

# PHILOSOPHY OF SCIENCE SYLLABUS

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## General Description

This course investigates the epistemological, methodological and ontological dimensions of science. Students will study the relation between perception, evidence and theory in the context of scientific research. They will explore different inferential accounts of this relation, paying particular attention to how evidence is used, and how it ought to be used, to confirm or disconfirm theories. Lessons from the history of science will provide checks and balances to these accounts as well as to accounts of the exact limits of scientific knowledge. Finally, students will reflect on some related topics in the metaphysics of science such as what are laws of nature and what constitutes a good scientific explanation.

Each and every lecture consists of a main topic and a supplementary, or as it is called below 'special', topic. The latter bridges the main topic to discussions in other areas of philosophy or different fields altogether. The supplementary topic is meant to help place the main topic in a broader context, thereby strengthening the student's understanding and appreciation of the discussion at hand.

Please note that due to copyright restrictions I cannot upload all the required readings on Moodle, though you will find that there is still a fair amount.

Disclaimer: The compulsory readings can be changed at any time in order to respond to the needs of course participants. It is important that students check for updates on Moodle every week.

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## Main Reading Sources:

- Curd, M., J.A. Cover and C. Pincock (eds.) (2012) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company.  
Curd, M. and S. Psillos (eds.) (2008), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge.

## Recommended Reading Sources:

- O'Hear, A. (1989) *An Introduction to the Philosophy of Science*, Oxford: Oxford University Press.  
Schurz, G. (2013) *Philosophy of Science: A Unified Approach*, New York: Routledge.  
Skyrms, B. (1999) *Choice and Chance*, fourth edition, Belmont, CA: Wadsworth.

## Brief Surveys:

- Okasha, S. (2002) *Philosophy of Science: A Very Short Introduction*, Oxford: Oxford University Press.

## HT Week 1: THEORY AND OBSERVATION

Key questions: What is the relation between observation and theory? Is the distinction between observables and unobservables warranted? How pervasive is the theory-ladenness of observation?

**Essential Reading:**

Kukla, A. (2008) 'Observation', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge.

**Further Reading:**

Fodor, J. (1984) 'Observation Reconsidered', *Philosophy of Science*, vol. 51(1): 23-43.

Kosso, P. (1992) *Reading the Book of Nature*, Cambridge: Cambridge University Press.

Maxwell, G. (1962) 'The ontological status of theoretical entities', in H. Feigl & G. Maxwell (eds.), *Scientific Explanation, Space, and Time*, vol. 3, Minnesota Studies in the Philosophy of Science, Minneapolis: University of Minnesota Press, pp. 3–15.

O'Hear, A. (1989) 'Observation and Theory', in *An Introduction to the Philosophy of Science*, Oxford: Oxford University Press, Ch. 5.

Votsis, I. (2015) 'Perception and Observation Unladen', *Philosophical Studies*, vol. 172(3): 563-585.

**Special Topic (+Reading): Theory-Ladenness**

Brewer, W. F., & B. L. Lambert (2001) 'The Theory-ladenness of Observation and the Theory-ladenness of the Rest of the Scientific Process', *Philosophy of Science*, vol. 68(3), S176–S186.

**HT Week 2: INDUCTION AND ITS PROBLEMS**

Key questions: How is induction different from deduction? Can we provide a general justification for induction? How are hypotheses about grue objects different from hypotheses about green/blue objects?

**Essential Reading:**

Skyrms, B. (1999) 'The Traditional Problem of Induction', in *Choice and Chance*, fourth edition, Belmont, CA: Wadsworth.

**Further Reading:**

Goodman, N. (1954) *Fact, Fiction, and Forecast*, Cambridge, MA: Harvard University Press.

Howson, C. (2000) *Hume's Problem*, Oxford: Oxford University Press.

Lipton, P. (1991) 'Induction', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

Norton, J. (2003) 'A Material Theory of Induction', *Philosophy of Science*, vol. 70(4): 647-670.

