

The scientific revolution

Start date 12 June 2020 **End date** 19 June 2020

Venue Virtual Classroom

Tutor Piers Bursill-Hall **Course code** 1920NRR047

Director of ISP and LL Sarah Ormrod

For further information on this course, please contact the Lifelong Learning team Zara Kuckelhaus, Fleur Kerrecoe
shortcourses@ice.cam.ac.uk or 01223 764637

To book See: www.ice.cam.ac.uk or telephone 01223 746262

Tutor biography

Piers Bursill-Hall was educated in England, France, USA, and Canada; university studies in mathematics and foundations of quantum mechanics (quantum logic) at Cambridge. Subsequently he has had a career in history of mathematics, and history of science, teaching at Cambridge in the Faculty of Mathematics and the Institute of Continuing Education, and elsewhere in Europe and North America, South Korea, India and Bangladesh. His research has concentrated on ancient mathematics (origins of proof; mathematical astronomy), Renaissance mathematical arts and sciences (changing status of mathematics, maths and engineering), and Enlightenment mathematics (foundations and dissemination of higher mathematics in France). Recently he has developed a side interest in early Islam and the origins of Islamic interest in science. He has taught very widely on the last two or three thousand years of history of science, history of mathematics and history of medicine for the Institute for Continuing Education.

Course programme

These interactive online sessions will start at 4.30pm each day for 7 days beginning on Friday 12 June. Each session will last approximately one hour (often with additional time for questions and discussion) and all sessions will be recorded and made available to students shortly after the course has finished. The lectures will be online using a secure version of Zoom, and you will get an email before the lecture with the meeting invitation, URL, and password. If you are new to Zoom, there will be a separate guide for how to set it up.

Friday 4.30pm

Session 1: Overview and outline; historiography and the idea of a 'revolution'. Renaissance background: the collapse of the classical hegemony of Aristotelian science, more or less radical alternatives, and the surprising unimportance of astronomy and cosmology

Saturday 4.30pm

Session 2: Copernicus and Kepler and Renaissance causation. Alchemy and the occult, and Renaissance causation. The ambition of "engineering"

Sunday 4.30pm

Session 3: An "engineer" in Padua turns his spyglass towards the heavens..

Monday 4.30pm

Session 4: Galileo and the triumph of the new science of mathematical mechanics (or maybe not), and Galileo as the father of the experimental method (definitely not). Who was reading Galileo? Galileo and the Church (myths debunked).

Tuesday 4.30pm

Session 5: Descartes: at last! A new natural philosophy based on corpuscles (not atoms) and mechanics. A pity it doesn't work, however.

Wednesday 4.30pm

Session 6: The mechanical philosophy: failure ... but promise. Failed innovations in chemistry. Changing social context of the practicing 'scientists'. Journals, institutions, communities. Revolutions turn out to be ... well, complicated.

Thursday 4.30pm

Session 7: Newton: a new physics, but at the most terrible cost to the mechanical philosophy. Newtonianism going forward: experimental physics and mathematical physics. Was there a revolution?

Course syllabus

Aims:

- (i) To understand modern historical approaches to the so-called scientific revolution,
 - (ii) to appreciate the controversies and different approaches as to what actually happened and why, and
 - (iii) to better appreciate the scientific work of several of the more significant figures of the period.
- And all of this with an approach that has less heroism and less modernising fantasy, and a more nuanced understanding of just how *un-modern* early modern science was in its origins.

Content:

This is an experimental online version of this course, and there will inevitably be a learning curve in finding out what works best. We may find that the sessions last longer than an hour, and there will be time for discussion afterwards – so please allow for some extra time for the lectures.

The topics to be covered are as outlined in the lecture titles; the point is to begin by exploring what we mean by “the scientific revolution” and look at assorted explanations of what happened in what we call the revolution. We will then mostly look at the so-called hard sciences around maths, physics, engineering, chemistry, mechanics, and astronomy (all in a non-technical way) and a number of key figures: Copernicus, Tycho Brahe, Kepler, Galileo, Descartes, and Newton ... as well as the changing social and institutional context in which the new science was studied and talked about. Finding the *revolution* in the scientific revolution turns out to be hard and really interesting. and just maybe it isn't there. Or is it? “The right idea for the wrong reasons” will take on a new meaning for you.

