Fundus Examination and depiction by Johann Nepomuk Oeller and other pioneers

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Summary

After the invention of the ophthalmoscope by the inspired great scientist Hermann von Helmholtz many successor ophthalmologists contributed to better knowledge of the retinal diseases describing and depicting what they saw. We examine this route staying mainly on the pioneers and among them the very gifted Johann Nepomuk Oeller.

We studied a sufficient number of atlases focusing mainly on the great large atlas by Johann Nepomuk Oeller

These atlases except of sources of the knowledge in 19th century are also pieces of art. The pictures match those we have today for many conditions of the retina.

Great physicians and great educators studied the retina and published a number of excellent atlases with fundus images of a great artistic quality. An important example is the fundus atlas by Johann Nepomuk Oeller.

Key words: fundus examination, Johann Nepomuk Oeller, ophthalmoscope, retinal deseases, atlas of ophthalmology.

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The invention of the ophthalmoscope and the pioneers in ophthalmoscopy

The invention of the ophthalmoscope (fig.1, 2, 3) by Hermann Von Helmholtz[1,2,3,4,5] (1821-1894) was mostly an incidental discovery that emerged during a demonstration and teaching of physiology in students. But the consequences of this discovery were surprisingly impressive. The doctor was now in possession of an instrument for the study of the living tissue, as for retina, optic nerve and blood vessels. Before Helmholtz, however, a French, Jean Mery[6] (1645-1722) was the first man who observed details of the fundus in a living eye (cat eye in the water under hypoxic conditions). Mery, instead, drew wrong conclusions about the cause of the phenomenon and he also believed wrongly that the organ of the vision was the choroid and not the retina. In 1709, also a French, Philippe de La Hire (1648-1718), correctly interpreted the findings by Mery. In 1823, Jan Evangelista Purkinje (1787-1869) believed that he found the principle of ophthalmoscopy examining the interior of a human eye, and also of a dog[6]. Charles Babbage (1792-1871), professor at the Lucasian chair of mathematics at Cambridge University from 1820 to 1831, designed an ophthalmoscope before 1847, which in essence was the same as this one presented later by Christian GT Ruete (1810-1867), Frans C. Donders (1818-1889) and Ernst Adolf Coccius (1825-1890), which were just variations of the Helmholtz's[4] ophthalmoscope. For this instrument there is only one reference from Thomas Wharton in 1854, but this was probably because he was my