Norton, J. (2005) 'A Little Survey on Induction', in P. Achinstein (ed.), *Scientific Evidence: Philosophical Theories and Applications*, Baltimore: John Hopkins University Press, pp. 9–34.

Popper, K. (1959) 'The Problem of Induction', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

**Special Topic (+Reading):** The New Riddle of Induction

Vickers, J. (2014) 'The Problem of Induction', *Stanford Encyclopaedia of Philosophy*, <http://plato.stanford.edu/entries/induction-problem/> (Section 5.2).

### HT Week 3: THEORIES OF CONFIRMATION: HYPOTHETICO-DEDUCTIVISM

Key questions: Is hypothetico-deductivism too simplistic an account of confirmation? What are the determining features of ad hoc hypotheses? How, if at all, can we respond to confirmation paradoxes like the Raven paradox?

**Essential Reading:**

Popper, K. (1963) 'Science: Conjectures and Refutations', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

**Further Reading:**

Gemes, K. (1998) 'Hypothetico-Deductivism: The Current State of Play; The Criterion of Empirical Significance: Endgame', *Erkenntnis*, vol. 49: 1-20.

Gillies, D. (1993) 'The Duhem Thesis and the Quine Thesis', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

Hempel, C. G. (1945) 'Studies in the Logic of Confirmation', *Mind*, vol. 54: 1–26, 97–121.

O'Hear, A. (1989) 'Falsification', in *An Introduction to the Philosophy of Science*, Oxford: Oxford University Press, Ch. 3.

Quine, W.v.O. (1951) 'Two Dogmas of Empiricism', *Philosophical Review*, vol. 60: 20-43.

**Special Topic (+Reading):** Ad Hoc-ness

Votsis, I. (2016) 'Ad hoc Hypotheses and the Monsters within', in V. C. Müller (ed.), *Fundamental Issues of Artificial Intelligence* (Synthese Library), Berlin: Springer.

### HT Week 4: THEORIES OF CONFIRMATION: BAYESIANISM

Key questions: What is the difference between objective and subjective Bayesians? How are we meant to interpret the probability calculus? What is the problem of old evidence?

**Essential Reading:**

Talbott, W. (2008) 'Bayesian Epistemology', *Stanford Encyclopaedia of Philosophy*, (Summer 2015 Edition), Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/sum2015/entries/epistemology-bayesian/>.

**Further Reading:**

- Carnap, R. ([1950] 1962) *Logical Foundations of Probability*, Chicago: University of Chicago Press.
- Earman, J. And Salmon, W.C. (1999) 'The Confirmation of Scientific Hypotheses', in M. Salmon et al. (eds.) *Introduction to the Philosophy of Science*, Indianapolis: Hackett Publishing Company, ch. 2.
- Gillies, D. (2000) *Philosophical Theories of Probability*, London: Routledge.
- Glymour, C. (1980) 'Why I am not a Bayesian', in M. Curd et al. (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.
- Howson, C. (2008) 'Bayesianism', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge.
- Skyrms, B. (1999) 'Probability and Scientific Inductive Logic', in *Choice and Chance*, fourth edition, Belmont, CA: Wadsworth.

**Special Topic (+Reading): Novel Predictions**

- Hajek, A. and J. M. Joyce (2008) 'Confirmation', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge, pp. 115-118.
- Votsis, I. (2014) 'Objectivity in Confirmation: Post-Hoc Monsters and Novel Predictions', *Studies in History and Philosophy of Science*, vol. 45(1): 70-78.

**HT Week 5: SCIENTIFIC REVOLUTIONS**

Key questions: Does anything survive scientific revolutions? If so, what is its significance for the realism debate?

**Essential Reading:**

- Kuhn, T. (1962) 'The Nature and Necessity of Scientific Revolutions', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

**Further Reading:**

- Bird, A. (2001) *Thomas Kuhn*, Chesham: Acumen.
- Lakatos, I. (1970) 'Falsificationism and the Methodology of Scientific Research Programmes', in I. Lakatos and A.E. Musgrave (eds.) *Criticism and the Growth of Knowledge*, Cambridge: Cambridge University Press.
- Laudan, L. (1977) *Progress and its Problems: Toward a Theory of Scientific Growth*, Berkeley: University of California Press.
- McMullin, E. (1993) 'Rationality and Paradigm Change in Science' in M. Curd et al. (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.
- Worrall, J. (2008) 'Theory-change in Science', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge.

