Syllabus: Philosophy of Science

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Office Hours: Thursdays 1-3pm

Course Description

Science constitutes the most successful human endeavor in cumulative acquisition of knowledge of the natural world. Why? What, if anything, separates science from pseudoscience? How literally should we interpret our best physical theories? What does scientific explanation consist in? Can we precisely formulate the relationship of evidence to theory? When and why is a simpler theory better? And how are we to understand the current replication crisis in the social and life sciences? Together, we'll explore these questions, and others, in weekly readings and discussions, and embark together on a path to a richer understanding of philosophy of science.

Student Learning Outcomes

By the end of this course, you will be able to:

1. Summarize some of the central debates in philosophy of science.
2. Evaluate arguments and evidence for the various positions in these debates.

Course Texts

You do not need to purchase any texts for this course. All readings will be made available on the course site.

Assignments

Participation: you are expected to actively participate in the class discussion by bringing your own questions, listening and responding to the questions of your peers, and offering your own points of view.

Reading summaries: periodically, you will be asked to submit concise reading summaries demonstrating your understanding of the texts.

Exams: there will be one midterm exam and one final exam. The final exam will be cumulative.

Final essay: you will be asked to write a 1000-1500 word essay on either (A) a theme in one of our three texts, or (B) a topic of connection between two of our texts.

Extra Credit. There will be one opportunity to earn extra credit by writing a short (600-1,000 words) reflection essay about how you see the material we cover in class connecting to your life, studies, and work, and to the development of your intellectual character.

Grading Breakdown

You final grade for the course will be determined by:
Participation - 15%
Reading summaries - 15%
Midterm - 20%
Final Exam - 25%
Final Paper - 25%

Grading Scale

A+ : 100-98 $\geq$ A : 97-93 $\geq$ A- : 92-90 $\geq$
B+ : 89-88 $\geq$ B : 87-83 $\geq$ B- : 82-80 $\geq$
C+ : 79-78 $\geq$ C : 77-73 $\geq$ C- : 72-70 $\geq$
D+ : 69-68 $\geq$ D : 67-63 $\geq$ D- : 62-60 $\geq$ F : 59-0

Late Work Policy

Late work will not be accepted.

Academic Honesty

This course will follow the University policy on academic integrity.

Course Calendar

Below are the readings that should be completed by beginning of each class. All readings will be made available on the course website.

WEEK 1. **Falsification & Testabilty**
Karl Popper (1963) "Science as Falsification" in *Conjectures and Refutations*
Elliott Sober (1999) "Testability" *Proceedings and Addresses of the American Philosophical Association,* 73 (2):47-76

WEEK 2. **Theory Change**
Thomas Kuhn (1962) "Progress through Revolutions" in *The Structure of Scientific Revolutions*
Imre Lakatos (1978) "A methodology of scientific research programmes" in *Methodology*

of Scientific Research Programmes

WEEK 3. **Realism and Antirealism**
Laudan (1981) "A Confutation of Convergent Realism" *Philosophy of Science*, 48 (1):19-49
Kyle Stanford (2019) "A Middle Path Forward in the Scientific Realism Debate"

WEEK 4. **Confirmation Holism**
Duhem, Pierre (1954) "To Save the Phenomena" in *The Aim and Structure of Physical Theory*
Deborah Mayo (1997) "Duhem's Problem, the Bayesian Way, and Error Statistics" *Philosophy of Science*, 64:222–44

WEEK 5. **Scientific Explanation**
Carl Hempel and Paul Oppenheim (1948) "Studies in the Logic of Explanation" *Philosophy of Science*, 15 (2):135-175
James Woodward ()2007) "Causation with a Human Face" in *Causation, Physics, and the Constitution of Reality* pp. 66–105.
Bas Van Fraasen, (1980) "To Save the Phenomena," Ch. 3 in *The Scientific Image*

WEEK 6. **Scientific Models**
Ludwig Boltzman (1911) "Model" *Encyclopedia Britannica.* Transcribed version.
Ron Giere (2004) "How Models are used to Represent Reality," *Philosophy of Science*, 71:742–752.

WEEK 7. **Scientific Idealization**
Ernan McMullin (1985) "Galilean Idealization" *Studies in History and Philosophy* 247-273.
Michael Weisberg, "Three Kinds of Idealization," *The Journal of Philosophy*, 104 (12):639-659.

WEEK 8. **MIDTERM**

WEEK 10. **Measures of Confirmation**
James Joyce, "Baye" Theorem" in *The Stanford Encyclopedia of Philosophy*
Colin Howson and Peter Urbach, 11Bayesian vs Non-Bayesian Approaches to Confirmation," from Ch. 7 of *Scientific Reasoning: The Bayesian Approach.*

WEEK 11. **Scientific Virtues**
Thomas Kuhn (1977) "Objectivity, Value Judgment, and Theory Choice," Ch. 13, pp. 320-339 in *The Essential Tension*
Heather Douglas (2013)"The Value of Cognitive Values," *Philosophy of Science*, 80:796-806.

WEEK 12. **The Social Structure of Science I**

Philip Kitcher (1990) 'The Division of Cognitive Labor" *The Journal of Philosophy* lxxvii (1):5–22
Michael Strevens (2006) "The Role of the Priority Rule in Science" *Journal of Philosophy*, 2:55–79

WEEK 12. **The Social Structure of Science II**
Mayo-Wilson, Kevin J.S. Zollman, and David Danks (2011) "The Independence Thesis: When Individual and Social Epistemology Diverge" *Philosophy of Science* lxxviii, 4:653–77.
Kevin Zollman (2018) "The Credit Economy and the Economic Rationality of Science" *Journal of Philosophy,* 115 (1):5-33

WEEK 13. **The Replication Crisis I**
John Ioannidis (2005) "Why Most Published Research Findings Are False" *PLoS Med* 2(8)
False-Positive Psychology (2011) "False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant" *Pyschological Science* 11:1359-1366

WEEK 14. **The Replication Crisis II**
—*Final Paper Due*—
Remco Heesen (2018) "Why the Reward Structure of Science Makes Reproducibility Problems Inevitable" *The Journal of Philosophy*, 115 (12):661-674
David Grimes, Chris Bauch, and John Ioannidis (2017) "Modeling science trustworthiness under publish or perish pressure" *Royal Society Open Science*

WEEK 15. **FINAL EXAM**