

Henry Baker: author of the first microscopy laboratory manual



HENRY BAKER,
Fellow of the Royal and Antiquarian Societies,
and of the Society for the Encouragement of
Arts, Manufactures, and Commerce.
Author of "The Microscope made easy"
"Employment for the Microscope," and other Works.
Born May 8, 1698, died Nov. 25, 1774.
Published by J. Bache, 105m. Ave. 17th St. N.Y.

▲ Portrait of Henry Baker. A stipple engraving by William Nutter published in 1812 and taken from an earlier oil painting by William Thomson. Baker was variously described as upright, benevolent, patient, homely, quietly spoken – and short-sighted (not surprising given all those hours looking down microscopes). The instrument on the table in the background is one of John Cuff's double microscopes.

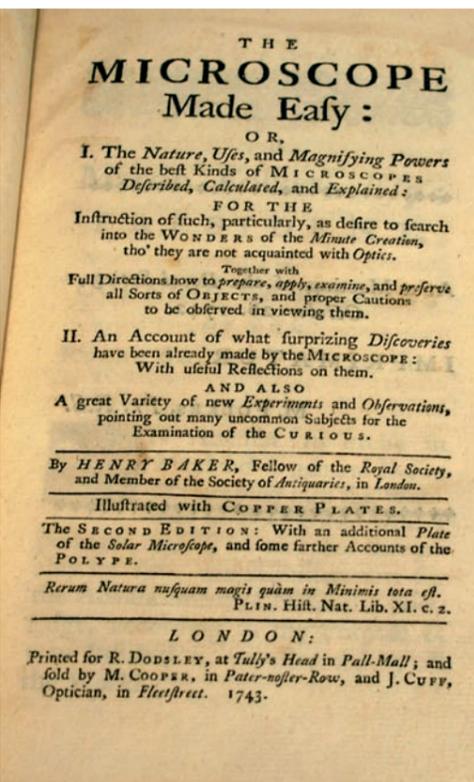
Henry Baker (1698–1774) was a typical 18th century polymath: natural historian, poet, translator of Molière, editor of a popular periodical and prolific correspondent. He was a co-founder of the Royal Society of Arts and a Fellow of the Royal Society of Antiquaries. Baker's influence on the development and popularization of the microscope was considerable and he wrote three books; the first, *The Microscope Made Easy*, was a best seller. In 1741 Baker was elected a Fellow of the Royal Society and played a prominent role in its activities for 30 years. The Bakerian Lecture was founded as a result of a bequest in his will.

The Microscope Made Easy
'Assert nothing till after repeated experiments and examinations, in all lights, and in all positions. Truth alone is the matter that you are in search after; and if you

have been mistaken, let not vanity seduce you to persist in your mistake.'

This is Baker's cautionary advice in *The Microscope Made Easy* published in November 1742. In setting out the reasons for writing the book Baker berates previous users of the microscope for giving the impression that only those with skill and learning could benefit from it. The only needs are 'good glasses, good eyes, a little practice, and a common understanding, to distinguish what is seen; and a love of truth, to give a faithful account thereof.'

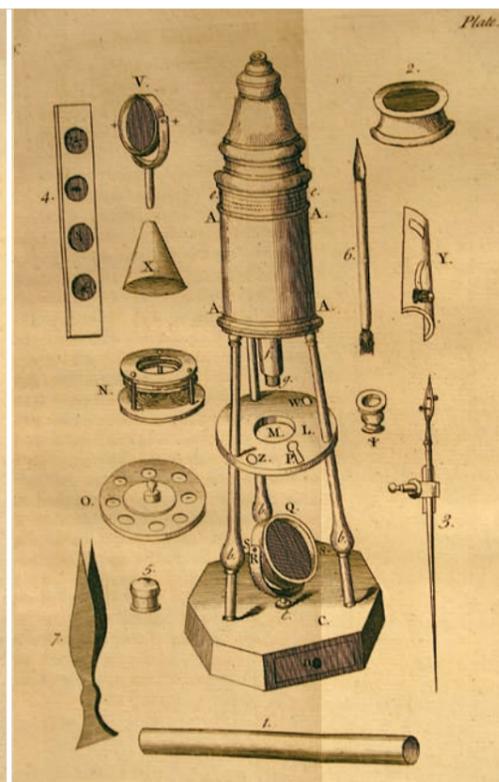
Part I describes simple and compound microscopes and trumpets the qualities of those made by his friend John Cuff. There is guidance on how to prepare specimens and how to calculate their size. Part II is a beginner's guide to microscopy and laboratory manual. It gives instructions on making infusions of pepper, hay, oats and wheat, and tells what to expect when these are studied under the microscope. 'Animalcules'



