Department of Science
& Technology Studies.
22, Gordon Square.

**Course HPSC1001,
Autumn 2011.**

The History of Science.

Lectures: Thursdays 2-4, Medawar Watson LT

Tutorials: Thursdays 4-5, 22 Gordon Sq. B15
Thursdays 5-6, 22 Gordon Sq. B15

Dr. Andrew Gregory
Room 2.1, 22 Gordon Square, 020-7679-2490.
e-mail - andrew.gregory@ucl.ac.uk
Office hours - Mondays 11-1, Thursdays 11-1.

This is an introductory course in history of science, and runs annually. In subsequent years you may be interested in the following more advanced courses:
2012 The Scientific Revolution.
3014 Magic to Science.
3015 The History of Astronomy and Cosmology.

HPSC1001. Lecture Timetable.

Thurs. 06/10.
1 - Introduction.
2 - Babylonian Science.

Thurs. 13/10.
3 - Early Greek Science and Philosophy.
4 - Aristotle and Plato.

Thurs. 20/10.
5 - Greek Astronomy and Cosmology.
6 - Greek Medicine and Life Science.

Thurs. 27/10.
7 - Hellenistic Science and Roman Science.
8 - Science in the European Middle Ages.

Thurs. 03/11.
9 - The Renaissance, Science, Art and Progress.
10 - Copernicus and the Reform of the Heavens.

First essay is due on Tuesday 8th November !

6th November - 13th November is reading week - no lectures.

Thurs. 17/11.
11 - Galileo Galilei, Motion, Telescope and the Church.
12 - Bacon, Descartes and the Reform of Science.

Thurs. 24/11.
13 - The Newtonian Synthesis.
14 - The Eighteenth Century in Outline.

Thurs. 01/12.
15 - The Romantic Reaction.
16 - The Life Sciences in the Eighteenth Century.

Thurs. 08/12.
17 - The Chemical Revolution.
18 - Electricity in the Eighteenth Century.

Thurs. 15/12.
19 - The Steam Engine and the Industrial Revolution.
20 - Review and Conclusions.

The second essay is due on Wednesday 14th December !

End of term Friday 16th December

HPSC1001. General Information 1.

Assessment

Assessment for the course is by means of two essays and an exam. The essays are each worth 25% of the overall mark, and the exam 50%.

Attendance.

This course is taught by lectures and tutorials. You are expected to attend all lectures and all tutorials. A record will be kept of your attendance. Failure to regularly attend lectures or tutorials may result in you being withdrawn from the course, barred from the examination, or both. We must be able to certify to the College that you have seriously engaged the course content. The STS Undergraduate Tutor reserves the right to bar from examinations students not meeting attendance criteria specified in the *UCL Student Handbook* or by the Course Tutor at the start of term.

Lectures.

The lectures will give you the backbone of the course material. You will find it very helpful to read the background reading material prior to the relevant lecture. Questions are encouraged during lectures.
I will also circulate some handouts and notes. Some of these are for your general interest and information, some are summaries of important topics or people, and should form an integral part of your essay writing and exam revision. If you miss any handouts/ notes, they can be found on the web at the Moodle site for the course.

Everything we display as an overhead projection is in the notes. Do not feel that you need to copy down everything. Use these as suits you best. If you need to take detailed notes to keep attention, please do so. A common practice is to use a highlighter pen to bring out important aspects of the notes, or to underline and make extra comments on the notes.

Tutorials.

Please use the tutorials to discuss the lecture material in more depth. Discussion is of considerable importance in helping you to understand the material at a greater depth and in fixing the material from the lectures in your mind. Tutorials are far better for the students (and far easier to run !) if you participate in them actively. Ask questions and raise issues that interest you, and feel free to discuss ideas for essays and any aspect of essay writing technique.

Completion.

All course work must be completed for a student to be eligible to sit the examination. To complete the course, all course work must be completed and the student must sit the examination.

