HPSC2007: History and Philosophy of Chemistry
Department of Science and Technology Studies
University College London
First Term, 2010-11

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Tutorial/office hours	to be confirmed	Mondays 2-4 p.m.

Lectures:
Mondays 11-12 am, Roberts 105b
Wednesdays 10-11 am, 20 Gordon Sq., 102, Seminar 4.

Aims of the course
This course examines highlights in the history of chemistry from around 1750 to the early 20th century, including some philosophical analysis of those historical developments. Our main focus will be on understanding how past chemists thought and worked as they developed, evaluated and used new theories and practical methods. Attention will also be paid to the practical applications of chemistry and the broader social, economic and cultural contexts in which chemistry developed, as well as its relation to other fields such as physics, biology and medicine.

This course is designed to develop your ability to understand primary sources sympathetically, to evaluate and build on secondary sources critically, and to apply ideas in philosophy of science to the description and explanation of historical events.

Assessment
Assessment is by a written examination (34% of the overall course mark), and two essays (33% each). More details about the essays will be given in separate handouts, and on Moodle (http://moodle.ucl.ac.uk).

Please consult the STS Student Handbook on departmental rules regarding essay assignments, including late penalties:

http://www.ucl.ac.uk/sts/bsc/sts_student_handbook.pdf

The exam is at the end of the academic year. There will be a revision session during the third term, and past exam papers are available online. Go to the "Digital Collections" web page, and follow the links from there:

http://digitool-b.lib.ucl.ac.uk:8881/R

Please note that you must complete all assessed elements in order to complete this course unit. Please make sure you are familiar with the revised departmental guidance on late submission of coursework for the academic year 2010-2011.
For assessment generally you will need to master the content of the lectures, the required readings listed in this syllabus, and any other specified readings.

Reading Materials
Required reading materials will be available on Moodle, UCL's virtual learning environment (http://moodle.ucl.ac.uk). Reading lists for Essay 2 will be available, and these readings will also be available on Moodle wherever possible. Additional reading material useful for both essays will generally be available in the UCL Science Library.

SCHEDULE OF LECTURES AND REQUIRED READINGS (AND ESSAYS)

1. Introduction: the World of the 18th-Century Chemist (Mon. 4 Oct.)

- Frederic L. Holmes, Eighteenth-Century Chemistry as an Investigative Enterprise (Berkeley: Office for History of Science and Technology, University of California at Berkeley, 1989), pp.3-20 (Lecture 1).

2. Pneumatic Chemistry and Phlogiston Theory (Wed. 6 Oct.)

- Thomas L. Hankins, Science and the Enlightenment (Cambridge: Cambridge University Press, 1985), pp. 81-112 (Ch. 4), especially pp. 94-110.

3. The Chemical Revolution: The Campaign for French Chemistry (Mon. 11 Oct.)

- Arthur Donovan, Antoine Lavoisier: science, administration, and revolution (Cambridge: Cambridge University Press, 1993), pp. 157-187 (Chapter 7).

4. The Chemical Revolution: Philosophy (Wed. 13 Oct., ET)

- Excerpts from T. Kuhn, The Structure of Scientific Revolutions, (Chicago: The University of Chicago Press, 1962), Chapter VIII pp. 66-75 and Chapters IX-X pp. 92-110.

5. Elements, Atoms and Analysis (Mon. 18 Oct.)

- Leonard K. Nash, ed., Atomic-Molecular Theory, in James Bryant Conant, ed., Harvard Case Histories in Experimental Science (Cambridge, Mass.: Harvard University Press, 1957), Vol. 1, pp. 220-237 (Case 4, Sec. 1) [extracts from Dalton, with commentary, concentrate on pp.230-237].
- Henry M. Leicester, Harry S. Klickstein, eds. A Source Book in Chemistry, 1400-1900 (Cambridge, MA: Harvard University Press, 1968), pp. 258-268 (Jöns Jacob Berzelius), especially pp. 258-264.
- Jöns Jacob Berzelius, transl. from the French by G.O.Rees, The Analysis of Inorganic Bodies, (London: Longman, 1833), pp. 27-30 (part section on Quantitative Analysis).

6. Chemistry and Medicine I: the Case of Disinfection (Wed. 20 Oct.)

- Anna Lewcock, Fiona Scott-Kerr, and Elinor Mathieson, "Chlorine Disinfection and Theories of Disease", in Hasok Chang and Catherine Jackson, eds., An Element of Controversy: The Life of Chlorine in Science, Medicine, Technology and War (British Society for the History of Science, 2007).