THE
MICROSCOPE
Made Easy:
OR,
I. The Nature, Uses, and Magnifying Powers
of the best Kinds of MICROSCOPES
Described, Calculated, and Explained:
FOR THE
Instruction of such, particularly, as desire to search
into the WONDERS of the Minute Creation,
tho' they are not acquainted with Optics.
Together with
Full Directions how to prepare, apply, examine, and preserve
all Sorts of OBJECTS, and proper Cautions
to be observed in viewing them.
II. An Account of what surprizing Discoveries
have been already made by the MICROSCOPE:
With useful Reflections on them.
AND ALSO
A great Variety of new Experiments and Observations,
pointing out many uncommon Subjects for the
Examination of the CURIOUS.
By HENRY BAKER, Fellow of the Royal Society,
and Member of the Society of Antiquaries, in London.
Illustrated with COPPER PLATES.
The SECOND EDITION: With an additional Plate
of the Solar Microscope, and some farther Accounts of the
POLYPE.
Rerum Natura nusquam magis quam in Minimis tota est.
PLIN. Hist. Nat. Lib. XI. c. 2.
LONDON:
Printed for R. DODSLEY, at Tully's Head in Pall-Mall; and
sold by M. COOPER, in Paternoster-Row, and J. CUFF,
Optician, in Fleetstreet. 1743.

seen in rain, ditch and pond water are illustrated and there are descriptions of blood, muscles, bones and nerves, semen, the louse, fleas and spiders, and how to kill insects with tobacco oil and mercury. One chapter contains a rag-bag of observations ranging from the behaviour of ants to snowflakes. All come (literally) under the microscope.

Baker refers frequently to the earlier discoveries of Hooke, Swammerdam, Leeuwenhoek and others. But he goes further and expresses his views on many of the controversial issues of the day. For example, spontaneous generation is dismissed ('Nothing seems now more contrary to reason ... that dead corrupting matter, and blind uncertain chance, should create living animals'), but preformation gets the thumbs up ('The growth of animals and vegetables seems to be nothing else but the gradual unfolding and expansion of their vessels'). There are even some thoughts about



