

DEPARTMENT OF PHILOSOPHY
School of Philosophy, Theology & Religion
UNIVERSITY OF BIRMINGHAM

Philosophy of Science
Banner code: PHIL 08 20248

20 Credits

MODULE GUIDE
2008/2009

This module outline **must** be read in conjunction with the relevant sections of *The Philosopher's Stone* and the *Philosophy Study Guide*, available from the Philosophy Office (room 107).

MOMD and Erasmus students should pick up a student pack (including the *Stone* and the *Philosophy Study Guide*) from the Philosophy Office. Erasmus students, please note that your attendance and assessment requirements are exactly the same as for all other students on this module. Please see the *Philosopher's Stone* for more information.

1. GENERAL INFORMATION

Module convenor: Dr. Samuel Schindler
Office number: room 109, Arts building, first floor
Email: s.schindler@bham.ac.uk
Office hours: Tuesdays 11-12, Fridays 11-12, or by appointment

Semester: Two
Credit rating: 20
Level: I (year 2)

Tutor: Seminars for this module will be taken by a tutor, who is a Postgraduate Teaching Assistant in the Department: Nigel Leary, nigel@leary@hotmail.com.

Seminar tutors do not have office hours; however, your seminar tutor will be very happy to talk to you about any aspect of this module by appointment. Please email him (or speak to him before or after your seminar) to arrange a place and time to meet.

2. ABOUT THE MODULE

MODULE SUMMARY

The philosophy of science can be approached in at least two different ways: *ontologically* and *epistemically*. According to the former approach, one may be interested in questions to do with the nature of scientific theories, scientific models, phenomena and scientific laws, and even with the nature of science itself (what is it that makes something a science?). Although we will discuss two important ontological topics in the second part of this course, this course will predominantly be concerned with epistemological questions: How is scientific knowledge established and how certain is this knowledge, which role do theories and experiments play respectively in the production of this knowledge, can we have any knowledge about things we cannot observe, and is there any (cumulative) progress in the knowledge we acquire about the world?

Starting with a challenge to a ‘common sense view’ about science, we will work our way through the classical topics of induction, Popper’s falsificationism, the “historical turn” brought about by T.S. Kuhn, and appreciated in Lakatos’s methodology of research programmes. We will consider different notions of natural laws, scientific explanation and at the end of the semester, this module will introduce the main positions of the realism-antirealism debate, arguably the most important debate within contemporary philosophy of science.

3. MODULE ORGANISATION

Classes: 11:00 – 12:00, Wednesday, Arts Lecture room 5. There will be a reading week in Week 6. There will be no classes during Reading Week.

There will be a weekly one-hour lecture and weekly one-hour seminar for small group discussion. **Attendance is compulsory for both lectures and seminars and you are expected to prepare for lectures and seminars.** In seminars you will be working on a previously read text, either individually or in groups. No reading is set for the first class, but I recommend that you have a look at one of the introductory texts in the Philosophy of Science that you find under “textbooks” in the reading list below. The class will be divided into three seminar groups:

Tuesday 10 am to 11 am in Mechanical Engineering B24

Wednesday 10 am to 11 am in Philosophy Seminar Room 104

Thursday 10 am to 11 am in Philosophy Seminar Room 104

**** You will have to sign up to one of these seminar groups in the first lecture of this course! If you fail to turn up in the first lecture (for whatever reason) you will have to talk to Janet Elwell.****

Work and attendance

The work and attendance requirements for this course are that you:

- **Attend all seminars.** If you are absent from a seminar through illness or for any other reason, you should inform the tutor as soon as possible – if possible, *before* the class.
- **Prepare adequately for seminars** as directed by your tutor or the module convenor.

- **Complete written work on time:** Failure to complete assessed work by the due date constitutes a violation of the work and attendance requirements.

Persistent violations of work and attendance requirements will be reported to the Senior Tutor. If you have difficulties (e.g. personal, financial or family problems) that result in persistent failure to meet the work and attendance requirements, you should talk to your academic tutor or the Welfare Tutor.