Feedback mechanisms

You can comment on this course by - filling in course evaluation forms; talking to your course tutor; talking to your personal tutor; talking to your Undergraduate tutor; via the Student-Staff consultative committee; Web comment boxes; STS Web site

Extensions

To apply for an extension on coursework, students must submit a completed a ‘request for extension of course work’ form, available in the departmental office. This request should be submitted, with documentation, to the course tutor in first instance. If confidential issues are involved, submission of the extension request and documentation may be made through a student’s personal tutor or the undergraduate tutor. Requests should be in advance of the set deadline; submission of a request is no guarantee of approval.

General course information 2.

Office Hours.

I will be glad to answer any questions, discuss or revise any topic after the lectures. If you wish to see me on a one - to - one basis to discuss essay questions, or discuss anything you haven't understood or would like to go over again, or anything else in relation to the course, I will be pleased to see you during my office hours, which are **Thursdays 11-1**. I guarantee I will be there and available to talk about this course during those times; you are of course welcome to try me at other time though I cannot guarantee I will be free, or to arrange a time to discuss anything relating to the course. I can be found in room 2.1 in 22 Gordon Square. My office phone number is 020-7679-2490 and my e-mail address is **andrew.gregory@ucl.ac.uk**

Moodle

There is a MOODLE VLE (Virtual learning environment) site for this course. Start from:
https://moodle.ucl.ac.uk/login/
On the Moodle site are:

- This syllabus document
- All of the lecture notes
- On-line essay submission
- Links to on-line essay readings
- All the past exam papers
- The virtual tutorial
- A news forum

Course Aims.

The general aim of the course is to present an overview of the History of Science from the beginnings up to the end of the eighteenth century. The course does not require any technical knowledge of current science. It is intended to function both as a course in its own right and as a foundation for other courses in Science and Technology Studies. It is hoped that a study of the origins and development of science will give better understanding of what science is now. The course is divided into three time periods, The Ancient World, The Scientific Revolution and The Enlightenment, and it is hoped that you will learn something of the scientific zeitgeist as well as the major advances of those periods; you will have to answer one question on each period in the exam.

By the end of the course, it is hoped that you will have acquired

- A working knowledge of the history of science up to 1800 - an in depth knowledge of one topic from each era, and a general knowledge of the themes of science in that era, demonstrated in essays and exam answers.
- Key essay writing skills; the ability to select the most important facts, to marshal those in argument and an awareness of the strengths and weaknesses of that argument.
- Some basic historiographical skills; an awareness of anachronism and the basic methods of writing the history of science.

Departmental and university policies

STS Student Handbook on-line: http://www.ucl.ac.uk/sts/study/bsc/documents/sts_student_handbook.pdf
UCL Student Handbook from Registrar

Information on Essay Submission/ Exams.

Coursework Information.

The two coursework essays should be 1500 words in length, within 10%.
For guidance on what is and what is not in the word count, please see p13, 6.3 ff of:
http://www.ucl.ac.uk/sts/study/bsc/documents/sts_student_handbook.pdf
As a brief indication, bibliography is not counted, quotations and footnpotes are.

The deadline for the first is on **Tuesday November 8th**, and for the second **Wednesday December 14th**. All coursework should be submitted via Moodle. It will be automatically uploaded to TurnItIn UCL's plagiarism detection software.

I expect you to read and use the first group of three readings for each essay. If you do not, your marks for that essay will be affected. The second group of readings are for your interest should you wish to look at the topic in some more depth.

Policy on late essays is that work submitted up to one day late will lose 5 marks. Between 2 day and 7 days late work will be penalised by a further 10 marks (i.e. 15 marks in total). After this date coursework will be considered complete but will receive a mark of 0. For further information see the STS Student Handbook http://www.ucl.ac.uk/sts/study/bsc/documents/sts_student_handbook.pdf

The first essay may be re-written. If you give in the first essay by the due date, I will mark it and comment on it. If you wish to re-write it in the light of the comments that I make, I will then re-mark it provided it is given in before the end of term.

The comments on your essays will give you feedback on the quality, strengths and weaknesses of the work submitted, with a clearly defined grade or class.

The exam.

The exam is three hours long and you will have to answer three questions. All the exam questions will be covered during the course, and there will be questions on all parts of the course - compare essay list, lecture list and past papers.

Previous exam papers are available from the Moodle site.
NB: I was on sabbatical for 2006. The 2006 exam paper should not be taken as typical.

