6 Robert Boyle and the Royal Society

FOR TEACHERS

Lesson Title: Robert Boyle and the Royal Society

Area of Learning: evidence, explanation, empathy

Aims: pupils should be able to: use, extract and evaluate information from sources relating to the Royal Society; explain the reasons for the foundation of the Royal Society; through producing a PowerPoint presentation, pupils should be able to select, organise and deploy relevant information to produce structured work, making appropriate use of dates and terms.

Vocab: disseminate; Royal Society; scholarly journal; archive; resource; transactions; experimentation; induction; fact-gathering; corroboration; fellow, membership; subscription, subscribe

Time frame: at least one hour plus homework

Resources: worksheet with questions and pictures

Pupil Tasks: The lesson could be divided into about three sections. In the first (section A 15-20 mins), an initial brainstorming session relating to how scientific information is disseminated and validated will enable pupils to understand why there was an increasing need – by natural philosophers working with inductive and experimental methods - for an organisation such as the Royal Society. Pupils can then be encouraged to devise or copy a short paragraph explaining why it is beneficial to modern scientists to: work in teams, corroborating information and data gained in experiments; gain credence and validation by publishing their work in peer-reviewed official journals. This paragraph could be entitled *How do modern scientists disseminate their research findings?*

The second section (B; 15 mins), will link with the aforementioned modern-day examples and show that the professional conditions described above were gradually also considered to be necessary to 17th century scientists using experimental, inductive methods and that these needs were some of the reasons for the foundation of the Royal Society. Pupils must read the given explanatory text and answer the questions.

Section C could be completed in a second lesson, or partially completed in the first and the task set for homework. Work done with sources in this section will show pupils how historians know about, and have been able to write about, the history of the Royal Society. Questions on the sources have been devised, to allow pupils to interpret the materials presented. This exercise will then allow pupils to properly utilise the information contained in the sources and allude to them in a (PowerPoint) presentation on the history of the Royal Society. Some children could be encouraged to do extra research on the members of the Royal Society listed in **source three** (eg Pepys, Newton and Halley). In this context teachers could draw attention to the fact that a fellow of the Royal Society did not necessarily have to be a practising scientist in order to be elected; such individuals were thus patrons of early modern science.

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For Pupils

Section A
Read the following text and then, try to answer the questions below after first discussing them with a partner. Record your answers in the space below.

Imagine you are a scientist working, in 2004, as the director of a team in a large, important and well-known teaching hospital in London. You and the team have just made an important scientific discovery which may help cure certain diseases in children. The cure however is controversial, since it involves patients taking a chemical that has formerly been labelled a poison.

1. Why would working as part of a team have been helpful to you?
2. Who would you want to tell about your discovery and why?
3. How would you disseminate (spread and communicate) the news of your breakthrough to other people? (There are *at least* seven ways to do this using modern technology.)
4. What methods of dissemination do you think would have been available to a scientist/natural philosopher such as Robert Boyle, working in the seventeenth century?

Using your ideas relating to the above questions, and those arising from the following discussion with your teacher, write a short paragraph explaining why modern scientists like to work in groups and publish in peer-reviewed journals. Write the paragraph under the sub-heading *How do modern scientists disseminate their research findings?*

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Section B: The Royal Society

Read the following text and answer the questions.

In the first part of the lesson you have considered how modern scientists work and disseminate and validate their findings by publishing in scholarly journals. In the same way, 17th natural philosophers such as Robert Boyle, who believed in inductive and experimental methods, thought it was a very good idea to share their knowledge and experiments with other scientists at regular meetings and publish their findings in journals. This they did by creating an organisation called the *Royal Society for the improvement of Natural Knowledge* (the *Royal Society* for short). This society was given an official charter (certificate/proof of its official creation) by Charles II in 1662. Members were elected as Fellows of the Society, and a membership fee was required. Many of the members of the Royal Society published reports of their work in a published journal entitled *Philosophical Transactions* (source four) which began regular publication in 1665. Other members could buy this journal and read reports of the experiments. The Royal Society originally met weekly in Gresham College, Broad Street, London. Robert Boyle attended its meetings from the time of its foundation. Initially he travelled from Oxford, where he lived, to do so; when he moved to London in 1668 he continued to attend some meetings until 1670. Source One, a modern secondary source based on information contained in several primary sources, provides more information on the history of the Royal Society.

The Royal Society is still in existence today (source two) and its Fellows are very great modern-day scientists. A website is available for viewing (http://www.royalsoc.ac.uk/education/). Using this site, biographies and pictures of some of the modern-day fellows can be viewed.