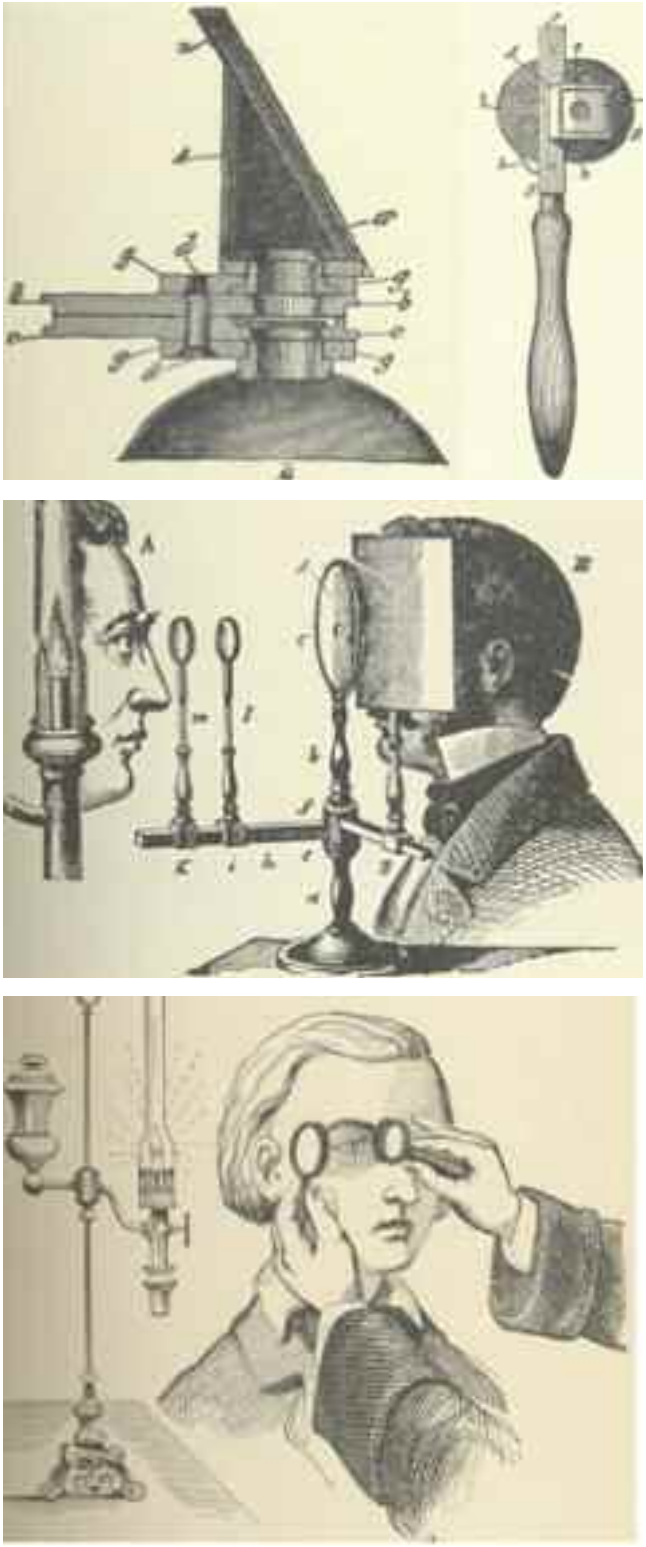

Fig. 1, 2, 3: Ophthalmoscope and its use

opic and expressed reservations about the value of the Babbage's ophthalmoscope.

The first fifty years after the invention of the ophthalmoscope by Helmholtz were years of evolution and improvement of the instrument, especially since 1885, when the electric ophthalmoscope was developed. Despite his own invention and the importance which as a physician and physiologist Helmholtz himself gave to that, he was not who was benefited the most from the instrument, but Albrecht von Graefe (1828-1870) was the first who recognized its fundamental importance. Helmholtz's invention had also and its rivals, like Thomas Wharton Jones, James Dixon, Sir William Bowman and John Dix, although the latter ultimately was one of the most active American ophthalmoscopers and published four papers entitled 'On the Ophthalmoscope and its Uses and methods of Application'. Dix included some incidents, attempted to draw images of the fundus and published bibliographic reviews.

Elkanah Williams (1822-1888) from Cincinnati, published two articles in 1854, describing the use of the ophthalmoscope and he noticed that the examination of the living fundus was'... by far the most significant progress occurred in Ophthalmology by then and was going to trigger interesting progress in the history of science... '.Beyond the description of the normal fundus, he also described the retinal detachment, vascular aneurysms and gray spots. American ophthalmologist Krause, also from Cincinnati, published an article commenting on the book of Jaeger's 'The Ophthalmoscope and Its Use'. Benjamin Joy Jeffries (1833-1915) making careful examinations wrote in 1862: "The fundus of the human eye has not even photographed, but no doubt that it will happen. It will be a great benefit to be photographed cases with diseases of the inner eye '. Henry Drury Noyes from New York (1832-1900) was an American pioneer in this field regarding the study of the fundus. Charles W. Rucker (1900) describes the two decades that followed the discovery of the ophthalmoscope as the 'Golden Age of Ophthalmology'. In addition a group of pioneers, including the distinguished doctors Sir Jonathan Hutchinson (1828-1913), John Hughlings Jackson (1835-1911), Sir William Gowers (1845-1915), demonstrated the importance of the ophthalmoscope to their colleagues. Sir Clifford Allbutt (1836-1925) notes with regret that 'the number of doctors using the ophthalmoscope in England counted on the fingers of one hand."

Christian Georg Theodor Ruete (1810-1867) in 1852, Carl Wilhelm von Zehender (1819-1916) in 1854 and Andreas Anagnostakis (1826-1897) in the same year contributed to the evolution of the ophthalmoscope with additions and variations. Austrian Eduard Jaeger (1818-1884) in 1854 developed a sophisticated instrument, based on the principles declared by Helmholtz, Ruete and others. Using this instru-