The exam paper will be in three sections, The Ancient World, The Scientific Revolution and The Enlightenment. You must answer one question from each section. There will be questions on all parts of the course.

The exam will be in the summer term, and there will be revision classes in the first week of the summer term. I will inform you of the days and times closer to the date.

The exam is much more a test of understanding than memory. The questions are structured such that you will not be able to write down everything you know about the topic in one hour. The key skills are being able to orientate to what the question is asking you to do, and being able to select the most important information at your disposal in order to construct a good argument or discussion.

Affiliate students.

Affiliate students returning to their own countries before the exam must submit a 3,000 word essay in lieu of taking the exam. The essay must be submitted by the first day of spring term. It may be submitted by e-mail or post.

Essay Titles and Reading Lists 1.

1. Is 'Celestial Forecasting' a fair description of the activities of the Babylonians ?

S. Toulmin and J. Goodfield, The Fabric of the Heavens, pp. 27-58.
O. Neugebauer, The History of Ancient Astronomy, Journal of Near Eastern Studies 4, 1945.
A.L. Oppenheim, Man and Nature in Mesopotamian Civilisation, In The Dictionary of Scientific Biography, ed. C.C. Gillispie Vol. 15 pp. 634-666.

D.C. Lindberg, The Beginnings of Western Science (Chicago U.P., 2007), Ch.1.
R. Olson, Science Deified and Science Defied, pp. 16-61.
F. Rochberg, The Heavenly Writing (Cambridge UP, 2005), Ch. 1.
J. Bottéro, Mesopotamia: Writing, Reasoning, and the Gods (Chicago, 1992)
B.L. Van Der Waerden, Basic Ideas and Methods of Babylonian and Greek Astronomy, In The Dictionary of Scientific Biography, ed. C.C. Gillispie, Vol. 15, pp. 667-680.
O. Neugebauer, The Exact Sciences in Antiquity. (New York, 1969), Chapter 5;
http://knp.prs.heacedemy.ac.uk

2. Did the presocratic Greeks create science ?

G.E.R. Lloyd, Magic, Reason and Experience, Ch. 1.
K.R. Popper, Back to the Presocratics, pp. 136-165 of Conjectures and Refutations.
A.D. Gregory, Eureka ! The Birth of Science (Icon, 2000), Ch. 2, pp. 23-46.

D.C. Lindberg, The Beginnings of Western Science (Chicago U.P., 2007), Ch. 2.
G.E.R. Lloyd, Early Greek Science: Thales to Aristotle.
G. Vlastos, The Greeks Invent the Cosmos, pp. 3-22 of Plato's Universe.

3. What differences were there for Aristotle between the celestial and the terrestrial realms ?

G.E.R. Lloyd, Aristotle: The Growth and Structure of his Thought, pp. Ch. 7.
S. Sambursky, The Physical World of the Greeks, Ch. 4.
D.C. Lindberg, The Beginnings of Western Science (Chicago U.P., 2007), Ch. 2.

G.E.R. Lloyd, Aristotle: The Growth and Structure of his Thought, pp. 57-67 and Ch. 8.
A.D. Gregory, Eureka ! The Birth of Science (Icon, 2000), Ch. 3.
T. Hankinson, J. Barnes (ed.) The Cambridge Companion to Aristotle, Ch. 5 pp. 140-167.
Aristotle, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
G.E.R. Lloyd, Early Greek Science: Thales to Aristotle, Ch. 8.
A.G.Molland, Aristotelian Science, in Companion to the History of Modern science

4. Discuss the contribution to medical science of either

a) Hippocrates

G.E.R. Lloyd, Hippocratic Writings, Introduction.
C. Singer and E.A. Underwood, A Short History of Medicine, Ch. 2.
G.E.R. Lloyd, Magic, Reason and Experience, Ch. 1.

Hippocrates, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
H.E. Sigerist, Early Greek, Hindu and Persian Medicine, pp. 317-333.
B. Farrington, Greek Science, Vol. 1 Ch. 5.