**Special Topic (+Reading): Case Studies**

- Votsis, I. and Schurz, G. (2012) 'A Frame-Theoretic Analysis of Two Rival Conceptions of Heat', *Studies in History and Philosophy of Science*, vol. 43(1): 105-114, Sections 5-6.

## HT Week 6: THE SCIENTIFIC REALISM DEBATE

Key questions: What challenge does constructive empiricism pose for realism? Are there always empirically equivalent rivals to any given theory? What is the no miracles argument? What is the pessimistic meta-induction argument?

### Essential Reading:

Laudan, L. (1981) 'A Confutation of Convergent Realism', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

### Further Reading:

Fahrbach, L. (2011) 'How the Growth of Science Ends Theory Change', *Synthese*, vol. 180(2): 139–155.

Hardin, C.L. and Rosenberg, A. (1982) 'In Defence of Convergent Realism', *Philosophy of Science*, vol. 49: 604-615.

Lyons, T.D. (2002) 'Scientific Realism and the Pessimistic Meta-Modus Tollens', in S. Clarke and T.D. Lyons (eds.) *Recent Themes in the Philosophy of Science*, Dordrecht: Kluwer Academic Publishers.

Van Fraassen, B. (1980) *The Scientific Image*, Oxford: Clarendon Press.

Votsis, I. (2012) 'The Prospective Stance in Realism', *Philosophy of Science*, vol. 78(5): 1223-1234.

Worrall, J. (1989) 'Structural realism: The best of both worlds?', in D. Papineau (ed.), *The Philosophy of Science*, Oxford: Oxford University Press, 1996.

### Special Topic (+Reading): Underdetermination

Douven, I. (2008) 'Underdetermination', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge, pp. 292-294.

## HT Week 7: READING WEEK

## HT Week 8: THEORIES OF EXPLANATION

Key questions: Must explanation involve deduction? What are the problems faced by the inductive-statistical account of explanation? Is the neo-classical account of reduction viable? If entailment is too strong as a logical relation between reduced and reducing fields or theories, what logical relation, if any, is adequate? Can we still speak of reduction when the meaning of the notions involved diverges?

### Essential Reading:

Hempel, C.G. (1962) 'Two Basic Types of Scientific Explanation' in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

### Further Reading:

Friedman, M. (1974) 'Explanation and Scientific Understanding', *Journal of Philosophy*, Vol. 71(1): 5-19.

Kitcher, P. (1981) 'Explanatory Unification', *Philosophy of Science*, vol. 48: 507–31.

- Salmon, M. (1989) 'Explanation in the Social Sciences', in P. Kitcher & W. Salmon (eds.), *Minnesota Studies in Philosophy of Science* (Volume 13), pp. 384-409.
- Salmon, W. (1984) *Scientific Explanation and the Causal Structure of the World*, Princeton, NJ: Princeton University Press.
- Woodward, J. (2008) 'Explanation', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge.

**Special Topic (+Reading): Inference to the Best Explanation**

- Lipton, P. (2008) 'Inference to the Best Explanation', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge.

**HT Week 9: CAUSATION**

Key questions: What is causation? How, if at all, does it differ from (mere) correlation? Can we speak of probabilistic causation? Can manipulability accounts of causation be given in non-circular terms? Is causation a unified category? How does causation relate to explanation? Is it legitimate to count omissions as causes?

**Essential Reading:**

- Woodward, J. (2003) *Making Things Happen*, Oxford: OUP, Ch. 1.