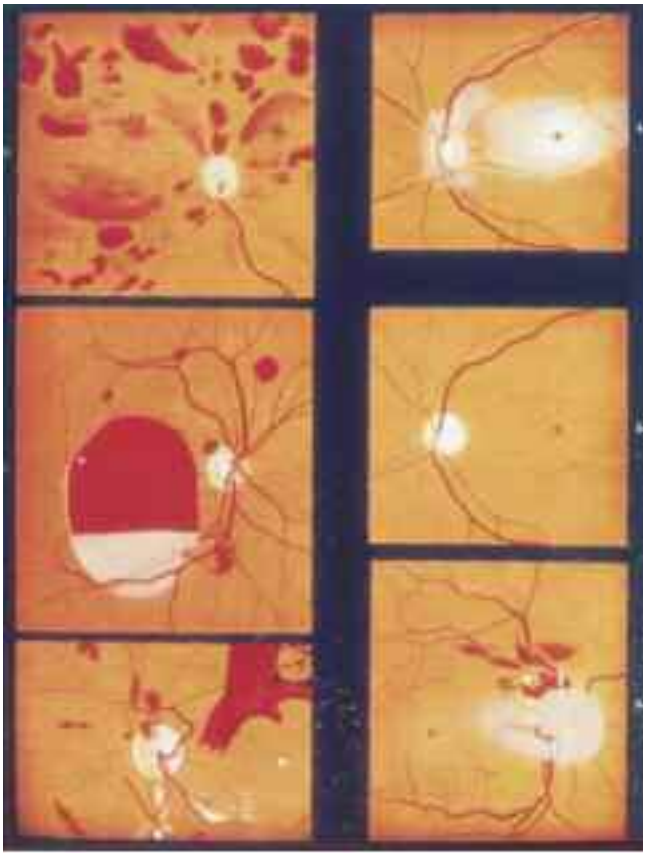

Fig. 4: Liebreich's Atlas

ment for diagnosis, Jaeger depicted many normal and pathological conditions of the fundus in artistically accurate paintings. This required sitting, examining and painting for each case about 20 to 30, and even 40 to 50 times and two to three hours at each time. Initially his findings were published in 1855 entitled: 'Beitruge zur Pathologie des Auges' and then enriched in larger publications entitled 'Ophthalmoscopisher Hand-Atlas' in German, French and English. These projects have played an important role in familiarizing ophthalmologists with normal and pathological fundus images. Jaeger, for example, was the first to describe the ophthalmoscopic findings in diabetes. Julius Hirschberg[5] says Jaeger was a talented painter, inheriting his talent by the renowned grandfather (from the mother) Joseph Beer and his also from the distinguished ophthalmologist father Friedrich Jaeger. Furthermore, he notes that he was a lover of the accuracy and for this purpose designed every detail in his paintings, unlike other authors who were satisfied with simple schematic depiction.

Also Richard L. Liebreich[6,7] (1830-1917) described a tubular ophthalmoscope, which in combination with a camera lucida* its eyepiece's end could display the image of the fundus. This image can be displayed in a board where easily can be designed. Liebreich displayed the inverted fundus image in a photo-sensitive glass plate, thus taking the first picture of the inner eye. He also designed a small simple ophthalmoscope that was very popular in Europe and America, and in 1863 he published the 'Atlas der Ophthalmoscopie' (Figure 4). This was the first Atlas of Ophthalmology and has been a model for those issued later. Until late 19th century were issued in Europe and America very remarkable Atlases of the fundus, as that one by professor Otto Haab[8,9] (1850-1931) from the University of Zurich, issued in 1890 among others an impressive atlas of ophthalmoscopy (fig. 5). In America W. Adams Frost released an equally impressive Atlas in 1896[10] (Figure 6).

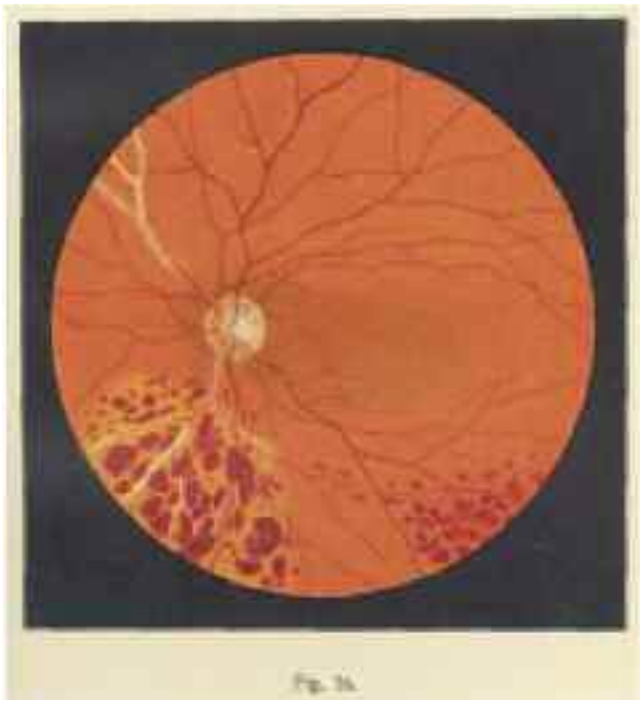

Fig. 5: Atlas by the Prof. Otto Haab

* Camera lucida: A visual artifact with a series of mirrors prisms and diaphragms allows the user to get in a piece of paper what he sees displayed on it and thus allows him to draw it. Camera Lucida was invented in 1807 by the British physicist William Hyde Wollaston (1766-1828) and its name is Latin and means "bright chamber '.

