

ACADEMIC SESSION 2010-2011

PH3580 SCIENTIFIC METHODOLOGY

Credits: 15; number of weeks: 12

PLEASE NOTE CAREFULLY:

The full set of school regulations and procedures is contained in the Undergraduate Student Handbook which is available online at <http://www.abdn.ac.uk/sdhp/ugradstudenthandbook/>. Students are expected to familiarise themselves not only with the contents of this leaflet but also with the contents of the Handbook. Therefore, ignorance of the contents of the Handbook will not excuse the breach of any school regulation or procedure.

You must familiarise yourself with this important information at the earliest opportunity.

COURSE CO-ORDINATOR/COURSE TEAM

Dr Luca Moretti,

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Office hours: Mon 13:00-15:00

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Discipline Secretary:

Tracy Noden

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TIMETABLE

Lectures (weekly from week 30): Thursday 3-4pm in TAYLOR A12

Tutorials (fortnightly from week 31): Wednesday 1-2pm in KING'S COLLEGE
KGC16

Students can view the University Calendar at

<http://www.abdn.ac.uk/sdhp/documents/weeknumbers2010-11.pdf>.

COURSE DESCRIPTION

This course aims at uncovering what is constitutive of scientific rationality.

The course is divided into two parts. In the first part, some of the most important conceptions of scientific methodology, including Baconian inductivism, Popper's falsificationism, Lakatos' methodology of research programs, and Feyerabend's anarchism, will be analysed. We will test these views on the historical case of the Copernican revolution.

The second part focuses on the problem of constructing a *formalized* system of inductive logic. In particular, we will analyse Hempel's conception of confirmation, formulations of Hypothetico-Deductivism and modern Bayesianism. Specific and "technical" topics, including the classical problem of induction, the Duhem-Quine thesis and paradoxes of confirmation will also be surveyed.

COURSE AIMS

To introduce students to scientific methodology and inductive reasoning.

To give students insight into the central problems of scientific methodology.

To test methodological views on concrete scientific cases.

To explore connections between scientific methodology and other disciplines such as epistemology and formal epistemology.

INTENDED LEARNING OUTCOMES

To learn important differences and relations existing between inductive and deductive reasoning.

To understand the essential contribution of methodology to the epistemological status of science.

To appreciate points of strength and weakness of rival scientific methodologies.

To be able to read and critically discuss journal articles carefully and identify key arguments.

To be able to articulate ideas clearly, confidently and systematically.

LECTURE/SEMINAR PROGRAMME

Part I: *Scientific methodology*

Week 1 Lecture: scientific rationality and basic notions

Week 2 Lecture: a case study - Copernican revolution I

Week 3 Lecture: a case study - Copernican revolution II

Week 4 Lecture: Baconian inductivism

Week 5 Lecture: Popper's falsificationism I

Week 6 Lecture: Popper's falsificationism II

Week 7 Lecture: Lakatos' methodology

Week 8 Lecture: Lakatos' methodology and Feyerabend's criticism

Part II: *Inductive logic and confirmation theory*

Week 9 Lecture: the classic problem of induction

Week 10 Lecture: Hempel on the logic of confirmation

Week 11 Lecture: Hypothetico-Deductivism

Week 12 Lecture: Bayesianism

READING LIST

All readings are required.

**** = *in the Heavy Demand section of QML*

A copy of each section/paper in the Heavy Demand section will also be available at my office door some days before the relevant class.

YOU MUST RETURN THE COPY AS SOON AS POSSIBLE ONCE YOU HAVE PHOTOCOPIED IT

Week 1

*J. Ladyman, *Understanding philosophy of science* (Routledge, 2002), pp. 1-18.

*B. Skyrms, *Choice and Chance* (Wadsworth, 2000 Fourth Edition), Ch. 2, "Probability and inductive logic".

Week 2

*T. Kuhn, *The Copernican revolution* (Harvard Univ. Press, 1985), Chs. 1 & 2.

Week 3

*T. Kuhn, *The Copernican revolution*, Chs. 5 & 6.

Week 4

*J. Ladyman, *Understanding philosophy of science*, pp. 18-31 and 52-61.

"Francis Bacon" in the Stanford Encyclopedia of Philosophy
(URL: <http://plato.stanford.edu/entries/francis-bacon/>).

Week 5

*K. Popper, "Science: conjectures and refutations" in M. Curd and J. A. Cover (eds.), *Philosophy of science: the central issues* (W.W. Norton & Co, 1998), pp. 3-10.

*J. Ladyman, *Understanding philosophy of science*, pp. 62-81.

Week 6

*J. Ladyman, *Understanding philosophy of science*, pp. 81-92.