Presentation of the course:

Sadly there are no practicals available for this course – no alchemical experiments, no surgical operations without anaesthetic or antiseptics, and no burning of heretics. The course will be lectures, with time for questions and discussion, and there will not be any use of PowerPoint. There is no presumption of any particular scientific background, and you are free and welcome to join in discussions and questions as much – or as little – as you wish.

As a result of the course, within the constraints of the time available, students should be able to:

- (i) Understand in a way that goes beyond the usual journalistic mythology of early science to see the so-called revolution as both full of extraordinary and radical changes, and continuities and continuing traditions that change only much more slowly.
- (ii) To appreciate how the origins of modern scientific thinking came from very *un-modern* thinking and principles, and that there was nothing either inevitable or logical about the emergence of what we call modern science.
- (iii) To be able to be much more critical of received wisdom, and able to question historical certainties that we are taught as carved in stone, and appreciate how much science exists in a larger social and intellectual context.
- (iv) And above all: enjoy being challenged and thinking about new ideas, and seeing the past as a lot more complicated than we were taught at school and pundits make it out to be.

Reading and resources list

Listed below are texts that might be of interest should you wish to supplement your learning on the course. Many can be found 2nd hand.

Please note: There is a huge literature on the scientific revolution, and a lot of it can be dull or just plain out-of-date and wrong. There is also a lot of politics about the scientific revolution amongst academics. Here follow a number of reasonable and general books on the scientific revolution that you can read with benefit, and which take reasonably modern approaches (without being painfully dogmatic or indigestible).

There is no requirement to complete extensive preliminary reading, and the books listed below can be read at any time. If you do wish to read in advance, it will help you to get more out of the course and to understand my particular take on these events. However, there is one classic book – T.S. Kuhn's *The Scientific Revolution* – that I would strongly suggest you **avoid**: it is out of date, much superseded and, as it turns out, quite mistaken in its analysis of the history. I'd like to avoid having to spend time correcting Kuhn's ideas.

Author	Title	Publisher and date
M. Boas Hall	<i>The Scientific Renaissance</i>	Various reprints; also can be found on the Web (see 'weblinks')
A.R. Hall	<i>The revolution in science</i>	Routledge, 1983 <i>Old, but has stood the test of time in many ways. A very good introduction.</i>
Richard Westfall	<i>The construction of modern science: Mechanisms and Mechanics</i>	CUP, 1978 <i>Another very old text that is still excellent and sound. Still in print, too; a very good intro.</i>
LM Principe	<i>The scientific revolution: a very short introduction</i>	OUP, 2011 <i>One of that series of very short intros; not bad.</i>
Steven Shapin	<i>The scientific revolution</i>	University of Chicago Press, 2019 <i>Quite political, very interesting</i>
H. Floris Cohen	<i>The scientific revolution: a historiographical enquiry</i>	University of Chicago Press, 1994 <i>A more sophisticated historical analysis, should open doors for discussion</i>

David Wooton	<i>The invention of science: a new history of the scientific revolution</i>	Penguin, 2016 <i>Not at all a new history but a good restatement of the standard modern view.</i>
Alexandre Koyre Transl. REW.Maddison K Park & L Daston, eds	<i>Metaphysics and Measurement. Essays in the scientific revolution</i> <i>Early Modern Science (Cambridge History of Science, ed. CD Lindberg & RL Numbers, vol.3)</i>	Harvard University Press, 1968 <i>Very old, but still a great historical analysis. Don't read this first.</i> CUP 2006; <i>this is quite a high level overview of everything with some very different approaches; a digital copy of this volume will be made available to you.</i>

Weblinks

M.B. Hall: *Scientific Renaissance*:

<https://archive.org/details/scientificrenais007153mbp/page/n10/mode/2up>

Additional information

Venue

Online using 'zoom'. A link to the course will be made available via email, and any queries should be emailed to shortcourses@ice.cam.ac.uk.

Note Students of the Institute of Continuing Education are entitled to 20% discount on books published by Cambridge University Press (CUP) which are purchased at the Press bookshop, 1 Trinity Street, Cambridge (Mon-Sat 9am – 5:30pm, Sun 11am – 5pm). A letter or email confirming acceptance on to a current Institute course should be taken as evidence of enrolment.

Information correct as of: 21 May 2020