Students are required by University regulations to display ‘due diligence’. Failure to do so may result in your being barred from assessment, which can lead ultimately to exclusion from your degree programme.

Study budget

The University’s Code of Practice specifies that a 20-credit module is expected to require about 200 hours work by students.

For this module, you are recommended to break this down roughly as follows:

Classes	20 hours
Preparation for classes	10 x 7 hours = 70 hours
Essay 1	20
Essay 2	20
Essential research / reading	40
Additional research / reading	30
TOTAL:	200 hours

Prompt arrival at classes

Students should note that all classes in the University start **on the hour** and should end at 50 minutes past the hour. Late arrival at classes may result in your being marked absent; if you arrive late it is your responsibility to ensure that your presence has been noted.

4. ASSESSMENT

The assessment for this module is as follows:

ASSESSMENT CRITERIA

For the Philosophy Department’s assessment criteria and guidance on how to meet them, see the *Philosophy Study Guide*.

ASSESSED ESSAYS

Two essays of 1500 words each should be chosen from the list provided below.

Presentation

Essays must be typed in at least 12 point in a readable font, with wide margins and page numbers, and should **not** be single spaced. They should include proper bibliography and references; **marks will be deducted for inadequate referencing/bibliography**. See the *Study Guide* for guidelines and the *Philosopher's Stone* for information about penalties.

Failure to provide adequate referencing can amount to plagiarism. Plagiarism is a form of cheating and can lead to exclusion from your degree programme. Please see the *Study Guide* for guidance on avoiding plagiarism and the *Philosopher's Stone* for information about how cases of plagiarism are dealt with.

Word limit

Your essay **MUST NOT** exceed the word limit stated above. **You must state the exact number of words used (excluding bibliography) at the end of the main text of your essay, and again on the essay submission form.** If you fail to do this, your essay may be returned to you so that you can add this information, and this may significantly delay the marking process.

See the *Philosopher's Stone* for more information about the word limits and penalties for exceeding them.

Deadlines

The first essay must be handed in by **10th March 2009**.

The second essay must be handed in by **5th May 2009**.

See the *Philosopher's Stone* for information about the granting of extensions and penalties for unexcused late submission. Late submissions for which no extension has been granted will be penalised at a rate of 5 marks per day.

Handing in your essay

You must hand **two copies** of your essay by 12.30pm on the due date, to the Philosophy Office. An essay submission form must be included with your essay; you can fill this in when you submit your essay. See the *Philosopher's Stone* for more information about essay hand-ins.

Uploading your essay to turnitinUK

You must upload your essay to turnitinUK prior to handing in the hard copies. You will be asked to tick a box confirming this on the essay submission form, and your essay will not be accepted unless you have ticked the box (or attach the form excusing you from this, signed by the Department's plagiarism officer). The essay you submit in hard copy **MUST** be exactly the same as the one you upload to turnitinUK. However if discrepancies do occur, it will be the hard copy that is assessed. See the *Philosopher's Stone* for more information.

Return of assessed essays

A report on your first assessed essay should be available by **14th April 2009** provided the essay is submitted on time. A report on your second assessed essay should be available by **9th June 2009** provided the essay is submitted on time. You will receive an email (to your bham.ac.uk account) as

soon as your essay is available to pick up from the Philosophy Office; please **do not try to pick up your essay before you have received the email.**

Please note that all essay marks are provisional until confirmed by the Board of Examiners in June. Note also that you are NOT entitled to question the academic judgement of the person marking your essay. If you are unhappy with your mark, you should make an appointment with the member of staff who marked the essay to discuss your performance. If you are still not satisfied, you can raise the issue with the Head of Department, who may then arrange for a second member of staff to look at the essay. The HoD will not do this unless you have already discussed your essay with the person who marked it.

Students are welcome to discuss their essay with the module convenor or their academic tutor during office hours.