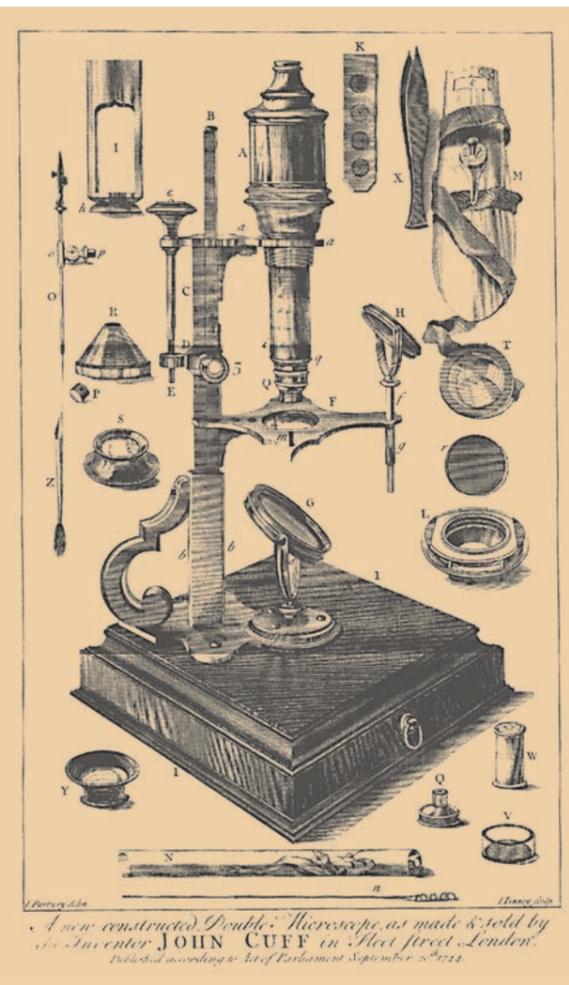
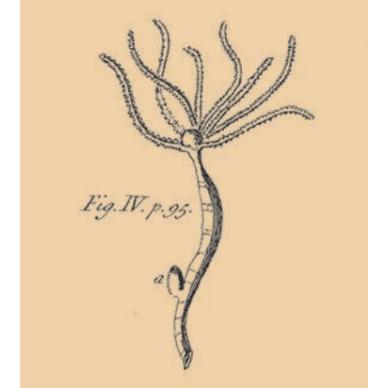
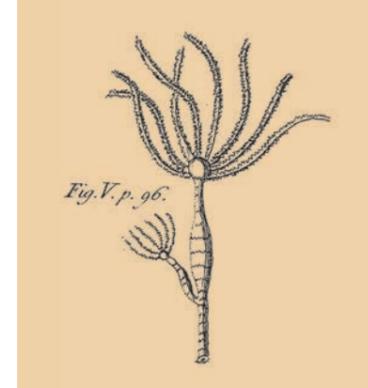
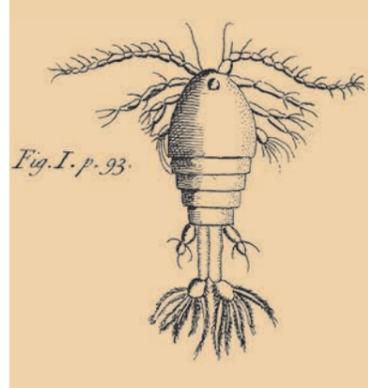
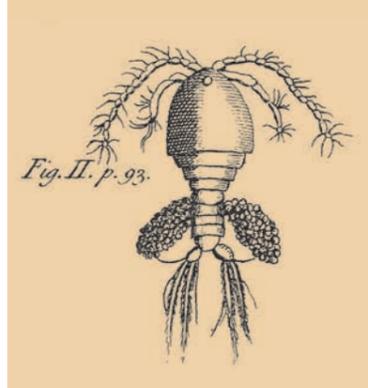
relativity ('Our ideas of matter, space, and duration are meerly comparative').

Towards the end of the book Baker compares the beauty of natural (bee stinging, silkworm web) and man-made objects (lace, works of art). To him the artefacts come a distant second: 'Our finest miniature paintings appear before this instrument as meer dawblings, plaistered on with a trowel, and entirely void of beauty.'

▲ Left. Title page of *The Microscope Made Easy* (2nd edn, 1743). A total of six English editions were published from 1742 to 1785 as well as Dutch, French and German translations. The book sold for 5 shillings (about £30 today) and Baker received the equivalent of approximately £5,000 for the first edition and half that for subsequent editions.

▲ Right. The double reflecting microscope. This is described by Baker as an improvement on John Marshall's turn of the century great double microscope made initially by Edmund Culpeper in the 1720s and then by Edward Scarlet in the late 1730s. The body is supported by three brass pillars mounted on a wooden base. There are five objective lenses that can be screwed to the nose piece (g). The brass plate (O) fits onto the fixed plate (L) and contains holes to carry specimens; ivory discs are used as the background for dark coloured objects and ebony discs for light coloured objects. Concave glasses retain liquids containing 'animalcules'. The lens (V) is attached at W to direct candle light or sunlight down onto opaque objects. Y is a fish-plate in which the blood circulation in the tail of a fish could be observed. Glass tubes (1) are used to immobilize frogs, newts, etc., for observation. Insects are trapped in the glass cell (2).