FIRST ESSAY

See essay instructions and due dates on the course Moodle pages.

7. The Chemistry of Life: Fermentation (Mon. 25 Oct.)

- Frederic L. Holmes, Lavoisier and the Chemistry of Life: An Exploration of Scientific Creativity (Madison: University of Wisconsin Press, 1985), pp. 316-352 (Chapter 12), especially pp. 326 onwards.

8. The Development of Organic Chemistry (Wed. 27 Oct.)

- Trevor H. Levere, Transforming Matter: A History of Chemistry from Alchemy to the Buckyball (Baltimore and London: The Johns Hopkins University Press, 2001), pp. 94-106 (Ch. 8).

9. Composition, Constitution, Structure and Synthesis (Mon. 1 Nov.)

- Peter J. Ramberg, Chemical Structure, Spatial Rearrangement: The Early History of Stereochemistry (Aldershot: Ashgate, 2003), pp. 11-52 (Chapter 2).

10. Chemistry and Medicine II: Alkaloids (Wed. 3 Nov.)

- François Magendie, transl. Joseph Houlton, Formulary for the Preparation and Employment of Several New Remedies (London: Underwood, 1828), pp. iii-v (Translator's Preface), ix-xii (Author's Preface) and pp. 20-21 (on morphine).
- Miles Weatherall, "Drug Treatment and the Rise of Pharmacology" in Roy Porter ed. The Cambridge History of Medicine (Cambridge: Cambridge University Press), pp. 211-237 (Chapter 7). [Concentrate on pp. 211 to 220 for this lecture; remainder of chapter useful background for lecture 20.]

Deadline for essay 1: Monday 15 November.

NO LECTURES during reading week (8-12 Nov.): work on essays.

11. The Organisation of Chemistry (Mon. 15 Nov.)

- Trevor H. Levere, "Dr Thomas Beddoes: Chemistry, Medicine, and the Perils of Democracy", Notes Rec. Roy. Soc. **63** (2009), 215-229.
- Seymour Mauskopf, "Review of Jonathan Simon", Bull. Hist. Med **82** (2008), 198-200.
- Ursula Klein, "Not a Pure Science; Chemistry in the 18th and 19th Centuries", Science **306** (2004), 981-982.

12. Chemistry and the University (Wed. 17 Nov.)

- W. V. Farrar, "Chemistry and the Chemical Industry in the 19th Century" in M. P. Crosland ed., The Emergence of Science in Western Europe (Basingstoke: Macmillan, 1975), pp. 179-192.

13. The Science of Weather I (Mon. 22 Nov.)

- Katharine Anderson, Predicting the Weather: Victorians and the Science of Meteorology (Chicago: Chicago University Press, 2005), pp 1-14 (Introduction) and pp. 235-284 (Chapter 6: Science, State and Empire).

14. The Science of Weather II (Wed. 24 Nov.)

- Initial readings for this year's *Nicholson's Virtual Journal* (Essay 2) will be listed on a separate sheet and made available on Moodle.

15. Chemical Industry in the 19th Century (Mon. 29 Nov.)

- Carsten Reinhardt and Anthony S. Travis, Heinrich Caro and the Creation of Modern Chemical Industry, (Dordrecht: Kluwer, 2000), pp. ix-xix (Introduction).

16. The Periodic Table and Natural Law (Wed. 1 Dec., CJ/ ET)

- Michael D. Gordin, A Well-Ordered Thing: Dimitrii Mendeleev and the Shadow of the Periodic Table (New York: Basic Books, 2004), pp. 15-45 (Chapter 2)
- M. Christie, Philosophers versus Chemists concerning "Laws of Nature", *Studies in History and Philosophy of Science Part A*, 25(4), pp. 613-629, August 1994.

17. Chemical Classification (Mon. 6 Dec., ET/CJ)

- Hendry, R. F. Elements, Compounds and other Chemical Kinds., *Philosophy of science.*, 73 (5). pp. 864-875, 2006.