*I. Lakatos, "Falsificationism and the methodology of scientific research programmes" in I. Lakatos, *Philosophical Papers* Vol. 1. (Cambridge Univ. Press, 1978), pp. 8-31 (i.e. from the beginning to Sect 2(c) excluded).
Lakatos' paper is included also in *I. Lakatos and A. Musgrave (eds.), *Criticism and Growth of Knowledge* (Cambridge, Univ. Press, 1970).

Week 7

*I. Lakatos, "Falsificationism and the methodology of scientific research programmes" in his *Philosophical Papers*, Vol 1, pp. 31-52 (i.e. from Sect 2(c) to Sect 3(b) all included), pp. 68-73 (i.e. Sect 3(d)), and pp. 86-90 (i.e. Sect 3(d.4)).

Week 8

*I. Lakatos, "Why did Copernicus research programme supersede Ptolemy's?" in his *Philosophical Papers*, Vol. 1, pp. 168-189.

*P. Feyerabend, *Against Method* (Verso, 2003), Chs. 8-10.

*P. Feyerabend, "Consolations for the specialist" in his *Philosophical Papers* Vol. 2 (Cambridge Univ. Press, 1981), Sect. 9.

NOTE that Feyerabend's *Philosophical Papers* Vol. 2 is also titled *Problems of Empiricism*.

Week 9

*J. Ladyman, *Understanding philosophy of science*, pp. 32-52.

*M. H. Salmon (et al.), *Introduction to philosophy of science*, (Hackett, 1999), pp. 55-66.

Week 10

*M. H. Salmon (et al.), *Introduction to philosophy of science*, pp. 42-44 and 49-52.

*C. Hempel, "Studies in the Logic of Confirmation", in his *Aspects of Scientific Explanation: and Other Essays in the Philosophy of Science* (Free Press, 1965), pp. 3-39.

Week 11

*M. H. Salmon (et al.), *Introduction to philosophy of science*, pp. 44-49.

T. Grimes. "Truth, Content, and the Hypothetico-Deductive Method", *Philosophy of Science* 57 (1990), pp. 514-22. (Download it from [jstor](#))

Week 12

*"Commentary: Bayes for beginners", in M. Curd and J. A. Cover (eds.), *Philosophy of science: the central issues*, pp. 627-638.

*M. H. Salmon (et al.), *Introduction to philosophy of science*, pp. 66-99.

SECONDARY READING

General anthologies

Boyd, R., Gasper, P. and Trout J.D. (1991) *The Philosophy of Science*.
Cambridge, Mass: London: MIT Press.

Curd M. and Cover J.A. (1998). *Philosophy of Science: The Central Issues*.
London: W.W. Norton. (You find it in the *Heavy Demand Section*).

Papineau, D. (1996). *The Philosophy of Science: Oxford Readings in
Philosophy* Oxford: OUP.

The demarcation problem (science and pseudoscience)

Lakatos, I.(1973) 'Science & Pseudoscience' in Curd and Cover (1998).

Hanson, S. O. (2008) 'Science & Pseudoscience' *Stanford Encyclopedia of
Philosophy* (on line).

Ruse. M.(1998). 'Creation Science is Not Science' in Curd and Cover (1998).

Thagard, P. R. (1978). 'Why Astrology is a Pseudo-Science' PSA:
Proceedings of the Biennial Meeting of the Philosophy of Science
Association, Vol. I, Contributed Papers, pp. 223-234

Baconian inductivism

Hesse, M. (1964), 'Francis Bacon's Philosophy of Science'. In D. J. O'Connor
(ed.), *A Critical History of Western Philosophy*. New York, pp.141-152.

Peltonen, M. (1996). *The Cambridge Companion to Bacon*, Cambridge:
Cambridge University Press.

Popper, K. (1963) *Conjectures & Refutations*. London: Routledge & Kegan
Paul, Chapter 3.

Zegorin, P. (2001). 'Francis Bacon's Concept of Objectivity and the Concept
of the Idols of the Mind'. *British Journal for the History of Science* 34(4),
pp.379-393.

Popper's falsificationism

Popper, K. (1959) *The Logic Of Scientific Discovery*. New York: Basic Books.

Popper, K. (1963) *Conjectures and Refutations*. London: Routledge and
Kegan Paul.

This is a good anthology (in two volumes):

Schilpp, P.A. *The Philosophy of Karl Popper*. La Salle: Open Court Press.