HPSC1001. Essay Titles and Reading Lists 2.

or b) Galen

C. Singer, A Short History of Anatomy and Physiology from the Greeks to Harvey, Ch. 2.
J. Rocca, Anatomy, in R.J. Hankinson, The Cambridge Companion to Galen.
V. Nutton, Ancient Medicine, Ch 16.

G.E.R. Lloyd, Greek Science After Aristotle, Ch. 9.
R.J. Hankinson, The Cambridge Companion to Galen, Ch. 10 Physiology, Ch. 11 Therapeutics.
C. Singer and E.A. Underwood, A Short History of Medicine, Ch. 3.

(general for both Hippocrates and Galen)
D.C. Lindberg, The Beginnings of Western Science (Chicago U.P., 2007), Ch. 6.
Vivian Nutton, Ancient Medicine.
P. van der Eijk, Medicine and Philosophy in Classical Antiquity (Cambridge UP, 2005)

5. Why was Aristarchus' heliocentric theory not accepted in antiquity ?

T.L. Heath, Aristarchus of Samos, pp. 299-316, (Dover 1981).
A.D. Gregory, Aristarchus, in Meet the Philosophers, ed. O'Grady (Ashgate 2005)
O. Pedersen, Early Physics and Astronomy, Ch. 6, Cambridge U.P. (1993)

E. Grant, Science and Religion 400BC – 1550 AD: From Aristotle to Copernicus, Ch. 2.
Aristarchus, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
D.C. Lindberg, The Beginnings of Western Science (Chicago U.P., 2007), Ch.5.
Gingerich, O. "From Aristarchus to Copernicus", in "The Great Copernicus Chase and Other Adventures in Astronomical History". Cambridge: Cambridge University Press, 1992, pp. 63-68.
Gingerich, O. "Did Copernicus Owe a Debt to Aristarchus?", in "The Eye of Heaven: Ptolemy, Copernicus, Kepler". New York: American Institute of Physics Press, 1993, pp. 185-192.

6. What scientific progress was made during the European Middle Ages ?

P. Kibre and N.G. Sirasi, The Institutional Setting: The Universities, in D.C. Lindberg (ed.), Science in the Middle Ages, pp. 120-144.
J.E. Murdoch, Philosophy and the Enterprise of Science in the Later Middle Ages, in Y. Elkana (ed.), The Interaction between Science and Philosophy, pp. 51-74.
M. Postan, Why was Science Backward in the Middle Ages ? Ch. 2 in The History of Science, ed. J. Lindsay.

D.C. Lindberg, The Beginnings of Western Science (Chicago U.P., 2007), Ch. 9 – 14.
W.A. Wallace, The Philosophical Setting of Medieval Science, in D.C. Lindberg (ed.), Science in the Middle Ages, pp. 91-119.
E. Grant, Physical Science in the Middle Ages.

7. Discuss the relation between art, science and mathematics in the Renaissance.

H. Butterfield, Renaissance Art and Modern Science, and H. Cline, Painting and Perspective, in H.F. Kearney (ed.), Origins of the Scientific Revolution.
A.G. Debus, Man and Nature in the Renaissance, Ch. 1.
W.P.D. Wightman, Science in a Renaissance Society, Ch. 1 & 3.

M. Boas. The Scientific Renaissance, 1450-1630.
J.W. Shirley & F.D. Hoeniger (eds.) Science and the Arts in the Renaissance.
C.S. Singleton, Art, Science, and History in the Renaissance.

HPSC1001. Essay Titles and Reading Lists 3.

8. What differences and similarities were there between Copernicus' new astronomy and what preceded it ?

T.S. Kuhn, The Copernican Revolution, Ch. 5.
J.R. Ravetz, The Copernican Revolution, Ch. 14, Companion To The History Of Modern Science, ed. R. Olby Et Al.
N. Copernicus, On the Revolutions of the Heavenly Spheres.

I.B. Cohen, The Birth of a New Physics, Ch. 1-3.
Copernicus, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
R. Westman (ed.) The Copernican Achievement,(Berkeley: University of California Press, 1975).
O. Gingerich, The Book Nobody Read (Arrow, 2005)
W.T. Vollmann, Uncentering the Earth, (W&N, 2006).