ESSAY TITLES

First essay:

1. What is the problem of induction and what is Popper's "solution" to it? Assess how the latter fares!
2. According to Kuhn, Normal Science does not seek to produce conceptual or phenomenal novelties (cf. first sentence of Chapter 4 of his *Scientific Revolutions*). This seems highly counter-intuitive. What may argue *in favour* of such a claim?
3. Does Lakatos' attempted "compromise" between Kuhn's "normal science" and Popper's falsificationism succeed? (You may, but you need not, pay particular attention to the notion of novel predictions in this context)
4. On the basis of historical examples, Kuhn and Feyerabend argued that theories/paradigms are incommensurable. What does that mean and what are the implications? Is there any way to evade these implications?

Second essay:

1. Philosophers have defended two principal views on laws of nature: laws as empirical regularities or laws as principles which govern the empirical world. Both views seem to come with (at least) one major flaw each. Identify, evaluate, and compare these flaws!
2. What conditions must be met for an explanation to be satisfactory, on the DN model of explanation? Explain the difference between objections that these conditions are not necessary and objections that they are not sufficient. Explain and evaluate one objection of each sort. Conclude with an overall assessment of the DN model of explanation.
3. What is the underdetermination of theories by evidence? In what ways can the realist respond to this antirealist argument? Does any of these arguments manage to rebut this attack?
4. What is the Pessimistic Meta Induction? Is structural realism, as Worrall (1989) contends, really the best of both worlds?

Do not hand in your second essay using a title from those listed for the first essay. **Do not** hand in your first essay using a title from those listed for the second essay.

5. OUTLINE OF THE MODULE

Week 1 (beginning 12 Jan):	Introduction, Overview, and Observability & Theory-ladenness
Week 2 (beginning 19 Jan):	The problem of induction
Week 3 (beginning 26 Jan):	Falsificationism and its limits
Week 4 (beginning 2 Feb):	The historical turn and T.S. Kuhn's Paradigms
Week 5 (beginning 9 Feb):	Lakatos' Research Programmes and Feyerabend's Methodological Pluralism
Week 6 (beginning 16 Feb):	READING WEEK (no classes)
Week 7 (beginning 23 Feb):	Scientific explanation
Week 8 (beginning 2 March):	Laws of nature
Week 9 (beginning 9 March):	The realism-antirealism debate I (Underdetermination of Theories by Evidence and Constructive Empiricism)
Week 10 (beginning 16 March):	The realism-antirealism debate II (Pessimistic Meta Induction and Structural Realism)
Week 11 (beginning 23 March):	RECAP

6. READING LIST

Compulsory purchase: There is no compulsory purchase for this course.

Recommended purchases:

- Chalmers, Alan (1999), *What is this thing called science*, 3rd edition.
- Ladyman, James (2002), *Understanding philosophy of science*, London: Routledge
- Bortolotti, Lisa (2008), *Introduction to the philosophy of science*, Polity Press.
- Okasha, Samir (2002), *A very short introduction to the philosophy of science*, Oxford University Press.

Course pack: A course pack is available for this module for £1. This includes readings for the seminars. If you have not yet bought a course pack, please buy one from the Philosophy Office.

Required seminar readings (incl. further readings and background readings):

Topic 1 (WEEK 2, beginning 19 Jan): **Observability and Theory-ladenness**

Required:

Maxwell, G. (1962) 'The Ontological Status of Theoretical Entities', reprinted in C&C, pp. 1052-1063.

Hacking, I. (1983), *Representing and Intervening*, chapter 10, 'Observation', pp. 167-185.

Further readings:

Carnap, R. (1956) 'The Methodological Character of Theoretical Concepts', *The Foundations of Science and the Concepts of Psychology and Psychoanalysis*, H. Feigl and M. Scriven (eds.), Minnesota Studies in the Philosophy of Science, vol. 1, Minneapolis: University of Minnesota Press.

