میکروسکوپ، اختراع انقلابی و خارق‌العاده‌ی دست بشر

لیون هوک (۱۶۳۲-۱۷۲۳م) و مارچلو مالپیگی (۱۶۲۸-۱۶۹۴م)، بنیان‌گذاران ریزبینی در جهان پزشکی معرفی شده‌اند. این دو غول جهان دانش و پژوهش با میکروسکوپ‌های بسیار ابتدایی خود توانستند بیشتر ساختارهایی را که اکنون پژوهش‌گران و دانشجویان پزشکی تنها با یاری گرفتن از ابزارهای بسیار پیچیده و نوین مشاهده نمایند، در تاریخ ثبت و ضبط کردند. گالیله سال‌ها پیش از این دو غول جهان تحقیقات، میکروسکوپ را ابداع نمود لیکن مدت‌ها طول کشید تا مشکلات آن از نقطه نظر فنی، نور، و تنظیم تصویر اصلاح شده و هم‌چون میکروسکوپ‌های امروزی در اختیار ابنای بشر قرار گیرد. این مقاله که توسط ناصر پویان «تاریخ‌نگار پزشکی، مترجم و مقاله‌نویس» به نگارش درآمده و به زبان انگلیسی می‌باشد، میکروسکوپ را از تولد تا به امروز در بر می‌گیرد.

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Microscope, the Man's Revolutionary Innovation

Abstract

Just when the simple lens began to be used as a microscope is not clear. Roger Bacon, in his “Opus majus”, speaks of the use of lenses for magnifying objects. In all, the use of strong lens as a magnifier must have been discovered repeatedly. In fact, the microscope evolved slowly, hampered both by lack of understanding and of the mechanical technology needed for making precision instruments. After the invention of the achromatic (color corrected) lens it was applied with some success to the microscope. Magnifying powers were increased by using a series of lenses in the objective.

About ۱۸۰۰, the compound microscopes of the better makers began to resemble their modern counterparts. Afterwards the microscope developed through a series of detailed optical and mechanical

improvements. In ١٩٢٦, Louis Victor Pierre de Broglie, suggested that electron might behave like light waves. This phenomenon was demonstrated by Sir George Paget Thomson. In ١٨٧٣, Ernst Abbe', proposed the basic fundamental theory that led to the discovery of the electron microscope in ١٩٤٣ by a German electrical Engineer Ruska of Heidelberg and L.Marton.

Key Words: Microscope, Leeuwenhoek, Malpighi, Ruska, electron microscope, and ultra-microscope.

Microscope [Greek: micros, small+skopein, view], an instrument used for obtaining magnified images of small objects. The "simple microscope" is a convex lens of short focal length, used to form a virtual image of an object placed just inside its principal focus. The "compound microscope" consists of two short-focus convex lenses, the objective and the eyepiece mounted at opposite ends of a tube[١]. The term of "microscope" was coined by Johannes Faber (١٥٧٤-١٦٢٩), of Bamberg, one of the original members of Academia de Linccei. The identity of the inventor of the microscope has not been clearly established. The earliest records of optical lenses date from the late ١٣th century, when spectacles came into use. Just when the simple lens began to be used as a microscope but is not clear. Roger Bacon (c.١٢١٤-١٢٩٨), of Ilchester, an English monk of the Franciscan order, a scientist and an alchemist, in his "Opus majus" of ١٢٦٨ speaks of the use of lenses for magnifying objects. Indeed, as spectacle lenses became common, the use of a strong lens as a magnifier must have been discovered repeatedly. Yet Three centuries passed before the compound microscope was devised. Apparently one of the first such instruments was made by Galileo about ١٦٠٩, as adaption of his telescope. Another, based on Johannes Kepler's (١٥٧١-١٦٣٠), telescope with its positive eye lens is said to be developed by

Cornelius Jacobson Drebel (١٥٧٠-١٦٣٥), of the Netherland, about ١٦٢٠. Some evidence, however, indicates that both he and Galileo (١٥٦٤-١٦٤٢), Italian scientist, founder of modern physics and of telescopic astronomy, may have been anticipated by two Dutch spectacle makers, Hans and Zacharias Jansen, about ١٥٩٠. A Jesuit priest, Athanasius Kircher (١٦٠١-١٦٨٠), of Geysen, used a primitive microscope of ٣٢× magnification to view blood cells in ١٦٥٨[٢]. The invention of the first magic lantern is also ascribed to Athanasius, and he produced, from ١٦٣٦ onward, scholarly studies of Coptic language as well.