- Bird, A. and Tobin, E. Natural Kinds, *Stanford Encyclopedia of Philosophy*, Ed. Zalta (ed.), 2008. Url : http://plato.stanford.edu/entries/natural-kinds/

18. Reductionism in Chemistry (Wed. 8 Dec., ET)

- R. LePoidevin, Missing Elements and Missing Premises: A Combinatorial Argument for the Ontological Reduction of Chemistry, *British Journal for the Philosophy of Science*, **56**, pp 117-134, 2005.
- R.F. Hendry and P. Needham. *Le Poidevin on the Reduction of Chemistry*, *British Journal for the Philosophy of Science*, **58**, pp. 339-353, 2007.

First Deadline for essay 2: Monday 13 December

19. The Chemists' War (Mon. 13 Dec.)

- Dietrich Stoltzenberg, Fritz Haber: Chemist, Nobel Laureate, German, Jew (Philadelphia: Chemical Heritage Press, 2004), pp. xxi-xxiii (Prologue), 121-155 (Ch. 7).

20. Chemistry and Medicine III: Penicillin (Wed. 15 Dec.)

- Robert Bud, Penicillin: Triumph and Tragedy (Oxford: Oxford University Press, 2007), pp. 23-53 (Chapter 2).

Second Deadline for essay 2: Monday 17 January 2011

SOURCES FOR BACKGROUND AND GENERAL REFERENCE

Introductory Texts in the Philosophy of Science

• A. Bird, Philosophy of Science, (London: UCL Press, 1998).
• A. F. Chalmers, What is this thing called science?, 3rd ed. (Buckingham: Open University Press, 1999).
• Donald Gillies, Philosophy of Science in the Twentieth Century (Oxford: Blackwell, 1993).
• Ian Hacking, Representing and Intervening (Cambridge: Cambridge University Press, 1983).
• Rom Harré, The Philosophies of Science (Oxford: Oxford University Press, 1972).
• Carl G. Hempel, Philosophy of Natural Science (Englewood Cliffs: Prentice-Hall, 1966).
• Peter Kosso, Reading the Book of Nature (Cambridge: Cambridge University Press, 1992).
• James Ladyman. Understanding Philosophy of Science, (London: Routledge, 2002.)
• Alan Musgrave, Common Sense, Science and Scepticism: A Historical Introduction to the Theory of Knowledge (Cambridge: Cambridge University Press, 1993).
• W. H. Newton-Smith, The Rationality of Science (London and New York: Routledge, 1981).
• Anthony O'Hear, An Introduction to the Philosophy of Science (Oxford: Clarendon Press, 1989).
• Samir Okasha, Philosophy of Science: A Very Short Introduction (Oxford: Oxford University Press, 2002).

General Surveys of the History of Chemistry

- Bernadette Bensaude-Vincent and Isabelle Stengers, trans. by Deborah van Dam, A History of Chemistry (Cambridge, Mass. and London: Harvard University Press, 1996).
- William H. Brock, The Fontana History of Chemistry (London: Fontana Press, 1992).
- Ida Freund, The Study of Chemical Composition (Cambridge: Cambridge University Press, 1904).
- Aaron J. Ihde, The Development of Modern Chemistry (New York: Dover, 1984; originally published in 1964).
- Bernard Jaffe, Crucibles: The Story of Chemistry from Ancient Alchemy to Nuclear Fusion, 4th ed. (New York: Dover, 1976).
- Trevor H. Levere, Transforming Matter: A History of Chemistry from Alchemy to the Buckyball (Baltimore and London: The Johns Hopkins University Press, 2001).
- T. M. Lowry, Historical Introduction to Chemistry (London: Macmillan, 1936).
- Mary Jo Nye, Before Big Science: The Pursuit of Modern Chemistry and Physics, 1800-1940 (Cambridge, Mass.: Harvard University Press, 1996).
- J.R. Partington, A History of Chemistry, 4 vols (London: Macmillan, 1961-70; Volume 1, published last, is incomplete), and its abridged version, A Short History of Chemistry, 3rd ed. (New York: Harper, 1957; originally published in 1937).
- Colin A. Russell, Science and Social Change 1700-1900 (London: Macmillan, 1983).
- Stephen Toulmin and June Goodfield, The Architecture of Matter (Harmondsworth: Penguin, 1965).
- Abraham Wolf, A History of Science, Technology, and Philosophy in the 18th Century, 2nd ed. (London: Macmillan, 1952).

