

Philosophy of Science

Course description

What is science? How does it work? When it works, what kind of knowledge does it provide? Is there a scientific method? How do experiments provide evidence for theories? What is the nature of scientific explanation? How does the social organization of science contribute, if at all, to its success?

Course texts

Two books are required for this course:

- Godfrey-Smith, P. 2021. *Theory & Reality*, 2nd ed. (Chicago) [TR]
- Kuhn, T. 2012. *The Structure of Scientific Revolutions*, 4th ed. (Chicago) [Structure]

Other readings will be made available on the Canvas page for the course.

Instructor details

My office is 125 Siena Hall. My official office hours are **Thursday 1:30 – 3:30**. In my experience, most people do not have availability during the actual office hours, so I am available by appointment as well. Just send me an email (smurray7@providence.edu) or talk with me before/after class to set up a time.

Grading

*All rubrics are available on Canvas. I will provide feedback on any assignment, but drafts must be submitted within 72 hours of the assigned due date.

Attendance (5%): This is a 1 or 0 in the gradebook. Excused absences require proper documentation.

Short responses (20%; *Due day class*): By 9pm the day *before* class, please submit a 100-word summary of the reading for class that day. In addition to a short summary, please include a short question that you would like to see addressed in class. These can be submitted on Canvas. Only one response is required per week. The assignment is by random draw and posted on Canvas. (If you are assigned to Group 1, your target article is Monday. Group 2? Your article is Wednesday. And 3? Friday. If we have an abbreviated week, then we'll do two groups. I'll provide an example summary in Week 1, so this assignment will not start until Week 2. You do not need to work together with people in your group, although it's fine to talk about the article with others as you prepare your summary.

Three short papers (45% [15, 15, 15]; *Due 2/26, 3/28, and 4/25*): Three short papers are due throughout the semester. The papers will combine exposition and criticism. Topics are available on Canvas and on the last pages of the syllabus.

Final exam (30%; *Exam date TBD*): There will be one cumulative final at the end of the term. A study guide will be made available before the end of the semester. This is an open note final.

Academic Integrity

All students pledge to abide by the guidelines on academic integrity outlined in the *Undergraduate Catalogue* (in the aptly titled section "Academic Integrity").

**Schedule
Spring 2025**

<i>Week</i>	Monday	Wednesday	Friday
Jan. 13 – 17	<i>Introduction</i>	<i>Overview of general philosophy of science</i> TR, ch. 1	<i>The briefest introduction to the Scientific Revolution (Part 1)</i> Descartes, <i>The World</i> (§§5 – 7)
Jan. 20 – 24	MARTIN LUTHER KING, JR. DAY <i>No class</i>	<i>The briefest introduction to the Scientific Revolution (Part 2)</i> Newton, <i>Principia</i> (pp. 382, 424, 588, 943)	<i>Traditional empiricism</i> Hume, <i>Treatise on Human Nature</i> (Book 1, Part 1, Sec. 1)
Jan. 27 – 31	<i>Logical positivism</i> Schlick, “Positivism and realism” (pp. 86 – 102, 106 – 7)	No class	<i>Logical empiricism</i> Maxwell, “The ontological status of theoretical entities” (pp. 3 – 11) TR, chapter 2 (§2.4 is optional)
Feb. 3 – 7	<i>Setting up the problem of induction</i> Hume, <i>Enquiry</i> §§4 – 5	<i>The modern problem of induction</i> Goodman, <i>Fact, Fiction, and Forecast</i> (pp. 72 – 75, 77 – 83) TR, ch 3 (skip §3.3)	<i>Popper’s falsificationism</i> Popper, <i>The Logic of Scientific Discovery</i> (pp. 3 – 24, 27 – 29, 57, 60 – 67)
Feb. 10 – 14	<i>Objections to falsificationism</i> TR, ch. 4.1 – 4.4	<i>Falsification and public health</i> Buck, “Popper’s philosophy for epidemiologists”	<i>Popper on confirmation</i> Popper, <i>The Logic of Scientific Discovery</i> (pp. 264 – 73, 278 – 82)
Feb. 17 – 21	<i>Confirmation across the sciences</i> Salmon, <i>Foundations of Scientific Inference</i> (selections)	<i>Further objections to Popper</i> TR, ch. 4.5 – 4.6	<i>Kuhn on normal science</i> Kuhn, <i>Structure</i> chs. 1 – 8 TR, ch. 5.1 – 5.4
Feb. 24 – 28	<i>Kuhn on revolutions I</i> Kuhn, <i>Structure</i> chs. 9 – 12 (pp. 96 – 103 and ch. 10 are optional)	<i>Kuhn on revolutions II</i> TR, ch. 5.5 – 5.8 **PAPER 1 DUE**	<i>Kuhn on progress</i> Kuhn, <i>Structure</i> §13 and postscript
Mar. 3 – 7	<i>Scientific progress I</i> Bird, “What is scientific progress?”	SAM AT UNC <i>No class</i>	SAM AT DUKE <i>No class</i>
Mar. 10 – 14	SPRING BREAK	SPRING BREAK	SPRING BREAK