- Popper, K. (1959) 'The Problem of Induction'. In his *The Logic of Scientific Discovery*, New York: Basic Books, pp. 27-34. Also included in Curd and Cover (1998).
- Popper, K. (1963). 'Science, Conjectures and Refutations'. In his *Conjectures and Refutations*. London: Routledge and Kegan Paul, pp. 33-39.
- Chalmers, A. (1978) *What is this thing called Science?* Berkshire: Open University Press. Chapters 5-7.
- Grünbaum, A. (1976) 'Is the Method of Bold Conjectures and Attempted Refutations Justifiably the Method of Science?' *British Journal for the Philosophy of Science* 27, pp. 105-136.
- Mellor, D. H. (1977). 'The Popper Phenomenon'. *Philosophy* 52, pp. 195-202.
- Nola, R. (1987). 'The status of Popper's theory of scientific method'. *British Journal for the Philosophy of Science* 38.

Lakatos' methodology

- Brendan, L. (1998). *Lakatos: An Introduction*. London: Routledge.
- Hacking, I. (1979) 'Imre Lakatos' Philosophy of Science'. *The British Journal for the Philosophy of Science* 30(4).
- Worrall, J. (1978). 'The Ways in Which the Methodology of Scientific Research Programmes Improves on Popper's Methodology'. In G. Radnitzky and G. Anderson (eds.), *Progress and Rationality in Science*. Dordrecht: Reidel, pp. 45-70.

Feyerabend and methodological anarchism

- Feyerabend, P (1975) *Against Method*. Verso, London.
- Chalmers, A. (1978). *What is this thing called Science?* Berkshire: Open University Press, Chapter 10.
- Laudan, L. (1989) 'For Method: or, Against Feyerabend', in Brown, J.R. and Mittelstrass, J. (eds.), *An Intimate Relation*. Dordrecht: Kluwer.
- Machamer, P. (1973) 'Feyerabend and Galileo: The Interaction of Theories, and the Reinterpretation of Experience'. *Studies in History and Phil of Science* 4, pp. 1-46.

Meynell, H. (1978). 'Feyerabend's Method'. *Philosophical Quarterly*, 28(112), pp. 242–252.

Preston, J. (2006). 'Paul Feyerabend' in *Stanford Encyclopedia of Philosophy (on line)*.

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

These are good anthologies:

Munévar, G. & Lamb, D. (eds.), (2000). *The Worst Enemy of Science? Essays in Memory of Paul Feyerabend*. Oxford: OUP.

Munévar, G. (1991). *Beyond Reason: Essays on the Philosophy of Paul Feyerabend*. *Boston Studies in the Philosophy of Science*, vol. 132.

Boston: Kluwer Academic Publishers.

The Duhem-Quine thesis and the underdetermination thesis

Ladyman, J. (2002). *Understanding Philosophy of Science*. London: Routledge, Chapter 3.4 and 6.

Quine, W. V. O. (1975). 'On Empirically Equivalent Systems of the World'. *Erkenntnis* 9, pp. 313-28.

Ariew, R (2007). 'Pierre Duhem in *Stanford Encyclopedia of Philosophy (on line)*. Sect 2.1

The following 4 papers are all in the anthology by Curd and Cover (1998):

Duhem, P. 'Physical Theory and Experiment';

Gillies, R. 'The Duhem Thesis and the Quine Thesis';

Laudan, L. 'Demystifying Underdetermination';

Quine, W. V. O. 'Two Dogmas of Empiricism', sect. 5 & 6.

The Copernican revolution (methodological considerations)

Andersson, G., (1991). 'Feyerabend on Falsifications, Galileo, and Lady Reason'. In Munévar, G. (1991). *Beyond Reason: Essays on the Philosophy of Paul Feyerabend*. *Boston Studies in the Philosophy of Science*, vol. 132. Boston: Kluwer Academic Publishers.

Ariew, R. (1987). 'The Phases of Venus before 1610'. *Studies in the History and Philosophy of Science* 18(1), pp. 81-92.

- Babb, S. E. (1977). 'Accuracy of Planetary Theories, Particularly for Mars' *Isis* (Sept) pp. 426-34.
- Barker, P. (1990). 'Copernicus, the Orbs, and the Equant'. *Synthese* 83, pp. 317-323.
- Chalmers, A. (1985). 'Galileo and the Telescope Observations of Mars and Venus' *British Journal for the Philosophy of Science* 36, pp. 175-191.
- Drake, S. (1987). 'Galileo's Steps to Full Copernicanism, and Back'. *Studies in the History and Philosophy of Science* 18(1), pp. 93-105.
- Goddu, A. (1990). 'The Realism that Duhem Rejected in Copernicus'. *Synthese* 83, pp. 301-315.
- Machamer, P. K. (1973). 'Feyerabend and Galileo: The Interaction of Theories, and the Reinterpretation of Experience'. *Studies in the History and Philosophy of Science* 4, pp. 1-46.
- Margolis, H. (1991). 'Tycho's System and Galileo's *Dialogue*'. *Studies in the History and Philosophy of Science* 22, pp. 259-275.
- Westman, R. S., (1972). 'Kepler's Theory of Hypothesis and the Realist Dilemma'. *Studies in the History and Philosophy of Science* 3, pp. 233-64.