Henry Baker played a big part in popularizing the microscope in the 18th century. **Richard Burns**, Henry's 'great x5' grandson, describes the life and activities of his illustrious ancestor.



▲ John Cuff's new double microscope, made in 1744 following advice from Henry Baker who wrote 'when examining daily the configurations of saline substances, the legs were continual impediments to my turning about the slips of glass ... Pulling the body of the instrument up and down was likewise subject to jerks, which caused a difficulty in fixing it exactly at the focus ... Mr Cuff, the optician, applied his thoughts to fashion a microscope in another manner, leaving the stage intirely free and open by taking away the legs (the popular Culpeper microscopes had a tripod support), applying a fine threaded screw to regulate and adjust its motions'. These polished brass instruments sold for 7 guineas – today you would be lucky to acquire one for less than £6,000!

▲ Top of page. Drawings of copopods and polyps from *The Microscope Made Easy*. First described by Leeuwenhoek, polyps were regarded by many as the missing link between plants and animals.

sexes who have not had the advantage of a learned education'). There is much information on insects, polyps, rotifers, nematodes and fungal spores as well as detailed accounts of Baker's own painstaking studies of inorganic and organic salts and how these led him to suggest mechanical improvements to the microscope. [The major optical advance, the adoption of the achromatic lens to reduce distortion, came much later.] In fact, crystals were Baker's first scientific love ('their variety and beauty no words or language can possibly express') and for this he received the Copley gold medal, putting him on a list of 18th century 'giants': Franklin, Priestley and Volta.

Romance, poetry and the Royal Society

Baker's lucrative 'day job' was as a speech therapist and in 1724 he was teaching in Stoke Newington when its most famous resident, Daniel Defoe, invited him to call. Despite a 40 year age difference, the two hit it off and Baker became a regular visitor. Soon, however, the highlight was afternoon tea with Defoe's daughters and Henry found himself falling in love with the youngest, Sophia, but it was almost four years before increasingly acrimonious negotiations with Defoe were resolved and the pair were married.

During this time, Baker launched and edited *The Universal Spectator* and published the much reprinted *The Universe. A Philosophical Poem Intended to Restrain the Pride of Man*. This is a long and somewhat reverential tract about the number and diversity of living forms. It is apparent that Baker was already familiar with the power of the microscope.

'Extend thy narrow sight: consult with art; And gladly use what helps it can impart; Each better glass will larger fields display, And give thee scenes of life, unthought of, to survey.'

In 1740 Henry's influential friends elected him a Fellow of the Society of Antiquaries and, the following year, to the Royal Society. His citation reads 'A Gentleman well versed in Mathematicks and Natural knowledge, particularly eminent for his great Skill and happy Success in teaching persons born deaf and consequently Dumb to Speak (having improved upon that great Invention of the late famous Dr Wallis) Author of a very beautiful Poem called the Universe, with many Curious Notes regarding Natural History, and one who hath communicated Some usefull papers to the Royal Society, being desirous to become a Member of the Same, is recommended by us as a Candidate well deserving that honour.' The six proposers included the heavyweights Hans Sloane (President), Martin Folkes (Sloane's successor) and Cromwell Mortimer (Biological Secretary).

Baker's 80 plus communications to the Royal Society between 1740 and 1769 are a mixture of the good, the bad and the ugly. They are mostly short papers and letters. Many appear trivial and reports about the weather, avalanches and minor earthquakes are common. One of the few substantial papers is a description of the Society's collection of 26 Leeuwenhoek microscopes. Baker calculates their magnifying power (the best was about $\times 160$) and concludes that by using these Leeuwenhoek could not possibly have seen the detail that is shown in many of his drawings. He carefully dodges the issue of whether the Dutchman exaggerated by concluding that experience, good eyesight and more powerful lenses would account for the discoveries. We can't check this because the microscopes have long since disappeared.

