



National Geographic: 100 scientific discoveries that changed the world - and the microscope came in at number...?

Owen R. Green

Most people are familiar with the National Geographic magazine. It was first published in 1888. The 'yellow border' (introduced during the second decade of the 20th century) is distinctly recognisable in the newsagents (and the dentist's waiting room), and it is guaranteed that in any monthly issue there will be at least one article that any reader will find captivating – even if you only read the descriptions accompanying the superb photographs and illustrations. The National Geographic Society has co-sponsored many pioneering explorations ranging from the upper atmosphere to the deepest oceans, and covering every continent and ocean on the planet.

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In addition to its monthly magazines, books, maps and DVD's the National Geographic also publishes 'special publications'. A recent addition to this series has been '100 Scientific Discoveries that changed the world'. I was intrigued to know if the microscope was mentioned, and if so where did it come within the 100? No more suspense, it came in at number 47! However, that is not the full story, as the microscope features in at least six of the other greatest discoveries.

The format adopted in this special publication sees the scientific discoveries organised into one of four groups: The Power of information - computing, communications, and the nanoworld (1-25); Engineering the Body - health and medicine (26-50); Invisible Forces - physics and engineering (51-77); This World and Others - earth science and astronomy (78-100). In addition, some of the discoveries are 'elevated' to 'Breakthrough' status, deemed as critical ideas that reflect the cutting-edge thinking of today. Within each of the groups, the discoveries are listed from youngest to oldest so that the most recent discoveries build on the work of those that precede them. Consequently, the study of microbiology (number 43, 1674) is attributed to Anton van Leeuwenhoek, the father of microscopy who amongst other things, observed yeast, blood and sperm cells with the aid of the microscope. The cell features in discovery number 45 (1665), with the microscopical observations of cells of cork by Robert Hooke illustrated in his book *Micrographica* cited. Continuing the chronological list of discoveries, the microscope is listed at number 47 (and dated 1590). The origin is credited to Dutch father and son

eyeglass makers Hans and Zacharias Janssen.

For centuries, people had been using a single (magnifying glass) lens in the examination of small objects. The Janssens discovered that it was possible to enhance magnification by using two lenses as a simple compound: an image magnified with one lens is further magnified by the second. As all RMS members will know, it was another Dutchman, Anton van Leeuwenhoek who during the late 1600's improved the technology by creating a microscope capable of magnifying objects nearly 270 times. The rest, as they say is history, and now the most powerful microscope can resolve an object to a half angstrom. The advances attributed in the 'breakthrough' topic (Nanomedicine, number 44) are underpinned by the development of high-powered microscopes and microscopical applications.

The RMS Annual Lecture presented during Microscience 2008 was titled *Mechanisms of self-assembly at nanoscale dimensions* and was delivered by Professor Sir Harry Kroto of the University of Sussex. The lecture essentially summarised the chemistry-based methods used in the creation of materials with specified atomic and molecular infrastructures - essentially a lifetime's work that now centres on that area of science known as nanoscience and the development of nanotechnology. For Harry Kroto and colleagues Professors Robert Curl and Richard Smalley of Rice University, Houston, Texas, the benchmark was achieved in 1985, following a twenty-year search for evidence confirming the presence of a molecule made of multiple carbon atoms. This family of remarkable pure carbon molecules have a triangle shaped lattice construction in the

form of the geodesic dome, a shape designed by Richard Buckminster Fuller (1895-1983), a visionary designer and architect. The unique properties are known as Fullerenes, and the spherical carbon-cage structures known as 'Buckyballs' or when formed into elongated nanotubes 'Buckytubes'. All three scientists received the Nobel Prize for chemistry in 1996. The Buckyball (1985) features as number 4 in chapter 1, The Power of Information, where further reference to nanotechnology in Carbon Nanotubes (number 2, 1991), and Nanolithography (number 1, 1999) both of which feature references to the use and application of the microscope.

The microscope may have come in at number 47 in National Geographic's top 100 scientific discoveries, but it is clearly a major factor in many other discoveries (e.g. Mass extinction, number 80 (1980), Archaea number 81 (1977), Ecosystems number 87 (1935), Continental Drift, number 90 (1915), Climate Change, number 91 (1896), Age of Earth, number 92 (1830) and Fossils, number 95 (1669) to name but just a few). It should be gratifying for Royal Microscopical Society members and any user of the microscope to know that the combination of lenses in eyepieces and objectives that form the microscope underpins many aspects of scientific research in Life, Natural and Material Sciences. The basic design since its invention over 420 years ago is still recognisable in today's latest high-tech forms. To the public it has even become the most iconic

It will be clear to most readers who browse through this publication that the microscope must have contributed in many of the Scientific Discoveries.

symbol of scientific research. At the start of the 21st Century, and coinciding with the Royal Microscopical Society's 175th Anniversary, the microscope in its various forms remains a fundamental tool at the cutting edge of so much ground-breaking research.

Owen R. Green

Department of Earth Sciences, University of Oxford

owing@earth.ox.ac.uk

Owen is the Geological Facilities Manager in the Department of Earth Sciences, University of Oxford. Research interests include geological and palaeontological sample preparation techniques and protocols, particularly light and scanning electron microscopy applicable to palaeobiology, and specifically applications in micropalaeontology. He is the author of *A Manual of Practical Laboratory and Field Techniques in Palaeobiology*, has studied the oldest putative microfossils on Earth (3.4 billion years old), and using single celled foraminifera dated the timing of India-Asian collision at 50.5 million years old.

