters,’ <i>Philosophy of Science</i>, 79 (2), 207–32.
Week 14	<p><i>Nov. 20</i> Representation Required readings:</p> <ul style="list-style-type: none"> – Van Fraassen, Bas C (2008), ‘Representation Of, Representation As,’ <i>Scientific Representation: Paradoxes of Perspective</i>. <p><i>Nov. 22</i> Thanksgiving Break</p>

Block 4: Puzzles of the Quantum (A Whirlwind Tour)	
Week 15	<p><i>Nov. 27</i> Nonlocality Optional reading:</p> <ul style="list-style-type: none"> – Maudlin, Tim (2011), ‘Bell’s Theorem: The Price of Locality,’ <i>Quantum Non-Locality and Relativity</i>. <p style="text-align: center;">Essay 2 Due</p> <p><i>Nov. 29</i> Measurement as Representation: An Introduction to Contextuality Required reading:</p> <ul style="list-style-type: none"> – Van Fraassen, Bas C (2008), ‘Measurement as Representation: 1. The Physical Correlate,’ <i>Scientific Representation: Paradoxes of Perspective</i>.
Week 16	<p><i>Dec. 4</i> Contextuality Reconsidered Optional viewing:</p> <ul style="list-style-type: none"> – Spekkens, Robert W. (2017), ‘Noncontextuality: how we should define it, why it is natural, and what to do about its failure’ http://pirsa.org/displayFlash.php?id=17070035. <p><i>Dec. 6</i> Review for Final Exam</p>
Week 17	<p><i>Dec. 16</i> Final Exam Due Revised and Resubmitted Essays Due</p>