General Surveys on the Philosophy of Chemistry

- R. Hendry. *The Metaphysics of Chemistry*, (Oxford, Oxford University Press, Forthcoming. Draft available at: http://www.dur.ac.uk/r.f.hendry/#books
- E. Scerri and L. McIntyre. The Case for the Philosophy of Chemistry, *Synthese* **111:** 213–232, 1997.
- E. Scerri. Philosophy of Chemistry: A New Interdisciplinary Field?, Journal of Chemical Education, **77**(XX): 1-4, 2000.
- E. Scerri. The Periodic Table: It's Story and Significance, (Oxford: Oxford University Press, 2007).
- D. Baird, E. Scerri and L. McIntyre (eds.) Philosophy of Chemistry: Synthesis of a New Discipline, Boston Studies in Philosophy of Science, 2006.

- Scerri, E. ed., Collected Papers in Philosophy of Chemistry, (London: Imperial College Press, 2008).

More Topical Secondary Sources on the History

- D. S. L. Cardwell, ed., John Dalton and the Progress of Science (Manchester: Manchester University Press, 1986).
- Archibald Clow and Nan L. Clow, The Chemical Revolution: A Contribution to Social Technology (London: Batchworth, 1952).
- Arthur Donovan, ed., The Chemical Revolution: Essays in Reinterpretation, vol. 4 of OSIRIS, second series (1988).
- Robert Fox, The Caloric Theory of Gases from Lavoisier to Regnault (Oxford: Clarendon Press, 1971).
- Jan Golinski, Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820 (Cambridge: Cambridge University Press, 1992).
- Thomas L. Hankins, Science and the Enlightenment (Cambridge: Cambridge University Press, 1985).
- Harold Hartley, Studies in the History of Chemistry [mostly biographical] (Oxford: Oxford University Press, 1971).
- John Heilbron, Weighing Imponderables and Other Quantitative Science around 1800, published as a supplement to Historical Studies in the Physical and Biological Sciences, 24:1 (1993).
- A. E. Musson and Eric Robinson, Science and Technology in the Industrial Revolution (Manchester: Manchester University Press, 1969).
- Alan J. Rocke, Chemical Atomism in the Nineteenth Century: From Dalton to Cannizzaro (Columbus: Ohio State University Press, 1984).
- Eric R. Scerri, The Periodic Table: Its Story and Its Significance (New York: Oxford University Press, 2007).

Edited Collections of Primary Materials

- James Bryant Conant, ed., Harvard Case Histories in Experimental Science, 2 vols (Cambridge, Mass.: Harvard University Press, 1957).
- M.P. Crosland, ed., The Science of Matter: A Historical Survey (Harmondsworth: Penguin Books, 1971).
- John Dalton, et al., Foundation of the Atomic Theory, No. 2 of the Alembic Club Reprints (Edinburgh: The Alembic Club, 1899).
- John Dalton, et al., Foundation of the Molecular Theory, No. 19 of the Alembic Club Reprints (Edinburgh: The Alembic Club, 1923).
- D.L. Hurd and J.J. Kipling, eds., The Origins and Growth of Physical Science, 2 vols. (Harmondsworth: Penguin Books, 1964; based on G. Schwartz and P.W. Bishop, eds., Moments of Discovery, published in 1958).
- David M. Knight, ed., Classical Scientific Papers -- Chemistry, first series (London: Mills and Boon, 1968).
- Henry M. Leicester and Herbert S. Klickstein, eds., A Source Book in Chemistry 1400-1900 (New York: McGraw-Hill, 1952).

References

- Charles Coulston Gillispie, editor-in-chief, Dictionary of Scientific Biography (New York: Charles Scribner's Sons, 1970-).
- Ted Honderich, ed., The Oxford Companion to Philosophy (Oxford: Oxford University Press, 1995). This is a dictionary of general philosophy, providing concise definitions and introductions to technical terms and major philosophers.

- R. C. Olby, G. N. Cantor, J. R. R. Christie, and M. J. S. Hodge, eds., Companion to the History of Modern Science (London and New York: Routledge, 1990).

Bibliographies

In addition to the sources listed above, you should find further sources on your own, especially in researching for your second essay. The following are particularly helpful and extensive.

- ISIS Cumulative Bibliography: available in electronic form as part of the "Eureka" database on the History of Science, Technology and Medicine. To access this, go to the UCL Library main web page, and follow links to *Electronic Resources*, then *Databases*, then *History of Science, Technology and Medicine*.
- The Philosopher's Index: this can also be accessed via the *Databases* link on the UCL Library web page.
- Science Citation Index: access via the *Databases* link, then click on *"Connect to the ISI Web of Knowledge Service"*, then click on *Web of Science*.