9. Which experiments and reasoning led Galileo to reject Aristotle's views on motion ?

S. Drake, Galileo, A Very Short Introduction, Chapter 2.
A.R. Hall, The Scientific Revolution 1500-1800, Ch. 3.
D. Shapere, Galileo and the Interpretation of Science, in Galileo, A Philosophical Study pp. 1-21.

I.B. Cohen, The Birth of a New Physics, Ch. 5.
Galileo, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
A.R. Hall, The Scientific Revolution 1500-1800, Ch. 3, The Attack on Tradition: Mechanics.
S. Drake Discoveries and Opinions of Galileo (Garden City, 1957).

10. How did Galileo use his discoveries with the telescope to support the Copernican theory, and what opposition did he have to overcome ?

N.M. Swerdlow, Galileo's Discoveries with the Telescope and their Evidence for the Copernican Theory, in P. Machamer ed. The Cambridge Companion to Galileo.
I.B Cohen, The Birth of a New Physics, Ch. 4.
S. Drake, Galileo, Ch. 4 (Oxford U.P., 1980)

Galileo, The Starry Messenger.
Galileo, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
S. Drake, Discoveries and Opinions of Galileo.
G. de Santillana, The Crime of Galileo.
M. Finocchiaro, Galileo on the World Systems (Berkeley: University of California Press, 1997).

11. What is Francis Bacon's importance in the history of science ?

P. Rossi, Bacon's Idea of Science, in M. Peltonen (ed.) The Cambridge Companion to Bacon.
A. Quinton, The New Method, in Francis Bacon.
J. Henry - Inventing Modern Science, in Francis Bacon: Knowledge is Power.

E.J. Dijksterhuis, The Mechanisation of the World Picture, on Francis Bacon, pp. 396-402.
C.D. Broad, Bacon and the Experimental Method, Ch. 4 in The History of Science, ed. J. Lindsay.
P. Rossi, Francis Bacon: From Magic to Science,
B. Willey, The Seventeenth Century Background, Ch. 2.
Francis Bacon, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.

HPSC1001. Essay Titles and Reading Lists 4.

12. What is Rene Descartes' importance in the history of science?

D.M. Clarke, Descartes' Philosophy of Science and the Scientific Revolution, in The Cambridge Companion to Descartes, ed. J. Cottingham.
B. Williams, Descartes, Ch. 9
R.S. Westfall, The Construction of Modern Science, Ch. 2, The Mechanical Philosophy.

M. Tannery, Companion To The History Of Modern Science, ed. R. Olby Et Al. Ch. 38, Atomism and the Mechanical Philosophy.
E.J. Dijksterhuis, The Mechanisation of the World Picture on Descartes, pp. 403-417.
Descartes, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.

13. Why might Newton's work be considered the culmination of the scientific revolution?

A. Koyre, The Significance of the Newtonian Synthesis, in Newtonian Studies, pp. 3-24.
I.B. Cohen, The Birth of a New Physics, Ch. 7, The Grand Design - A New Physics.
D. Cassidy, Newton's Unifed Theory (web resource).

R.S. Westfall, The Construction of Modern Science, Ch. 8, Newtonian Dynamics.
I.B Cohen, The Newtonian Revolution. Cambridge UP, 1980.
Newton, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
I.B Cohen & G.E. Smith, The Cambridge Companion to Newton.
R.S. Westfall, Never at Rest.
A.R Hall, Isaac Newton, Adventurer in Thought, pp. 179-201 and 381-386.

14. What was the 'Enlightenment Programme'?

N. Hampson, The Enlightenment, Ch.2 , Natue and Nature's God.
H.P. Reill, The Legacy of the Scientific Revolution: Science and the Enlightenment. Cambridge History of Science, vol. 4.
B. Willey, How the Scientific Revolution Affected Other Branches of Thought, Ch. 8 in The History of Science, ed. J. Lindsay

T.L. Hankins, Science and the Enlightenment, Ch. 1.
P. Gay, The Enlightenment, An Interpretation, Ch. 3, The Enlightenment's Newton.
R. Fox, Companion To The History Of Modern Science, Ed. R. Olby Et Al. Ch. 18, Laplacian Physics.
C.C. Gillispie, The Edge of Objectivity, Ch. 5, Science and the Enlightenment.
R. Porter, The Enlightenment.