Lewis, D. (1970) 'How to Define Theoretical Terms', *Journal of Philosophy*, vol. 67(13): pp. 427-446.

Quine, W.V. (1993) 'In Praise of Observation Sentences', *Journal of Philosophy*, vol. 90(3): 107-116. Chalmers, A. (2003) 'The Theory-dependence of the Use of Instruments in Science', *Philosophy of Science*, vol. 70(3): 493-509.

Franklin, A. (1997) 'Calibration', *Perspectives on Science*, vol. 5: 31-80.

Rasmussen, N. (1993) 'Facts, Artifacts, and Mesosomes: Practicing Epistemology with the Electron Microscope', *Studies in History and Philosophy of Science*, vol. 24(2): 227-265.

Background readings:

Chalmers, A. *What is this thing called science?*, chapters 1-3

Hacking, I., *Representing and Intervening*, chapter 10

Topic 2 (WEEK 3, beginning 26 Jan): **The problem of induction**

Required:

Hume, D. *Enquiry Concerning Human Understanding*, Section IV (parts I and II). Online at <http://eserver.org/18th/hume-enquiry.html>

Okasha, S. (2001), "What did Hume really show about induction?", *The Philosophical Quarterly*, vol. 51, no. 204

Further readings:

Popper, K. "The problem of induction", CC, pp. 426-432

See references in the background readings

Background readings:

Chalmers 4 & 5; Ladyman 2&3; Bortolotti 2, 3

Topic 3 (WEEK 4, beginning 2 Feb): **Falsificationism and its limits**

Required:

Popper, K. "Conjectures and refutations", C&C, pp. 3-11

Duhem, P. "Physical Theory and Experiment", C&C pp. 257-279.

Further readings:

Barrett, R. (1969) 'On the Conclusive Falsification of Scientific Hypotheses', *PhilSci* 36, pp.363-374.

Grünbaum, A. (1976) 'Is Falsifiability the Touchstone of Scientific Rationality? Karl Popper versus Inductivism', in Cohen, R.S., Feyerabend, P.K. & Wartofsky, M. (eds.) *Essays in Memory of Imre Lakatos*, Dordrecht: Reidel, pp.213-252.

Grünbaum, A. (1976) 'Ad Hoc Auxiliary Hypotheses and Falsification'. *BJPS* 27, pp. 329-62.

Readings in Lakatos, I. & A. Musgrave: *Criticism and the Growth of Knowledge*, Cambridge University Press

Background readings:

Chalmers 6 & 7; Bortolotti 1,2,4; Ladyman 2

Topic 4 (WEEK 5, beginning 9 Feb): **The historical turn and T.S. Kuhn's Paradigms**

Required:

Kuhn, T.S., "The Nature and Necessity of Scientific Revolutions", in C&C, pp. 86-101

Kuhn, T.S., "Anomaly and Emergence of Scientific Theories", Chpt 6 of *The Structure of Scientific Revolutions*, pp. 52-65

Further readings:

Popper, K, "The Rationality of Scientific Revolutions", in Ian Hacking, ed. , *Scientific Revolutions* (Oxford: Oxford University Press, 1981), pp. 80-106
Popper, K., „Normal Science and Its Dangers”, in Imre Lakatos and Alan Musgrave, eds., *Criticism and the Growth of Knowledge* (Cambridge: Cambridge University Press, 1970), pp. 51-58.
Readings in Lakatos, I. & A. Musgrave: *Criticism and the Growth of Knowledge*, Cambridge University Press

Background readings:

Chalmers 8, Ladyman 4, Bortolotti 5

WEEK 6 (beginning 16 Feb):

READING WEEK (no classes)

Topic 5 (WEEK 7, beginning 23 Feb): **Lakatos’ Research Programmes and Feyerabend’s Methodological Pluralism**

Required:

Lakatos, I. & A. Musgrave: *Criticism and the Growth of Knowledge*, Cambridge University Press, 1970, p. 132-159 ONLY.

