Stories of Science: Robert Hooke – more than just springs

The story about the story of Britain's forgotten polymath.

Robert Hooke was born 28th July 1635 on the Isle of Wight, where his Father was a priest at the church in Freshwater. His father home-schooled him, due to ill health and when he died, Robert was left £40, which was enough to purchase an apprenticeship in London, to painter Sir Peter Lely. Unfortunately, his health was affected by the paint fumes and left at 13 to join Westminster school. Hooke's talents were quickly recognised, and he acquired a mastery of Latin, Greek and Hebrew, learned to play the organ, contrived flying machines and mastered the first six books of Euclid's *Elements* in a week.

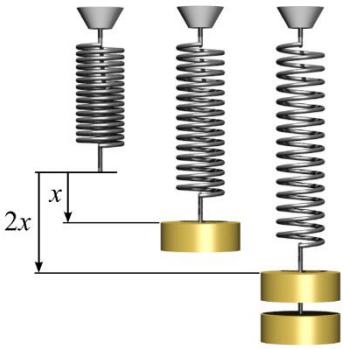
From Hooke's Micrographia

In 1653, Robert Hooke took up a poor scholar's place at Christ Church, Oxford, with a possible musical scholarship. At Oxford he began his studies of science, astronomy, mathematics, and mechanics, and formed a collection of influential, rich and creative friendships, not least Christopher Wren and Robert Boyle.

The Royal Society (initially the Learned Society) was founded in 1660 and Robert Hooke was appointed in 1663 the Curator of Experiments. For this he was paid a salary – making him the first professional research scientist. Soon after he became the Professor of Geometry at Gresham College. Hooke's interests were broad and far reaching, though he never stayed on one topic for long due to the nature of his job, he often had to leave work incomplete, allowing others to finish the work and claim the credit.

In 1665 he published his book *Micrographia*, which was the first book to illustrate insects and plants as seen through a microscope, and was a scientific sensation. He was also the first person to identify plant cells and in fact came up with the name 'cell' to describe them. He was also very interested in astronomy and had a telescope installed in his rooms in Oxford. He studied the motion of comets and the planets and the nature of gravity, which is where is long running arguments with Isaac Newton began. In case that wasn't enough, he was also a respected architect; involved in the building of the Royal Observatory at Greenwich and Ragley Hall (pictured) he was also the Surveyor to the City of London after the Great Fire of 1666.

Ragley Hall



Hooke's Law

Despite all his great achievements, Robert Hooke only has one law named after him- Hooke's law of stretching or squishing a spring, which states that the force (F) needed to extend or compress a spring by some distance x scales linearly with respect to that distance: $F = k x$. (Which he published in the form of a Latin anagram!) Hooke's law was used initially to improve clock and watch making, fine tuning the balance needed and it is still useful today. Hooke's law applies to much more than just springs – blood vessels stretching, chemcial bonding and even explaining the Greenhouse effect all use Hooke's law. However, not all materials follow Hooke's law, they stretch in different way, such as a rubber band, these materials are called non-hookean.

Dispute with Isaac Newton

The rivalry between Newton and Hooke began on the subject of light, after Newton was admitted to the Royal Society, in 1672. Newton thought light was a particle when Hooke thought it was a wave (we now know that is a bit of both!) But they really came to blows on the topic of gravity. Hooke suggested it was a universal force and that the force of gravity varies inversely squared with respect to the distant between the two bodies. He could not do the mathematical analysis to prove his ideas. Newton could and it would take him two years to prove this with his book *Principia Mathmatica*. Newton's famous quote "If I have seen further it is by standing on the shoulders of giants" (found on the edge of £2 coins) was writen in a letter to Hooke and is believed to be a insult about Hooke's lack of height and crooked back. Their rivally continued even after Hooke's death. When Newton became President of the Royal Society the only known portrait of Robert Hooke mysteriously disappeared and Hooke was pretty much written out of the history books.

Comprehension and Reflection Questions

1. A polymath is someone who knows a lot about a lot of subjects, why does this term apply to Robert Hooke?

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2. An elastic or rubber band is described as non-hookean, what is meant by this?

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3. Why was Newton's quote about "standing on the shoulders of giants" a dig at Robert Hooke?

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4. Sir Christopher Wren was given credit for designing the London Monument to the great fire, evidence is now emerging that it was actually designed by Robert Hooke. Why do you think this might have happened?

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Extension Activities

Ideas for things to do next:

Use the simulation to find the masses of the coloured blocks. https://phet.colorado.edu/sims/html/masses-and-springs-basics/latest/masses-and-springs-basics_en.html

Robert Hooke has been called the English Leonardo, find out more about Leonardo da Vinci's life and the similarities and difference between these two men.

Further Reading

Ideas for things to read next:

http://www.roberthooke.org.uk/ for more details about Hooke's life and work.

https://www.rmg.co.uk/discover/behind-the-scenes/blog/robert-hooke-and-rebuilding-london-after-great-fire for more details on his work rebuilding London

Read the Wikipedia pages on Hooke, Hooke's law and Mircographia