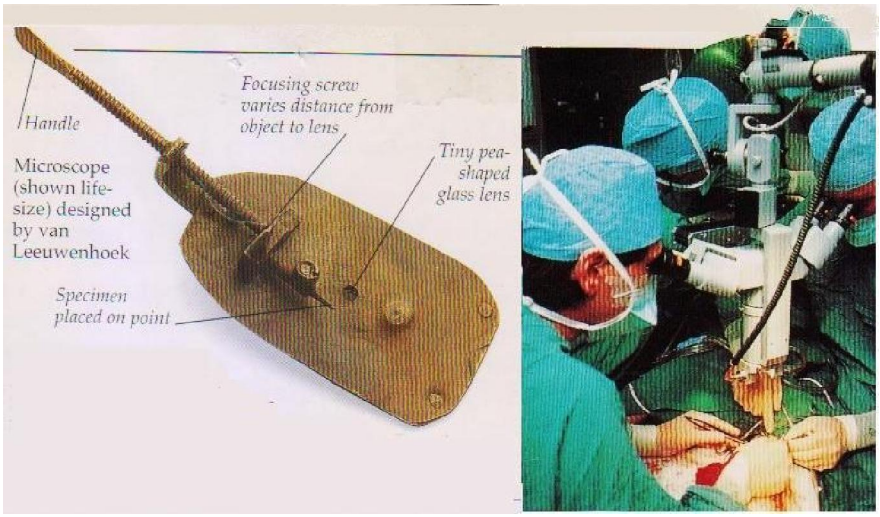
Antoni van Leeuwenhoek (١٦٣٢-١٧٢٣), Dutch microscopist and father of protozoology and bacteriology ground his own lenses and constructed over ٢٠٠ simple microscopes and described protozoa, bacteria, blood corpuscles, spermatozoa, and the striated fibers in bundles in voluntary muscles. The first description of a compound microscope was given by Robert Hooke (١٦٣٥-١٧٠٣), brilliant British experimental philosopher who wrote "Micrographia[٣]" and described cells as biological units in ١٦٦٧. In ١٦٦٨, Eustachio Divini, gave an account of his own early compound microscope to the Royal Society in London. Philip Bonnai published an account of two compound microscopes in ١٦٩٨. A French philosopher, Le Pere Cherubin, was the first to view small objects under the microscope conjointly with both eyes, in ١٦٧٧. Johan Zahn (١٦٤١-١٧٠٧), gave the first complete history of early microscopes in ١٦٨٥. In England, Benjamin Martin improved the microscope and sold pocket versions of it in ١٧٤٠. Henry Baker of London improved the microscope in ١٧٦٣, and recapitulated much of van Leeuwenhoek's work in his book "The Microscope made Easy" (١٧٤٣). A diamond microscope was constructed in ١٨٢٤ by Andrew Pritchard, who introduced "test