1. Write another subheading *How did Seventeenth-century Scientists in England disseminate their research findings?* In the light of the knowledge gained in the first part of this lesson, explain *why* scientists in seventeenth century England may have wished to disseminate news of their discoveries to other scientists.
2. Name the society that the seventeenth century English scientists wished to join.
3. Name the publication in which these scientists would have published their work and explain why they wanted to publish there.

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Section C

Look at the sources sheet and answer the following questions.

1. Where does the information in source one come from?
2. What kind of source (documentary, material, visual) is source two and what does it show?
3. Using source three, name two fellows of the Royal Society in the 1670s. If there is time, find out something about the biographies of these two men.
4. Look at source Four. What is it and why was it published?
5. How do sources five and six help historians know what happened at Royal Society meetings?

Homework Task. How and what do historians know about the *Royal Society*?

Prepare a PowerPoint or other type of presentation entitled *How and What do Historians know about the History of the Royal Society?* Use some of the sources printed on the worksheet, the website of the Royal Society and the ideas formed during the class discussion. Mention *when* and *why* the Society was established. List some of its past and famous current members (including women). Refer to the types of sources historians use to write the history of the society. Mention the *Philosophical Transactions* and describe what the journal was for. Prepare at least 5 slides if you are using PowerPoint. Try to refer to the sources printed on the sources sheet. Use phrases such as 'source x shows'; 'source y is an example of …'

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Sources Sheet

Source One: Entry on the Royal Society from B. Weinreb and C. Hibbert eds, *The London Encyclopaedia* (Basingstoke, 1992), p. 680.

'Meetings of natural philosophers occurred in Wadham College Oxford in the 1650s. By the 1660s scientists met in London at Gresham College. This group was known as the Royal Society and in 1662 King Charles II gave the group a charter of foundation that made their meetings official. In 1665 a journal in which many of the Royal Society's members published the results of their experiments was published … The society moved several times … and in 1967 it moved to its present location in Carlton House Terrace … From 1945 women were admitted as Fellows of the Society. The Society has organised many scientific expeditions and has advised the government on numerous scientific subjects … It awards several medals annually for original research work in many scientific fields. Well known men who have been presidents of the Society include Isaac Newton (1703-27).'

Source Two: The Royal Society. Modern Picture of the Royal Society in 2004, now based in central London (Carlton House Terrace SW1).

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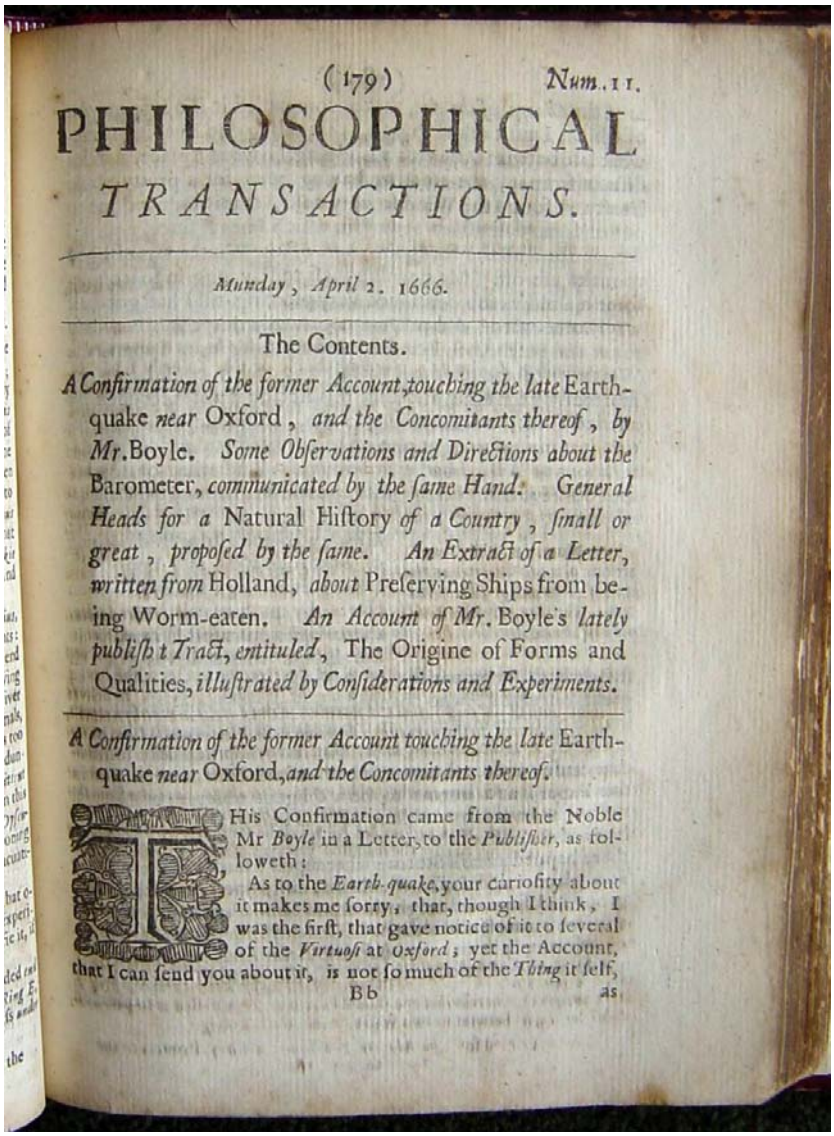
Source Three: List of Fellows from M. Hunter, *The Royal Society and its Fellows 1660-1700*, British Society for the History of Science monograph (Oxford, 1994)