**Further Reading:**

- Cartwright, N. (2004a) 'From Causation to Explanation and Back', in B. Leiter (ed.), *The Future for Philosophy*, Oxford: Oxford University Press.
- Cartwright, N. (2004b) 'Causation: One Word, Many Things', *Philosophy of Science*, vol. 71(5): 805-819.
- Dowe, P. (2000) *Physical Causation*, Cambridge: Cambridge University Press.
- Hall, N. (2004) 'Two Concepts of Causation', in J. Collins, N. Hall and L. Paul (eds.), *Causation and Counterfactuals*, Cambridge: MIT Press, pp. 225–276.
- Lombrozo, T. (2010) 'Causal-Explanatory Pluralism: How Intentions, Functions, and Mechanisms Influence Causal Ascriptions', *Cognitive Psychology*, vol. 61: 303–32.
- Pearl, J. (2000) *Causality: Models, Reasoning and Inference*, Cambridge: Cambridge University.
- Psillos, S. (2002) *Causal Asymmetries*, Stocksfield, UK: Acumen Publishing.
- Spirtes, P., C. Glymour and R. Scheines (2000) *Causation, Prediction and Search*, 2nd edition, Cambridge: MIT Press.
- Woodward, J. (2006) 'Sensitive and Insensitive Causation', *Philosophical Review*, vol. 115: 1–50.

**Special Topic (+Reading): Unifying Power**

- Jones, T. (2008) 'Unification', in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge, pp. 489-496.

**HT Week 10: LAWS OF NATURE**

Key questions: What is a law of nature? How, if at all, does it differ from accidental generalisations? Do laws of nature tell us how things must behave? What is a *ceteris paribus* law? Are there really any such laws?

**Essential Reading:**

Beebe, H. (2000) 'The Non-Governing Conception of Laws of Nature', *Philosophy and Phenomenological Research*, vol. 61(3): 571-594.

**Further Reading:**

Armstrong, D.M. (1983) *What is a Law of Nature?*, Cambridge: Cambridge University Press.

Ayer, A.J. (1956) 'What Is a Law of Nature?', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

Cartwright, N. (1980) 'Do the Laws of Physics State the Facts?', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

Dretske, F. I. (1977) 'Laws of Nature', in M. Curd, J.A. Cover and C. Pincock (eds.) *Philosophy of Science: The Central Issues*, second edition, New York: W.W. Norton & Company, 2012.

Loewer, B. (1996) 'Humean Supervenience', *Philosophical Topics*, vol. 24(1): 101–127.

Woodward, J. (2002) 'There is no such Thing as a *Ceteris Paribus* Law', *Erkenntnis* 52: 303–328.

**Special Topic (+Reading):** *Ceteris Paribus* Clauses

Reutlinger, A. et al. (2011) '*Ceteris Paribus* Laws', *Stanford Encyclopaedia of Philosophy*, <http://plato.stanford.edu/entries/ceteris-paribus/> (Sections 1.1 - 1.2).

**HT Week 11: NATURAL KINDS**

Key questions: What are natural kinds? How are they different from non-natural kinds? Does nature really have joints? If so, can these joints be found in some domains (e.g. physics and chemistry) but not others (biology and psychology)?

**Essential Reading:**

Ellis, B. (2008) 'Essentialism and Natural Kinds' in M. Curd and S. Psillos (eds.), *The Routledge Companion to Philosophy of Science*, New York, NY: Routledge.

**Further Reading:**

Goodman, N. (1954) *Fact, Fiction, and Forecast*, Cambridge, MA: Harvard University Press.

Hendry, R. (2006) 'Elements, Compounds and Other Chemical Kinds', *Philosophy of Science*, 73: 864–875.

Kripke, S. (1972) *Naming and Necessity*, Oxford: Blackwell Publishers.

Putnam, H. (1975) 'The meaning of "meaning"', in *Mind, Language, and Reality: Philosophical Papers*, vol. II, Cambridge: Cambridge University Press.

Quine, W.V.O. (1969) 'Natural Kinds', in *Ontological Relativity and Other Essays*, New York: Columbia University Press, pp. 114-138.

**Special Topic (+Reading):** Dispositions

Schurz, G. (2013) *Philosophy of Science: A Unified Approach*, New York:  
Routledge, Section 3.10 (pp. 135-140).

## **HT Week 12: COLLECTIONS**

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