Johann Nepomuk Oeller and his work 'Atlas der Ophthalmoskopie'

The finest and most impressive, as generally is admitted, fundus Atlas was that by Johann Nepomuk Oeller (1850-1932)[11], professor for twenty years (1901-1920) at the University of Erlangen. Professor J.N. Oeller was impressed

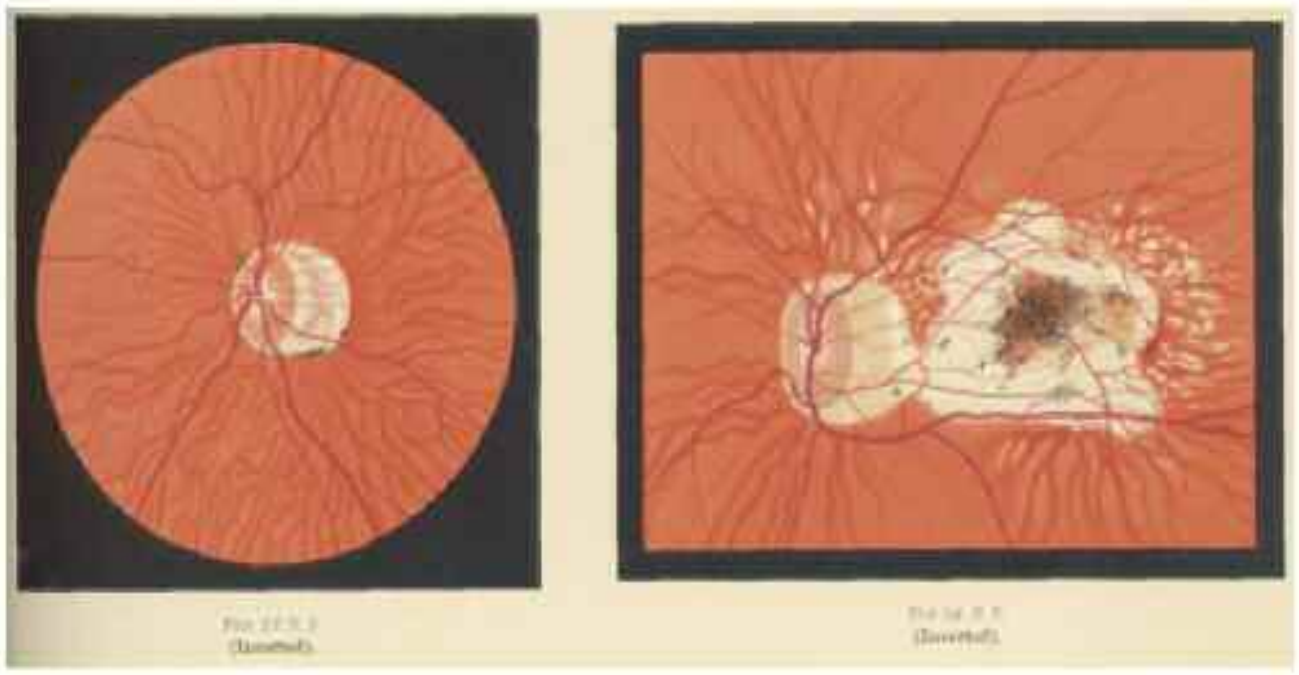

Fig. 6: Adam Frost's Atlas

from the works by R. Liebreich, particular by Eduard Jaeger and his work 'Beitruge zur Pathologie des Auges' and decided to draw up and publish an ambitious project, his own 'Atlas der Ophthalmoskopie'. Oeller drew himself the paintings from his own cases and handed them to the Art Institute and Printing Company of Wurzburg. Julius Hirschberg[7] states the following about Oeller's Atlas:

... 'The color images are displayed at a magnification of about 10X. The author is a skillful Artist. His purpose is to represent the eye fundus of the eye from the most common and important diseases especially in relation to the systemic diseases. The images are realistic and colorful. All images derived from the author's personal patient files and were painted by him (using indirect ophthalmoscopy). He used oil on canvas. It is an excellent and very informative book. In addition to the German version there is also an English translation (by A. Knapp). Several tables were added later...'

As mentioned before, Oeller painted himself the tables from his own cases and he handed them to the Art Institute and Printing Company of Wurzburg and these were printed with the lithographic process, each copy is in itself a Piece of Art. The entire project was published progressively from 1896 to 1924. Specifically, at first, (1896-1899) was issued the 'Atlas der Ophthalmoskopie'[12] consisting of five sections (A, B, C, D and E) in a loose leaf binding in a type of folders with 75 total chromolithographic tables on size 395x303 mm with a description of the diseases in two languages, German and English (fig.7-13).

