



## Robert Hooke (1635 – 1703)

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[http://en.wikipedia.org/wiki/Robert\\_Hooke](http://en.wikipedia.org/wiki/Robert_Hooke)

Robert Hooke FRS was an English natural philosopher, architect and polymath.

His adult life comprised three distinct periods: as a scientific inquirer lacking money; achieving great wealth and standing through his reputation for hard work and scrupulous honesty following the great fire of 1666, but eventually becoming ill and party to jealous intellectual disputes. These issues may have contributed to his relative historical obscurity.

He was at one time simultaneously the curator of experiments of the Royal Society and a member of its council, Gresham Professor of Geometry and a Surveyor to the City of London after the Great Fire of London, in which capacity he appears to have performed more than half of all the surveys after the fire. He was also an important architect of his time, though few of his buildings now survive and some of those are generally misattributed, and was instrumental in devising a set of planning controls for London whose influence remains today. Allan Chapman has characterised him as "England's Leonardo".

Hooke studied at Wadham College during the Protectorate where he became one of a tightly knit group of ardent Royalists centred around John Wilkins. Here he was employed as an assistant to Thomas Willis and to Robert Boyle, for whom he built the vacuum pumps used in Boyle's gas law experiments. He built some of the earliest Gregorian telescopes, observed the rotations of Mars and Jupiter and, based on his observations of fossils, was an early proponent of biological evolution. He investigated the phenomenon of refraction, deducing the wave theory of light, and was the first to suggest that matter expands when heated and that air is made of

small particles separated by relatively large distances. He performed pioneering work in the field of surveying and map-making and was involved in the work that led to the first modern plan-form map, though his plan for London on a grid system was rejected in favour of rebuilding along the existing routes. He also came near to deducing that gravity follows an inverse square law, and that such a relation governs the motions of the planets, an idea which was subsequently developed by Newton. Much of Hooke's scientific work was conducted in his capacity as curator of experiments of the Royal Society, a post he held from 1662, or as part of the household of Robert Boyle.

### **Mechanics:**

In 1660, Hooke discovered the law of elasticity which bears his name and which describes the linear variation of tension with extension in an elastic spring. He first described this discovery in the anagram "ceiinossttuv", whose solution he published in 1678 as "Ut tensio, sic vis" meaning "As the extension, so the force." Hooke's work on elasticity culminated, for practical purposes, in his development of the balance spring or hairspring, which for the first time enabled a portable timepiece – a watch – to keep time with reasonable accuracy. A bitter dispute between Hooke and Christiaan Huygens on the priority of this invention was to continue for centuries after the death of both; but a note dated 23 June 1670 in the Hooke Folio, describing a demonstration of a balance-controlled watch before the Royal Society, has been held to favour Hooke's claim.

It is interesting from a twentieth-century vantage point that Hooke first announced his law of elasticity as an anagram. This was a method sometimes used by scientists, such as Hooke, Huygens, Galileo, and others, to establish priority for a discovery without revealing details.

Hooke became Curator of Experiments in 1662 to the newly founded Royal Society, and took responsibility for experiments performed at its weekly meetings. This was a position he held for over 40 years. While this position kept him in the thick of science in Britain and beyond, it also led to some heated arguments with other scientists, such as Huygens and particularly with Isaac Newton and the Royal Society's Henry Oldenburg. In 1664 Hooke also was appointed Professor of Geometry at Gresham College in London and Cutlerian Lecturer in Mechanics.

On 8 July 1680, Hooke observed the nodal patterns associated with the modes of vibration of glass plates. He ran a bow along the edge of a glass plate covered with flour, and saw the nodal patterns emerge.

### **Personality and disputes:**

Hooke was irascible, at least in later life, proud, and prone to take umbrage with intellectual competitors, though he was by all accounts also a staunch friend and ally and was loyal always to the circle of ardent Royalists with whom he had his early training at Wadham College, particularly Christopher Wren. His reputation suffered after his death and this is popularly attributed to a dispute with Isaac Newton over credit for his work on gravitation, the planets and to a lesser degree light. His dispute with Oldenburg over credit for the watch escapement is another well-known example. Newton, as President of the Royal Society, did much to obscure Hooke, including, it is said, destroying (or failing to preserve) the only known portrait of the man. It did not help that the first life of Wren, *Parentalis*, was written by Wren's son, and tended to exaggerate Wren's work over all others. Hooke's reputation was revived during the twentieth century through studies of Robert Gunther and Margaret Espinasse. After a long period of relative obscurity he has now been recognized as one of the most important scientists of his age.

He was apt to use ciphers and guard his ideas. As curator of Experiments to the Royal Society he was responsible for demonstrating many ideas sent in to the Society, and there is evidence that he would subsequently assume some credit for these ideas. Hooke also was immensely busy and thus unable – or in some cases unwilling, pending a way of profiting from the enterprise via letters patent – to develop all of his own ideas. This was a time of immense scientific progress, and numerous ideas were developed in several places simultaneously.

None of this should distract from Hooke's inventiveness, his remarkable experimental facility, and his capacity for hard work. His ideas about gravitation, and his claim of priority for the inverse square law, are outlined below [in the full Wikipedia article]. He was granted a large number of patents for inventions and refinements in the fields of elasticity, optics, and barometry. The Royal Society's Hooke papers (recently discovered after disappearing when Newton took over) will open up a modern reassessment.

Much has been written about the unpleasant side of Hooke's personality, starting with comments by his first biographer, Richard Waller, that Hooke was "in person, but despicable" and "melancholy, mistrustful, and jealous." Waller's comments influenced other writers for well over two centuries, so that a picture of Hooke as a disgruntled, selfish, anti-social curmudgeon dominates many older books and articles. For example, Arthur Berry said that Hooke "claimed credit for most of the scientific discoveries of the time." Sullivan wrote that Hooke was "positively unscrupulous" and possessing an "uneasy apprehensive vanity" in dealings with Newton. Manuel used the phrase "cantankerous, envious, vengeful" in his description. More described Hooke having both a "cynical temperament" and a "caustic tongue." Andrade was more sympathetic, but still used the adjectives "difficult", "suspicious", and "irritable" in describing Hooke.

The publication of Hooke's diary in 1935 revealed other sides of the man that 'Espinasse, in particular, has detailed carefully. She writes that "the picture which is usually painted of Hooke as a morose and envious recluse is completely false." Hooke interacted with noted craftsmen such as Thomas Tompion, the clockmaker, and Christopher Cocks (Cox), an instrument maker. Hooke often met Christopher Wren, with whom he shared many interests, and had a lasting friendship with John Aubrey. Hooke's diaries also make frequent reference to meetings at coffeehouses and taverns, and to dinners with Robert Boyle. He took tea on many occasions with his lab assistant, Harry Hunt. Within his family, Hooke took both a niece and a cousin into his home, teaching them mathematics.

Robert Hooke spent his life largely on the Isle of Wight, at Oxford, and in London. He never married, but his diary shows that he was not without affections, and more, for others. On 3 March 1703, Hooke died in London, having amassed a sizable sum of money, which was found in his room at Gresham College. He was buried at St Helen's Bishopgate, but the precise location of his grave is unknown.