In 1994 Professor Michael Hunter published a book containing a list of all Fellows of the Royal Society between 1660-1700. Many men whose work made important contributions to the development of science are listed there. Professor Hunter's work is a secondary source for, in order to compile his list, he extracted information about each fellow from a number of primary sources, including the Royal Society's account books (for membership fees) and the minutes (records) of its meetings.

Robert Boyle	elected fellow 1660
John Evelyn	elected fellow 1660
Robert Hooke	elected fellow 1663
Samuel Pepys	elected fellow 1665
Isaac Newton	elected fellow 1672
Edmund Halley	elected fellow 1678

Source Four: The title-page of issue II of *Philosophical Transactions* (1666).



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PHILOSOPHICAL

TRANSACTIONS.

Munday, April 2. 1666.

The Contents.

A Confirmation of the former Account, touching the late Earthquake *near* Oxford, *and the Concomitants thereof, by Mr.* Boyle. *Some Observations and Directions about the* Barometer, *communicated by the same Hand. General Heads for a* Natural History *of a Country, small or great, proposed by the same. An Extract of a Letter, written from* Holland, *about* Preserving Ships from being Worm-eaten. *An Account of Mr.* Boyle's *lately publish't Tract, entituled,* The Origine of Forms and Qualities, *illustrated by Considerations and Experiments.*

A Confirmation of the former Account touching the late Earthquake *near* Oxford, *and the Concomitants thereof.*

THis Confirmation came from the Noble Mr *Boyle* in a Letter to the *Publisher*, as followeth:

As to the *Earth-quake*, your curiosity about it makes me sorry, that, though I think, I was the first, that gave notice of it to several of the *Virtuosi* at *Oxford*; yet the Account, that I can send you about it, is not so much of the *Thing* it self,

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Source Five: extract from the diary of John Evelyn (1620-1706). Evelyn was a wealthy, educated government official who was interested in science. He was one of the earliest members of the Royal Society. He wrote a diary for most of his adult life, and sometimes he mentions the meetings of the Royal Society. The 'Torricellian experiment' to which he refers was a famous experiment by which Evangelista Torricelli demonstrated, using a mercury-filled tube, that the atmosphere had weight.

'1661 January. I was chosen by vote to be a Fellow of the Royal Society, now meeting at Gresham College … The Society had begun some years before at Oxford, and had continued interruptedly here in London during the Civil War. On the 16th I went to the Philosophic Society, where was examined the Torricellian experiment. I presented my *History of Mechanical Trades* … On March the 6th, I went to the Royal Society, to which the king had sent a small piece of glass which, though struck with an hammer at the oval end, would not break. But, breaking the tail, or small part … with your hand, the whole would crumble to dust. The reason for this was considered, but it was hard to know why.'(Adapted from E.S. de Beer, ed., *the Diary of John Evelyn* (5 vols. Oxford, 1955), vol. 3, pp. 266, 268, 272').

Source Six: extract from the diary of John Evelyn

This extract describes how Evelyn saw a demonstration of Robert Boyle's experiments with an air pump at the Royal Society in 1661:

'I went to the Royal Society where there were several Experiments using Mr Boyle's Pneumatic Engine (Air Pump). We put in a Snake but could not kill it, by exhausting the air, only making it extremely sick, but the chick died of convulsions out right, in a short space'. (Adapted from E. S. de Beer ed., *The Diary of John Evelyn* (5 vols., Oxford, 1955), vol. 3, pp. 284-85).

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