Education Sector

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Medicine in philately: Antony Van Leeuwenhoek, the father of microscope

Pullardaki tıp: Antony Van Leeuwenhoek, mikroskobun kâşfî

The origin of the word microscope comes from two Greek words, “uikpos,” small and “okottew,” view. It has been known for over 2000 years that glass bends light. In the 2nd century BC, Claudius Ptolemy described a stick appearing to bend in a pool of water, and accurately recorded the angles to within half a degree. He then very accurately calculated the refraction constant of water. During the 1st century, around year 100, glass had been invented and the Romans were looking through the glass and testing it. They experimented with different shapes of clear glass and one of their samples was thick in the middle and thin on the edges [1].

They discovered that if you held one of these lenses over an object, the object would look larger. These early lenses were called magnifiers or burning glasses. The word lens is actually derived from the Latin word lentil, as they were named because they resembled the shape of a lentil bean [2].

In the 14th century, the art of grinding lenses is developed in Italy and spectacles were made to improve eyesight. Then in 1590, Dutch lens grinders Hans and Zacharias Janssen made the first microscope by placing two lenses in a tube. In 1667, Robert Hooke studied various object with his microscope and publishes his results in Micrographia. Among his work were a description of cork and its ability to float in water. After Robert Hook’s work, Antony van Leeuwenhoek, who will be discussed in a detailed way in this paper, used a simple microscope with only one lens to look at blood, insects and many other objects. He was first to describe cells and bacteria, seen through his very small microscopes with, for his time, extremely good lenses (Figure 1) [3].

After van Leeuwenhoek’s contribution, there were big steps in the world of microscopes. Several technical innovations made microscopes better and easier to handle, which led to microscopy becoming more and more popular among scientists. An important discovery was that lenses combining two types of glass could reduce the chromatic effect, with its disturbing halos resulting from differences in refraction of light (Figure 2) [4].

In 1830, Joseph Jackson Lister reduced the problem with spherical aberration by showing that several weak lenses used together at certain distances gave good magnification without blurring the image. In 1903, Richard Zsigmondy developed the ultramicroscope which was able to show objects below the wavelength of light and got the Nobel Prize in Chemistry in 1925. Then, Frits Zernike invented the phase-contrast microscope that allowed the study of colorless and transparent biological materials in 1932; and got the Nobel Prize in Physics in 1953. Ernst Ruska developed the electron microscope in 1938. The ability to use electrons in microscopy greatly improved the resolution and greatly expanded the borders of exploration. The Nobel Prize in Physics 1986 was divided, one half awarded to Ernst Ruska “for his fundamental work in electron optics, and for the design of the first electron microscope”, the other half jointly to Gerd Binnig and Heinrich Rohrer “for their design of the scanning tunneling microscope” (Figure 3) [5].

Among all these magnificent developments in the world of microscopes, it was Antony van Leeuwenhoek, known as the Father of the Microscope and considered to be the first microbiologist, who improved microscope enabling to see things that no man had ever seen before [4].

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Antony van Leeuwenhoek was born on October 24, 1632 in Delft, The Netherlands. He was entirely self-taught and did not receive a formal degree. His primitive approach, dismissing any type of scientific dogma, made him think freely, and directed him only towards his own passion and interests. His father was a basket-maker, while his mother’s family were brewers. Antony was educated as a child in a school in the town of Warmond, then lived with his uncle at Benthuizen; in 1648 he was apprenticed in a linen-draper’s shop. Around 1654 he returned to Delft, where he spent the rest of his life [6]. He set himself up in business as a draper; he is also known to have worked as a surveyor, a wine assayer, and as a minor city official. In 1668, Antony van Leeuwenhoek learned to grind lenses, made simple microscopes, and began observing with them. He seemed to have been inspired to take up microscopy by having seen a copy of Robert Hooke’s illustrated book Micrographia, which depicted Hooke’s own observations with the microscope and was very popular (Figure 4) [7].

As a salesman by profession who traded household linen, he often took magnifying glasses to judge the quality of cloth. Leeuwenhoek employed his own lenses of diamond shavings, which he got from Delft-diamond cutters. He constructed his own microscopes which were basically simple instruments consisting of a single lens.

Figure 1: A stamp published in Malawi in 2008 for the honour of great scientists, Robert Hooke and William Harvey.