15. Why was Romanticism opposed to 'Newtonian science' and what alternatives did it offer?

D.M Knight, Introduction and Ch. 1, Romanticism and the Sciences, in A. Cunningham and N. Jardine (eds.), Romanticism and the Sciences.
D. Knight, German Science in the Romantic Period, in M. Crosland (ed.), The Emergence of Science in Western Europe.
P. Gay, The Enlightenment, An Interpretation, Ch. 4.

T.L. Hankins, Science and the Enlightenment, Ch. 5 .
Goethe, Schelling, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
T.S. Hall, Ideas of Life and Matter, Ch. 25-27 and 31-34.
A. Cunningham and N. Jardine, Romanticism and the Sciences.

HPSC1001. Essay Titles and Reading 5.

16. Why did the programme of mechanical biology run into trouble, and what role did vitalism subsequently play?

T.L. Hankins, Science and the Enlightenment, Ch. 5.
R.S. Westfall, The Construction of Modern Science, Ch. 5.
J. Roger, The Mechanistic Conception of Life, in D.C. Lindberg & R.L. Numbers, God & Nature, Ch. 11.

A.R. Hall, The Scientific Revolution 1500-1800, Ch. 10
P.J. Bowler, The Fontana History of the Environmental Sciences, pp. 139-193.
P.H. Reill, Storming the Temple of Error.

17. What changes in chemistry did Lavoisier bring about?

C.E. Perring, The Chemical Revolution, in Companion To The History Of Modern Science, Ed. R. Olby et al. Ch. 17
M.P. Crosland, Chemistry and the Chemical Revolution, in G.S Rousseau and R. Porter (eds.), The Ferment of Knowledge. (Cambridge: Cambridge University Press, 1980), 389-416.
M.P. Crosland, Lavoisier, In R. Porter (ed.), Man Masters Nature.

A. Donovan, Antoine Lavoisier: Science, Administration and Revolution (Oxford: Blackwell, 1983).
A. Donovan (ed.), The Chemical Revolution: Essays in Reinterpretation, Osiris, series 2, vol. 4 (1988).
T.L. Hankins, Science and the Enlightenment, Ch. 4.
W.H. Brock, The Fontana History of Chemistry, Ch. 3.
Lavoisier, Priestley in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
H.M. Leicester, The Historical Background to Chemistry.

18. Did the study of electricity become a 'Newtonian' science in the eighteenth century?

J.L. Heilbron, Ch. 9 358- 387, in G.S Rousseau and R. Porter (eds.), The Ferment of Knowledge, = J.L. Heilbron, Elements of Early Modern Physics, Ch. 3.
A. Wolf, A History of Science, Technology and Philosophy, Ch. 9.
J.L. Heilbron, Electricity in the Seventeenth and Eighteenth Centuries, Ch. XIV.

T.L. Hankins, Science and the Enlightenment, Ch. 3.
P. Fara, An Entertainment for Angels.
Gilbert, Franklin, in The Dictionary of Scientific Biography, ed. C.C. Gillispie
I.B. Cohen, Franklin's Science.

19. To what extent was the industrial revolution in Britain dependent on science?

P. Mathias, Who Unbound Prometheus?, in P. Mathias (ed.), Science and Society 1600-1900.
D.S.L. Cardwell, Power Technologies and the Advance of Science, 1700-1825, Technology and Culture, 1965, pp. 188-207.
A.E. Musson and A.E. Robinson, Scientific Prelude to the Industrial Revolution, Science and Technology in the Industrial Revolution

D.S.L. Cardwell, James Watt, In R. Porter (ed.), Man Masters Nature.
C. Smith, Energy, The Companion To The History Of Modern Science, Ed. R. Olby Et Al. Ch. 21.
Watt, in The Dictionary of Scientific Biography, ed. C.C. Gillispie.
P. Deane, The First Industrial Revolution.
D.S. Landes, The Unbound Prometheus, Ch. 2.
D.S.L. Cardwell, Science and the Steam Engine, in P. Mathias (ed.), Science and Society 1600-1900