Oeller then proceeded to publish the supplement entitled: Atlas seltener ophthalmoskopischer Befunde. Zugleich Ergunzungstafeln zu dem Atlas der Ophthalmoskopie[13], in order to present rare diseases and their ophthalmoscopic findings (fig. 14-17). This issue was published again progressively from 1900 to 1912, the first 8 sections and the ninth was issued finally in 1924. This work, of equal artistic importance as of the previous, as mentioned, consists by nine parts with 40 tables in total, sized 411x309 mm and translated in English by Thomas Snowball. Both collections were issued by the publishing House JF Bergmann in Wiesbaden. It is extremely difficult to find the whole project with all the sections, especially the 9th supplement and this makes it very rare and precious. Oeller in the prologue of his work[12] thanks Prince Luitpold of Bavaria for the financial support he has provided. The prince was a lover of the arts and sciences. Oeller also highlights the usefulness of this project in the diagnosis, but especially in education and underlines that the described disease entities are exclusively from his own cases. Finally, he thanks Professor Alfred Knapp for his parallel translation of this work in English.

Fig. 7-13: Johann Nepomuk Oeller's Atlas with images from the earlier publication with the most common pathological conditions

Conclusion

The discovery of the ophthalmoscope was the beginning of a new era in the evolution of Ophthalmology. The ability of a physician to observe living tissues such as the retina and the vessels of the optic nerve and other eye components was a milestone in the study and diagnosis of the eye diseases, in particular of its interior. Furthermore, the literature was enriched with new data on the anatomy, physiology and pathology of the vision's organ. Within these studies the first Atlas of the eye's fundus appeared to help physicians to familiarize the use of this valuable instrument, the Ophthalmoscope. The depiction of the retina soon reached a very high artistic level. Concrete examples are Fundus Atlases by Eduard Jaeger, Richard Liebreich and finally by Johann Nepomuk Oeller, which apart from diagnostic manuals are also great works of art. Oeller's Atlas undoubtedly is considered the most complete, by its artistic side of course. The Atlases are also used to highlight the importance and the role of the findings in the evolution of our knowledge about the diseases of the fundus of the eye as well as the importance of using the ophthalmoscope during the early years of its discovery.

The artistic representation of the diseases of the eye fundus, beyond the diagnostic value it had for its era, was also a milestone in coupling Art and Science. Oeller's work is a living monument of scientific and artistic creation

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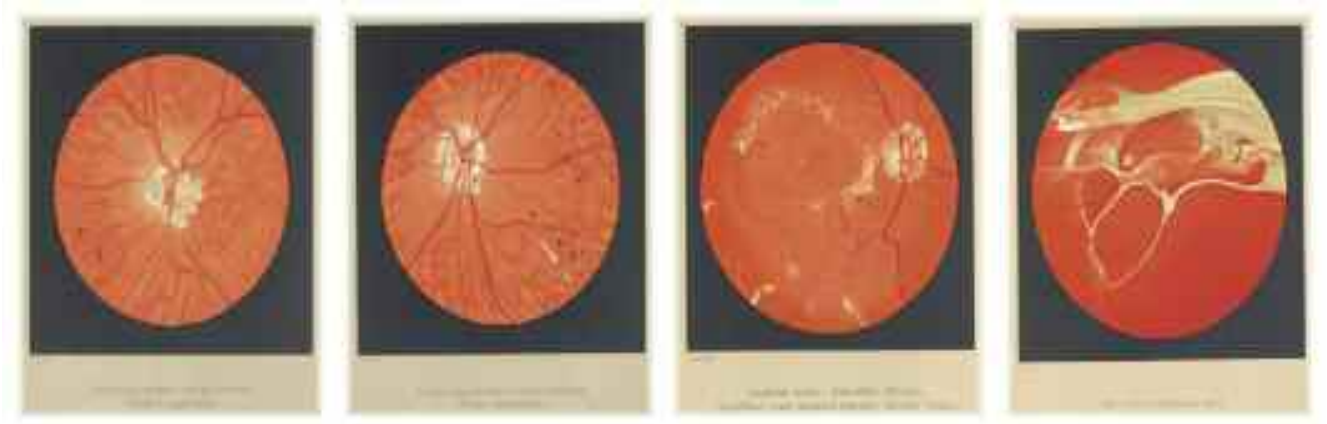

Fig. 14-17: Johann Nepomuk Oeller's Atlas of rare Diseases and their ophthalmoscopic

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