TEACHING ARRANGEMENTS

This course is taught through lectures and accompanying, fortnightly tutorials. Tutorials are intended for in-depth discussion of the material presented in the lectures. The students are required to read the relevant papers, included in the reading list above, and the slides of the relevant lectures (available online at <http://www.lucamoretti.org/teaching.html>) before each tutorial.

REGULARITY OF ATTENDANCE

Attendance of lectures is optional, but very strongly recommended. Attendance of tutorials is compulsory. Participants are required to attend *all* tutorials and to contribute actively (see the Handbook for general rules).

Absence from Classes on Medical Grounds

Candidates who wish to establish that their academic performance has been adversely affected by their health are required to secure medical certificates relating to the relevant periods of ill health (see General Regulation 17.3).

The University's policy on requiring certification for absence on medical grounds or other good cause can be accessed at:

www.abdn.ac.uk/registry/quality/appendix7x5.pdf

You are strongly advised to make yourself fully aware of your responsibilities if you are absent due to illness or other good cause. In particular, you are asked to note that self-certification of absence for periods of absence up to and including eleven weekdays is permissible. However, where absence has prevented attendance at an examination or where it may have affected your performance in an element of assessment or where you have been unable to attend a specified teaching session, you are strongly advised to provide medical certification (see section 3 of the Policy on Certification of Absence for Medical Reasons or Other Good Cause).

Additional information regarding medical absences, extenuating circumstances and exam absences can be found in the Student Handbook, pg 6-8.

CLASS CERTIFICATE

Failure to attend classes or failure to submit a piece of continuous assessment may result in your class certificate being refused.

Students who are refused a class certificate are withdrawn from the course and cannot take the prescribed degree assessment in the current session, nor are eligible to be re-assessed next session, unless and until they qualify for the award of a class certificate by taking the course again in the next session.

Students who attend and complete the work required for a course are considered to have been awarded a 'Class Certificate'. Being in possession of a valid Class Certificate for a course entitles a student to sit degree examinations for that course. From 2010/11 class certificates will be valid for

two years and permit a total of three attempts at the required assessment within that two year period i.e. the first attempt plus up to two resits.

Full information on Class Certificates can be found in the Student Handbook, pg 6-7.

ASSESSMENT

1 essay (2500-3000 words) (50%) and 1 two-hour written examination (50%)

Students can view the Common Assessment Scale (CAS) at

<http://www.abdn.ac.uk/sdhp/ugrad-degrees.php>.

ESSAYS

2500-3000 words. Essays should be in 12 point font with line spacing of at least 1½. The word limit is confined to plus or minus 10% and essays deviating in length from the norm will be subject to penalty.

You are encouraged to choose your own topics. Please consult with the course-co-ordinator.

Students can also find advice on essay writing in the Student Handbook, pg 15-19.

ASSESSMENT DEADLINES

The essays are due by 3pm on Thursday, 5 May 2011

SUBMISSION ARRANGEMENTS

Students must submit **one printed copy** to the School Office (KCG 11c), together with a completed [essay cover sheet](#) for the School of Divinity, History and Philosophy attached. **One further copy must** be submitted to TurnitinUK.

CLASS ID:

PASSWORD:

Please note: Failure to submit coursework to TurnitinUK will result in a mark of zero for the coursework.

TURNITIN USER INSTRUCTIONS

TurnitinUK is an online service which compares student assignments with online sources including web pages, databases of reference material, and content previously submitted by other users across the UK. **The software makes no decision as to whether plagiarism has occurred**; it is simply a tool which highlights sections of text that have been found in other sources thereby helping academic staff decide whether plagiarism has occurred.

Further information on TurnitinUK and instructions on how to submit an assignment to TurnitinUK can be obtained from the following area of the Student Learning Service website: <http://www.abdn.ac.uk/sls/plagiarism/>. These pages provide information and advice on avoiding plagiarism including the University's Definition of Plagiarism, a Checklist for Students, Referencing and Citing as well as information on TurnitinUK.

If students are having difficulty with a Turnitin account, please contact the discipline secretary at t.noden@abdn.ac.uk, or by going to KCG11b, King's Quad.