<i>Week</i>	Monday	Wednesday	Friday
	<i>No class</i>	<i>No class</i>	<i>No class</i>
Mar. 17 – 21	<i>Theory and observation</i> Fodor, “Observation reconsidered” (skip §§1 – 2)	<i>Realism</i> Hanson, <i>Patterns of Discovery</i> ch. 1 TR, ch. 9.1 – 9.3	<i>Laws and explanation: empiricism</i> Ayer, “What is a law of nature?” (pt. 2) Hempel & Oppenheim, “Studies in the logic of explanation” (pp. 135 – 46)
Mar. 24 – 28	<i>Laws: Realism</i> Dretske, “Laws of nature”	<i>Laws: Pluralism</i> Mitchell, “Dimensions of scientific law”	<i>Critiques of empiricism</i> Salmon, <i>Four Decades of Scientific Explanation</i> (pp. 46 – 50) TR, ch. 11 **PAPER 2 DUE**
Mar. 31 – Apr 4	<i>The causal approach</i> Strevens, “The causal and unification approaches to explanation unified—causally”	<i>Laws and explanation: Cartwright</i> Cartwright, “Truth doesn’t explain much” Cartwright, <i>The dappled world</i> , pp. 1 – 6	<i>Instantialism and the ravens</i> Hempel, “Studies in the logic of confirmation” (§§ 1 – 5) TR, ch. 3.3
Apr. 7 – 11	<i>Bayesianism I: Credence and probability</i> TR, ch. 12.1 – 3	<i>Bayesianism II: Conditionalization</i> *No reading	<i>Bayesianism III: Confirmation</i> TR, ch. 12.5
Apr. 14 – 18	<i>Bayesianism IV: Solutions and Puzzles</i> TR, ch. 12.4	<i>Science and values</i> Douglas, “Inductive risk and values in science” TR, ch. 8.1	GOOD FRIDAY <i>No class</i>
Apr. 21 – 25	EASTER BREAK <i>No class</i>	<i>Social critiques of science</i> Richardson, “Sexes, species, and genomes” TR, ch. 8.2 – 8.6	<i>The sociology of science</i> TR, ch. 7
Apr. 28 – May 2	<i>Constructivism</i> Collins, “The seven sexes”	<i>The priority rule</i> Strevens, “The role of the priority rule in science”,	<i>The credit system in science</i> TR, ch. 9.4 – 9.6

<i>Week</i>	Monday	Wednesday	Friday
	TR, ch. 8.2 – 8.6	TR, ch. 9.4 – 9.6	***PAPER 3 DUE

Paper topics

The topics are organized by due date. Don't go beyond the due date when selecting a paper topic. All earlier topics remain on the table. For example, you can choose to write on any topic for your third paper.

1. Can a principled distinction be drawn between what's observable and what's not? (The optional Maxwell reading will come in useful here.) What implications does the answer have for Schlick's logical positivist program? (Don't forget to explain what the program is.)
2. From the observation up to the present day of large numbers of emeralds, all green, is it just as rational to infer that all emeralds are grue as to infer that all emeralds are green? (An emerald is grue if it is green and first observed before the year 2050 or blue and not observed before the year 2050.)
3. Why, according to Popper, is a single observation typically not sufficient to falsify a hypothesis? What does he mean when he says that falsification requires a "reproducible effect"? Having explained Popper's views on this matter, critique or defend them.
4. Is Popper's "corroboration" just a lightly disguised version of inductive support? Consider arguments both for and against.
5. According to Kuhn, what role is played by a paradigm (in the broad sense) during normal science? In answering this question, discuss two important functions of the paradigm. To what extent is it important that scientists are incapable of thinking outside the paradigm?
6. During periods of normal science, Kuhn says, there can be only one paradigm. What are his motivations for saying this? Is he right?
7. In revolutionary times, can there be good reasons for a scientist to make the leap from the old paradigm to the new paradigm? Explain Kuhn's answer to this question, and discuss.
8. In what ways is it possible to say that a move from one paradigm to another constitutes scientific progress, according to Kuhn? Is his view plausible?
9. To what extent are the results of observations in science determined by outputs of parts of the brain that work the same way in all normal humans, regardless of beliefs, culture, and so on? How does this help with the problem of the theory-ladenness of observation? (Be sure to say what the problem is.)

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10. What is the regularity account of laws of nature? Present one of Dretske's arguments against the regularity account. Is Dretske right?
11. Describe Dretske's account of laws of nature. Present one advantage and one disadvantage of the account. Discuss.
12. What does Mitchell mean when she says that biological laws come arrayed along several "dimensions"? Give one argument in favor of her view and one against. Which is stronger?
13. What is Hempel's deductive-nomological theory of explanation? Give one or two arguments against the account. How might Hempel defend himself against these objections?
14. Give an argument in favor of the causal account of explanation. Then give an argument against some version of the causal account. Critically discuss one of these arguments. (So: present two arguments, then pick one of the two and discuss whether or not it works.)
15. What is the function of law statements in science, according to Cartwright? Give an argument against Cartwright's view. Is the argument successful or can she deflect it?
16. Describe Hempel's instantialist theory of confirmation. What is one problem that Hempel's account solves? What is one difficulty that Hempel's account faces? How bad is that difficulty?
17. What is Hempel's "raven paradox"? Explain one way that the paradox might be resolved. Is the resolution successful?

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18. Why do some philosophers think that the Bayesian theory of confirmation is "too subjective"? Explain how convergence results might help to defuse this objection. Consider one or two weaknesses of this use of convergence; are the weaknesses fatal?

19. How can Bayesian confirmation theory be used to address Hempel's ravens paradox? (Start by explaining the paradox.)
20. What is one way in which values enter into scientific inquiry, for better or worse? (You might focus on either the Douglas or the Richardson papers.) To what extent must traditional philosophy of science be modified to accommodate the impact of values? (It may help to choose a particular dead philosopher of science to represent "tradition", e.g., Popper or Hempel or even Kuhn. You may, if you wish, argue that no modification is needed at all.)
21. To what extent do sociological studies of science (I am of course thinking of Collins in particular) undercut Kuhn's account of scientific inquiry? Lay out some central theses of Kuhn's account first; then show how the sociology might be thought to refute those theses. Defend Kuhn, if you will.
22. How can the social organization of science help to make science a more effective means of inquiry? (I suggest that you focus on either the "priority rule" or the "communist norm" presented by Merton.) Discuss.