Figure 2: A stamp published in Berlin, Germany in 1981 emphasising the importance of microscopes.

Figure 3: A stamp issued in Germany in 1980 showing the different types of early microscopes.
The product, containing two metal plates set to each other with a fixed lens in between, was however with high precision, and able to perform magnifications of around 300x. Leeuwenhoek made more than 500 optical lenses [8]. He also created at least 25 microscopes, of differing types. His microscopes were made of silver or copper frames, holding hand-made lenses. Although he has been widely regarded as a dilettante or amateur, his scientific research was of remarkably high quality [7].

**Microscopic study with his microscopes**

Van Leeuwenhoek’s microscopes were actually very strong magnifying glasses, having considerable similarities with the composite microscopes of the time. It was Leeuwenhoek’s passion, skill and the quality to illuminating the objects properly that made him discover the microscopic objects. He analyzed things like tooth plaque, stagnant water, baker’s yeast, sperm and blood [9].

Leeuwenhoek’s main discoveries are; the infusoria protists in modern zoological classification, in 1674; the bacteria, (e.g., large Selenomonads from the human mouth), in 1676; the vacuole of the cell; the spermatozoa in 1677, the banded pattern of muscular fibers, in 1682. In 1687 he reported his research on the coffee bean. He roasted the bean, cut it into slices and saw a spongeous interior. The bean was pressed, and an oil appeared. He boiled the coffee with rain water twice, set it aside. Leeuwenhoek was interested in the dried cochineal, trying to find out if the dye came from a berry or an insect (Figure 5) [10].

In 1673, Reinier de Graaf, a Delft physician, brought van Leeuwenhoek to the Royal Society, where he published his uniquely detailed findings in Dutch, consisting of only 200 letters. Despite the initial success of Leeuwenhoek’s relationship with the Royal Society, this relationship was soon severely strained. In 1676, his credibility was questioned when he sent the Royal Society a copy of his first observations of microscopic single-celled organisms. Previously, the existence of single-celled organisms was entirely unknown [9]. Thus, even with his established reputation with the Royal Society as a reliable observer, his observations of microscopic life were initially met with both skepticism and open ridicule. Eventually, his letters, written in Dutch, were translated into English or Latin and printed in the Philosophical Transactions of the Royal Society, and often reprinted separately. Finally in 1677, Leeuwenhoek’s observations were fully vindicated by the Society (Figure 6) [11].
Emine Elif Vatanoğlu-Lutz and Ahmet Doğan Ataman: Antony Van Leeuwenhoek, the father of microscope

Personal life

He married Barbara de Mey in July 1654, with whom he would have one daughter, Maria. His wife died in 1666, and in 1671 Leeuwenhoek remarried Cornelia Swalmius, with whom he had no children. His status in Delft had grown throughout the years. In 1669 he was appointed as a land surveyor by the Court of Holland; at the same same time he combined it with another municipal job, being the official “wine-gauger” and in charge of the city’s wine imports and wine taxation [7].

Leeuwenhoek was a Dutch Reformed Calvinist. He often referred with reverence to the wonders God designed in making creatures great and small. He believed that his amazing discoveries were merely further proof of the great wonder of God’s creation [12]. Leeuwenhoek’s discovery that smaller organisms procreate similarly to larger organisms challenged the contemporary belief, generally held by the 17th century scientific community, that such organisms generated spontaneously. The position of the Church on the exact nature of the spontaneous generation of smaller organisms was ambivalent. Leeuwenhoek gained worldwide fame with these observations, however he wrote in 1716 that he “did not strive for fame, but was driven by an inner craving for knowledge” (Figure 7) [8].

Death

By the end of his life, Leeuwenhoek had written approximately 560 letters to the Royal Society and other scientific institutions concerning his observations and discoveries. Even when dying, Leeuwenhoek kept sending letters full of observations to London. The last few also contained a precise description of his own illness. He suffered from a rare disease, an uncontrolled movement of the midriff, which is now named Van Leeuwenhoek’s disease [9]. He died at the age of 90, on August 26, 1723 and was buried four days later in the Oude Kerk, Delft. In 1981 the British microscopist Brian J. Ford found that Leeuwenhoek’s original specimens had survived in the collections of the Royal Society of London. They were found to be of high quality, and were all well preserved [6]. Known as the father of microscope, Antony van Leeuwenhoek is considered to be one of the greatest discoverers of all times.

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