Feeling the Wonder in London

by Laurence Scales

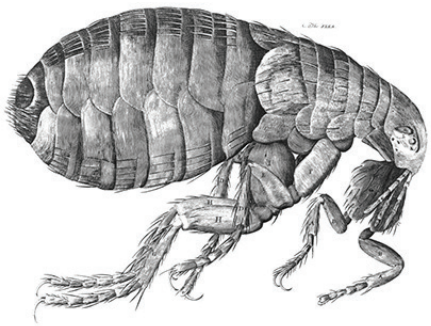
London has been at the forefront of exploration beyond the naked eye by telescope and microscope. But another inspiration behind this article was Will Self, the sesquipedalian writer, who recently left London for the underground particle collider at Geneva to see if he could 'feel the wonder'. (Self Orbits CERN, BBC Radio 4.)

He could not, and who could blame him? The instrumentation engineers, metaphorically looking under the bonnet of the detector, were somewhat detached from the wonder, and the absurd public relations people were bowling him sound bites as if he were a person unused to thinking. Nobody seemed to say to him that particle colliders are continuing an age old exploration of both the infinitesimally small and the infinitely large. A succession of Russian dolls has been opened up, often by Londoners. We may regard ourselves as one doll somewhere in the middle of the set.

Through the Lens

The first astronomers were limited to studying where the heavenly bodies appeared, and it helped them to cultivate and to navigate. A few weeks before Galileo obtained his telescope in 1609 Thomas Harriot at Syon Park pointed one at the moon and, drawing its imperfections, made the kind of observation that we are all capable of: '[It] lookes like a tarte that my Cooke made me last Weeke.' Galilieo's discovery of Jupiter's moons was probably more significant in the long run.

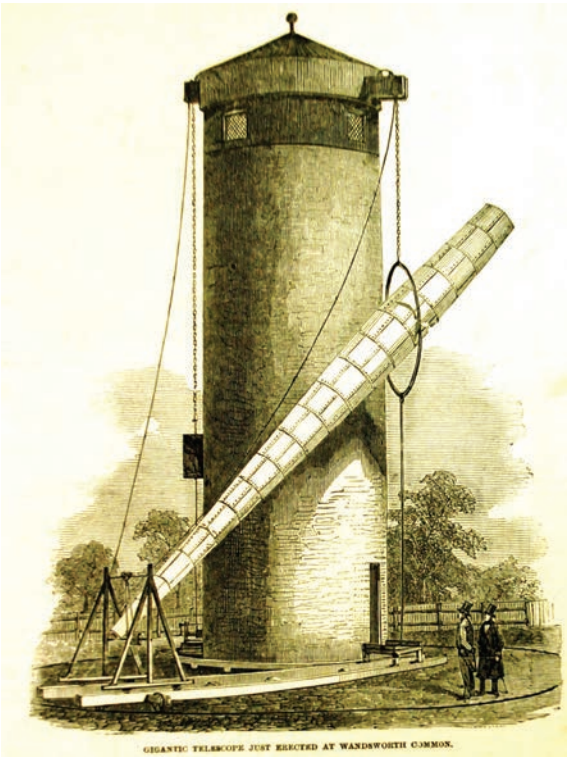
In simple form the optical microscope and telescope both involve a pair of lenses. The main difference lies in where the focus of the lenses needs to be. Robert Hooke bought a microscope from Christopher Cock and published, despite terrible lenses, fine drawings he made of familiar objects such as a body louse in *Micrographia* in 1665. (Familiar? Eek!)



From this we get the Hooke's word 'cell' for the biological building block. Samuel Pepys found the book 'so pretty that I presently bespoke it.' Even before *Micrographia*, Pepys was already succumbing to the wonders of the microscope in 1664.

'After dinner up to my chamber and made an end of Dr. Power's booke of the Microscope, very fine and to my content, and then my wife and I with great pleasure, but with great difficulty before we could come to find the manner of seeing any thing by my microscope. At last did with good content...'

A lens usually has a spherical surface because it is easy to make it that way. Unfortunately it is not quite the right shape to focus properly and, even if it were, it would not focus the different colours in the same place. For the telescope, Isaac Newton solved the problem in 1668 by using a curved mirror instead of a lens, bouncing rather than bending the rays. Optician John Dollond, one of the Huguenot silk weavers of Spitalfields, was able to correct the problem for the lens by adding a layer of a different glass in 1758. It is sad that such a name as Dollond should be discarded from the high street by the Philistines of our own time.