In 1743 Baker published his second book '*An Attempt Towards a Natural History of the Polype*'. In it he records his attempts to repeat the experiments of Abraham Trembley who, 4 years

earlier, had cut up fresh water polyps (*Hydra vulgaris*) and found that the parts regrew to form entire animals. This news excited the scientific establishment, because of the debate about the distinction between animals and plants (only plants grow from 'cuttings' but only animals move and eat worms), as well as the natural philosophers who were puzzled as to how the 'soul' of the polyp was distributed among the progeny. Baker was amazed by what he saw as he chopped the hydra into pieces.

In the late 1740s Baker's interests turned to electricity (the hot topic of the day) and he reported experiments that were thought to show its beneficial medical qualities.

The friend and the cheat

Henry Baker's most prolific correspondent was William Arderon, an obsessive collector of objects and obscure facts who wrote about what he had seen and heard. In return Baker kept his pen pal up to date with events at the Royal Society and life in London, and describes his editing activities, of which two are noteworthy.

In the mid 1740s, the surviving plates for Robert Hooke's classic *Micrographia* were cleaned and the missing ones re-cut. Baker tells Arderon that he is: 'overlooking the press which a little work of mine has just now passed through. I call it *Micrographia Restaurata or the Copper Plates of Dr Hook's wonderful discoveries by the microscope reprinted and fully explained*.' Baker says that he has asked the booksellers to price it as low as possible to attract customers and convert them to the wonders of microscopy.

In August 1749 Baker informs Arderon that he is involved in editing Benjamin Wilkes' *The English Moths and Butterflies* and pays Wilkes a wonderful backhanded compliment: 'indefatigable in his observations, and faithful in minuting down every particular, but for want of learning quite incapable of writing a book.' But there is no mention of Baker's involvement when this beautifully illustrated book was published, although some lines on butterflies from *The Universe* are included.

George Adams was a prominent instrument maker who could see what *The Microscope Made Easy* was doing for the sales of Cuff's instruments and in 1746 published *Micrographia Illustrata* in which he describes the merits of his own microscopes. However, Adams had plagiarized sections of *The Microscope Made Easy* and Baker was incensed. He wrote to his friends warning them of the 'notorious robbery' by 'an ignorant but impudent fellow' and urging them not to buy the book.

The end

Henry Baker died in November 1774 and was buried alongside his wife in the churchyard at St Mary le Strand.

In his will he left £500 to the Royal Society (in addition to the Bakerian lecture bequest of £100), but most of his considerable fortune went to his grandson, William. The Bakerian lecture ('for an oration or discourse to be spoken or read yearly by some one of the Fellows of the Society on such a part of natural history or experimental philosophy') was first given in 1775. Early speakers included Cavallo, Davy and Faraday and many of the greatest scientists of the day, including Rutherford, Herschel, Fox Talbot, Maxwell and Hoyle, have delivered the lecture.

Would Henry Baker be remembered if not for the eponymous lecture and footnotes in the many Daniel Defoe biographies? There is no doubt that *The Microscope Made Easy* was widely read not only by natural historians, but also writers, poets and thinkers of the day. Baker's purpose in writing the book was to popularize the use of the microscope and instill in others a curiosity for objects previously invisible to the naked eye. These aims were achieved. Henry Baker was once described as 'a philosopher of little things', which can be interpreted in two ways: a man who thought deeply and wrote extensively about the minute objects he examined under the microscope or one who spent his life collecting and explaining essentially trivial observations. The former definition is the more accurate one.

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Further reading

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Turner, G. I.E. (1974). Henry Baker, FRS: founder of the Bakerian lecture. *Notes Rec Roy Soc* 29, 53–79.

Victoria and Albert Museum Forster Manuscripts. The collection includes four volumes of Baker's correspondence with William Arderon and his autobiographical memoranda.

Woodruff, L.L. (1918). Baker on the microscope and the polype. *Sci Mon* 7, 212–226.