Hacking, I. (1979) ‘Imre Lakatos’ Philosophy of Science’, *The British Journal for the Philosophy of Science*, Vol. 30, No. 4 (Dec., 1979), pp. 384-391, and pp. 394-398 ONLY.

Further readings:

Brendan Larvor, *Lakatos: An Introduction* (London and New York: Routledge, 1998).

Laudan, L. (1986) ‘Scientific Change: Philosophical Models and Historical Research’, *Synthese*, p. 69

Musgrave, Alan (1974): “Logical Versus Historical Theories of Confirmation.” *The British Journal for the Philosophy of Science* **25**: 1-23.

Snyder, L., “Is Evidence Historical”, C&C, pp. 460-481

Achinstein, P., “Explanation v. Prediction”, C&C, pp. 481-494

Schindler, S., (2008) “Use-novel predictions and Mendeleev’s Periodic Table”, *Studies in Hist. Phi. Sci.*, Vol. 39, Issue 2, June 2008, Pages 265-269 [contains a brief summary of the “novelty” debate and many references]

T. S. Kuhn, “Notes on Lakatos”, *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, (1970), pp. 137-146

Feyerabend, P., *Anything goes*, Chapters 1-4

Worrall, J. (1978) ‘Against Too Much Method’, *Erkenntnis* 13.

Machamer, P. (1973) ‘Feyerabend and Galileo: The Interaction of Theories, and the Reinterpretation of Experience’, *Studies in Hist and Phil of Sci.*, vol. 4, pp. 1-46..

Laudan, L. (1989) ‘For Method: or, Against Feyerabend’, in J.R. Brown & J. Mittelstrass (eds.) *An Intimate Relation*, Dordrecht: Kluwer.

Background readings:

Chalmers 8, Ladyman 4, Bortolotti 5

Topic 6 (WEEK 8, beginning 2 March): **Scientific Explanation**

Required:

Hempel, C. “Two Basic Types of Scientific Explanation”, CC, pp. 685-695.

Hempel, C. “The thesis of structural identity”, in C&C, pp. 695-705.

Further readings:

M. Friedman (1974) “Explanation and scientific understanding”, *Journal of Philosophy* **71**, 1-19.
Download online from JSTOR <http://www.jstor.org/action/showBasicSearch>

P. Kitcher (1989) “Explanatory unification and the causal structure of the world” in P. Kitcher and W. Salmon (eds.) *Scientific explanation*, Minnesota Studies in the Philosophy of Science Vol. XIII, pp. 410–505.

Van Fraassen (1980) *The scientific image*, ch. 5.

P. Humphreys (1989) “Scientific explanation: the causes, some of the causes, and nothing but the causes”, in P. Kitcher and W. Salmon (eds.) *Scientific explanation*, Minnesota Studies in the Philosophy of Science Vol. XIII, pp. 283–306

Van Fraassen “The pragmatics of explanation” in Boyd, Gasper and Trout (eds.) *Philosophy of science*, pp. 317–328

For many references see also Woodward (2008) (see below)

Background readings:

W. Salmon “Four decades of scientific explanation”, reprinted in P. Kitcher and W. Salmon (eds.) *Scientific explanation*, Minnesota Studies in the Philosophy of Science Vol. XIII, see especially Sections 0, 1, and 2, pp. 3–60

Woodward, J. (2008), “Scientific Explanation”, *The Stanford Encyclopedia of Philosophy (Fall 2008 Edition)*, Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/fall2008/entries/scientific-explanation/>.

Topic 7 (WEEK 9, beginning 9 March): **Laws of Nature**

Required:

Cartwright, N., “Do the Laws of Physics State the Facts?”, C&C pp. 865-878.

Cartwright, N., “Fundamentalism vs. the patchwork of laws”, in Papineau, D. (ed). *The Philosophy of Science*

Further readings:

Regularity view

Ayer, A. “What is a law of nature?”, in Curd and Cover, pp. 808–825

Dretske, F. “Laws of nature” in C&C pp. 826-845.