1852 saw the construction of Reverend John Craig's telescope on Wandsworth Common. The lens, two feet in diameter, was flawed and the tube dangled at the mercy of the wind. Rather than a failure of Victorian big science, this was one man's folly.

Similar problems afflicted microscopes but as the microscope was more a toy than a scientific instrument it had to wait until 1826 for a similar solution by Joseph Jackson Lister. In 1827 botanist Robert Brown of Soho noticed pollen grains jiggling about under the microscope as if pummelled by unseen fists. This 'Brownian

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motion' is caused by invisibly small atoms and molecules striking the pollen. But no one knew it at the time. Atoms were, in 1827, only a theoretical abstraction.

We probably associate the microscope more with microbiology now than any other discipline. It is no coincidence that Lister's son, the famous surgeon and pioneer of antiseptic surgery, unlike so many others, was receptive to the notion that invisible particles might contaminate and putrefy wounds. A few stones of Joseph Jackson Lister's house remain in an east London park. Most accounts of the house do not bother to mention him.

Joseph Jackson Lister

Particle physics had to be developed over the next century before there were further significant advances in microscopy, such as the electron microscope. If you can crystallise a substance then X-ray diffraction can reveal the structure. The beautiful patterns captured by researchers, some at the Royal Institution, sufficiently excited interior and fashion designers to incorporate them in products and at the Festival of Britain in 1951. An X-ray image made at King's College London in 1952 resolved the structure of DNA. Atomic force microscopes now make it possible to see single atoms as fuzzy blobs. Poking about inside the blobs is where particle colliders come in.

Early Victorian astronomers such as those at Greenwich were still limited to studying the position and motion of the heavenly bodies. William Hyde Wollaston, who lived just off Fitzroy Square, found in 1802 that the light from the sun, refracted to display a spectrum, was missing certain narrow bands of colour. It was found on the continent around 1860 that chemical elements held in a flame burn with light characteristic of that element. The two discoveries were combined and for the first time it was possible to consider stars as objects of varied substance rather than points of reference.

Three people who explored that substance through studying spectra were draper William Huggins of Tulse Hill who had his own observatory there; Margaret Murray whose own interest in spectroscopy led to her marrying Huggins in 1875; and civil servant Norman Lockyer whose first purchase of a telescope was sparked by socialising at the Wimbledon Literary and Scientific Society and having a house there with a good hilltop position. He identified a new chemical element, helium, in the sun in 1868. Today we need liquid helium to cool magnets in MRI scanners in hospitals.

Dig for the Sky

The nuclear reactions in the stars that forge those elements also produce splinters in the form of cosmic rays. Paradoxically the rays are often studied underground so as not to overwhelm the detectors. We now know that all of the heavier atoms in our own body (the iron from your spinach) formed inside stars.

In the 1930s nobody was thinking of building a 27km cavern for research underground but a cosmic ray detector (an instrument called a cloud chamber originally created to study… clouds) was installed in the unused Aldwych platform at Holborn underground station. Cloud chambers like this one were designed so that invisible particles stealing across them would photograph their own visible trails. This development won Patrick Blackett a Nobel Prize. Some of the detectors at CERN (bubble chambers and spark chambers) are descendants of his cloud chambers.

The Hugginses and others assayed the stars and interstellar dust. But from Hubble telescope observations it turns out that the substance we have come to understand over several centuries only adds up to about 5% of the mass of the universe. The collider will help to find the rest. So, we now find ourselves down a hole, using a descendant of the microscope, to explore what is too distant or too ephemeral to see with the telescope. Do you feel the wonder yet? Would you want the exploration to stop? The hole may be in Geneva, but London has always provided explorers, and a vital prerequisite: scope to wonder.

About Laurence Scales

Laurence Scales is a guide specialising in offbeat historical walking tours focusing on intriguing and amusing tales of discovery, invention and intelligence. He is a volunteer working at the Royal Institution for which he has devised walking tours, and also guides walks and tunnel tours for the London Canal Museum. Welcoming residents and visitors who want to look beyond the main London attractions he reveals a wealth of lesser known historic sites and offers a double-take on some famous ones. Please contact Laurence via his web site: http://www.laurenceswalks.co.uk/.