LATE SUBMISSION

Further information regarding late submission and extensions can be found in the Student Handbook, pg 8-10.

ASSESSMENT FEEDBACK

The University recognises that the provision of timely and appropriate feedback on assessment plays a key part in students learning and teaching. The guiding principles for the provision of feedback within the University are detailed in the Institutional Framework for the Provision of Feedback on Assessment available at: www.abdn.ac.uk/registry/quality/appendix7x8.pdf.

PLAGIARISM

'Plagiarism is the use, without adequate acknowledgement, of the intellectual work of another person in work submitted for assessment. A student cannot be found to have committed plagiarism where it can be shown that the student has taken all reasonable care to avoid representing the work of others as his/her own.'

Plagiarism is a serious offence everywhere, both within and outwith the academic community. All cases of suspected plagiarism will be reported to the Head of School in the first instance and cannot be discussed with or determined by a Tutor or Course Co-ordinator.

Please note that students **MUST** refer to the School's Undergraduate Student Handbook for more detailed information on what constitutes plagiarism, how to avoid it, and what the University's procedure is should plagiarism be suspected.

EXAMINATION

A 2-hour exam, in which the student will give written answers to 2 out of 7-8 questions, will take place at the end of the half session. The questions may cover any part of the course.

Past exam papers can be viewed at <http://www.abdn.ac.uk/library/examdb/>.

Resit Eligibility: Candidates are only eligible to resit an exam provided that each element of coursework assessment is CAS 6 or above. New coursework can be submitted in agreement with the course coordinator. It is the student's responsibility to contact the coordinator if the student has failed a course.

Further information regarding exams can be found in the Student Handbook, pg 20-23.

CLASS REPRESENTATIVES

We value students' opinions in regard to enhancing the quality of teaching and its delivery; therefore in conjunction with the Students' Association we support the operation of a Class Representative system.

The students within each course, year, or programme elect representatives by the end of the fourth week of teaching within each half-session. In the Philosophy discipline we operate a system of course representatives for Levels 1 & 2, and year representatives for Levels 3 & 4. Any student registered within a course or year that wishes to represent a given group of students can stand for election as a class representative. You will be informed when the elections for class representative will take place.

What will it involve?

It will involve speaking to your fellow students about the year you represent. This can include any comments that they may have. You will attend a Staff-Student Liaison Committee and you should represent the views and concerns of the students within this meeting. As a representative you will also be able to contribute to the agenda. You will then feedback to the students after this meeting with any actions that are being taken.

Training

Training for class representatives will be run by the Students Association. Training will take place in the fourth or fifth week of teaching each half-session. For more information about the Class representative system visit www.ausa.org.uk or email the VP Education & Employability vped@abdn.ac.uk. Class representatives are also eligible to undertake the STAR (Students Taking Active Roles) Award, further information about the co-curricular award is available at: www.abdn.ac.uk/careers.

THE CO-CURRICULUM

The co-curriculum enhances a student's employability and provides opportunities to develop and achieve Aberdeen Graduate Attributes. Co-

curricular activities complement a student's degree programme and include: work placements, study abroad, enterprise and entrepreneurship activities, the BP Student Tutoring Scheme and the STAR (Students Taking Active Roles) Award initiative. Below are examples of credit-bearing co-curricular activities.

ERASMUS is an exchange programme funded by the European Commission which enables students to study or work in another European country as part of their degree programme. Eligible students will receive a grant to help with extra costs while abroad and a number of our partner institutions teach through English. For more information, visit www.abdn.ac.uk/erasmus/.

The University also has opportunities for students to study in a non-European country as part of their degree through the **International Exchange Programme** (www.abdn.ac.uk/undergraduate/international-exchange.php). International partners include universities and colleges in North America, Hong Kong and Japan. The University aims to ensure full academic recognition for study periods abroad, therefore the credits gained from study abroad will count towards the Aberdeen degree programme for students participating in both ERASMUS and the International Exchange Programme.

Work placements can also form an integral part of a degree programme and attract academic credit. Placements are available locally, nationally and internationally, lasting from a few weeks to a full year and are generally paid. Visit the Careers Service website for further placement information and to find available work placements.

Further information about the co-curriculum is available at: www.abdn.ac.uk/careers.

STUDENT SUPPORT

It is important that students check their university e-mail account regularly as this is the first method of contact by university staff members.

For information regarding *appeals*, students can refer to the Student Handbook, pg 25.

For information regarding *complaints or feedback*, students can refer to the Student Handbook, pg 11-12.

Additional information regarding student support can be found throughout the Student Handbook. Students can also contact [Student Support Services](#) or the [discipline secretary](#) if additional information is needed.