objects" to compare the quality of different microscopes. The microscopical Society of London was established in ۱۸۳۹[۴].
Giovanni Batista Amici (۱۷۸۶-۱۸۶۳), an Italian physicist of Modena who constructed the reflecting microscope and improved the achromatic objective of the microscope in ۱۸۱۴. He also invented the water immersion objective for the microscope in ۱۸۴۰, and produced the first high-power objectives by using meniscus lenses in ۱۸۴۴[۵]. Henry Clifton Sorby (۱۸۲۶-۱۹۰۸), of Sheffield, English chemist and geologist, in ۱۸۶۵, exhibited a spectrum microscope capable of detecting one millionth of a grain of blood[۶]. In ۱۸۷۸, Ernst Abbe' (۱۸۴۰-۱۹۰۵), an ophthalmologist and partner at the optical Company of Carl Zeiss (۱۸۱۶-۱۸۸۸), who worked on the improvement of microscopes, added the apochromatic objective, and developed the oil immersion method[۷]. He also added the sub-stage condenser in ۱۸۸۶, and improved the technique of phase-contrast microscopy, in ۱۸۹۲. The modern phase-contrast technique was introduced by a Dutch physicist Frits Zernike (۱۸۸۸-۱۹۶۶), in ۱۹۵۳, and received the ۱۹۵۳ Nobel Prize in Physics for his important work (development of the phase-contrast microscope). Among the many uses, this microscope permits the viewing of living cells without staining. Richard Adolf Zsigmondy (۱۸۶۵-۱۹۲۹), in collaboration with H.F.W Siedentopf, in ۱۹۰۳ he developed the ultra-microscope, capable of seeing particles below the usually visible wavelength of ۴۰۰-۷۰۰µm. Zsigmondy received the Nobel Prize of ۱۹۲۶ in chemistry[۸].

The highlights

- Microscope was one of the most important inventions in development of general sciences.
- A tiny one-lens microscope was invented by Antoni van Leeuwenhoek.

- Leeuwenhoek by holding his pioneer microscope close to his eye, he observed and described protozoa, bacteria, blood corpuscles, spermatozoa, and the striated fibers found in bundles in voluntary muscles.



Left: The pioneer microscope of Antoni van Leeuwenhoek (١٦٣٢-١٧٢٣), and the modern two binocular microscope for microsurgery (Right).

- The microscope played a vital part in explaining the role of microorganisms in the production of disease.
- The simple microscope, or magnifier, is merely a lens held near the eye, but a typical modern research microscope is extremely complex.
- It is notable that Leeuwenhoek's pioneer observations of yeast cells and other microorganisms were made with simple microscopes. The optical development of microscopes has been primarily a struggle for higher resolving power through larger usable angular apertures.
- Binoculars: An instrument with a lens for each eye, making distant objects seem nearer.

- Ernst Abbe' who was a partner of Carl Zeiss modernized the microscope by adding the apochromatic objective and the oil immersion device in ۱۸۷۸.
- The ultra-microscope capable of seeing particles below the usually visible wavelength of ۴۰۰-۷۰۰μm was invited in ۱۹۰۳ by Siedentopf and Richard Adolf Zsigmondy.
- The modern phase-contrast technique was introduced in ۱۹۳۵ by Dutch physicist Frits Zernike.

Conclusion and Impact

One of the most important inventions in the development of general sciences and medicine was the microscope. The use of a ground lens as a magnifying glass was known in antiquity and eyeglasses had been made in the Middle Ages. The earliest microscopes were crude and achieved a magnification of no more than ten times. The first significan treatise making use of microscope was on the structure of the bee and was published in Rome, in ۱۶۲۵. Pierre Borel may have made the first use of microscope for medical inquiry, but whether this was merely a fanciful elaboration of ancient views is not known[۹]. Antoni van Leeuwenhoek (۱۶۳۲-۱۷۲۳), a Dutch draper, in his spare time designed the famous one-lens microscope and revealed a new and tiny world. In the ۱۷th century Leeuwenhoek and Marcello Malpighi (۱۶۲۸-۱۶۹۴), Italian physician, microscopist and founder of histology became two giants of microscopy. Their contribution in botany, biology, protozoology, and microbiology affect the entire science of microscopy for ever since. The microscope itself extended man's limited vision and revealed to him the world of microforms that exists beneath the everyday appearance of things. The microscope's range of observation has been greatly extended since the late ۱۷th century. It played a vital part in explaining the role of microorganisms

in the production of disease. Since ١٧th century microscopes has proved invaluable both as a tool for diagnosis and as an instrument for conducting basic research into the complex life processes of disease-producing organisms[١٠].

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