David Lewis (1973) *Counterfactuals* pp. 72-77. (a classic text for the regularity theory)

D. M. Armstrong (1983) *What is a law of nature?* (Cambridge: Cambridge University Press), ch. 1, 2, 5 (see also other interesting chapters 3 and 4 in the same book).

Necessitarian view

Bas van Fraassen (1989) *Laws and symmetry*, (Oxford: Clarendon), ch, 3

David Lewis (1994) “Humean supervenience debugged” *Mind* **103**, pp. 478–9 only

Barry Loewer “Humean supervenience” in John W. Carroll *Readings on laws of nature* ch. 10.

Van Fraassen “Armstrong on laws and probabilities” in John W. Carroll (ed.) *Readings on laws of nature* (University of Pittsburgh Press), ch. 6.

Bas van Fraassen (1989) *Laws and symmetry*, (Oxford: Clarendon), pp. 94-109.

J. Bigelow, B. Ellis, C. Lierse “The world as one of a kind” in John W. Carroll *Readings on laws of nature* ch. 8.

M. Tooley “Laws of nature” in John W. Carroll *Readings on laws of nature* ch. 2

Cartwright on laws

Cartwright, N. (1983), *How the Laws of Physics Lie*, Oxford Clarendon Press.

Cartwright, N. (1994), *Nature and Capacities*, Oxford Clarendon Press.

Cartwright, N. (1999), *The dappled world*, Cambridge University Press.

Chalmers, A. (1993), ‘So the laws of physics needn’t lie’, *Australasian Journal of Philosophy*, 71:2, pp. 196 -205.

Cartwright, N. (1995), “Precis of Nature’s Capacities and their measurement”, *Philosophy and Phenomenological Research*, Vol. 55, no.1, pp. 153-156

Humphreys, P. (1995), “Abstract and Concrete”, *Philosophy and Phenomenological Research*, Vol. 55, no.1, pp. 157-161

Morrison, M. (1995), “Capacities, Tendencies, and the Problem of Singular Causes”, *Philosophy and Phenomenological Research*, Vol. 55, no.1, pp. 163-168

Background readings:

Bird, A. (1998), *Philosophy of Science*, McGill Queens, chapter 1.

J. W. Carroll “Laws of nature”, download online from <http://plato.stanford.edu/entries/laws-of-nature/> (see especially Sections 1, 2, 3 and 8).

Rosenberg, A. *The Philosophy of Biology: A Contemporary Approach* (contains a chapter on laws in biology).

Background readings:

Chalmers 14

Topic 8 (WEEK 10, beginning 16 March): **The Realism-Antirealism Debate I**

Required:

Van Fraassen, B. "Arguments concerning Scientific Realism", C&C, pp. 1064-1087

Further readings:

See the readings in Leplin, J. (ed.) and further references in the background readings

Background readings:

Ladyman chpt. 6, Bortolotti 4

Topic 9 (WEEK 11, beginning 23 March): **The Realism-Antirealism Debate II**

Required:

Worrall, J. (1989) "Structural realism, the best of both worlds", *Dialectica*, reprinted in: Papineau (ed.), pp. 139-165

Further readings:

Ladyman, J. (1998). What is structural realism? *Studies in History and Philosophy of Science* 29: 409–424.

Fine, A. The natural ontological attitude, CC, pp. 1186-1208

Musgrave, A., NOA's Ark –Fine for Realism, CC pp. 1209-1226

See the readings in Leplin, J. (ed.) and further references in the background readings

Background readings:

Ladyman, James, "Structural Realism", The Stanford Encyclopedia of Philosophy (Fall 2008

Edition), Edward N. Zalta (ed.), <<http://plato.stanford.edu/archives/fall2008/entries/structural-realism/>>.

Psillos, S., *How Science Tracks Truth*

Bortolotti, chapter 4