

THE BEGINNINGS OF FUNDUS ILLUSTRATION

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THE earliest drawings of the fundus have a special interest in showing what the first ophthalmologists saw, or thought they saw, with their imperfect instruments. Helmholtz published his pamphlet, *Beschreibung eines Augenspiegels zur Untersuchung der Netzhaut im lebenden Auge*, in 1851, and consequently that date is our starting-point. He supplied a diagram of his instrument, but did not go the length of enlightening us as to the appearances which the fundus presented to him. Others, however, were less reticent, and hidden away in the dusty Archives and Transactions of small local societies, now forgotten, there may be drawings illustrating features which must have been a wonder to their observers. Of these it is difficult to say who was the first to publish a sketch, and we have to rely upon such material as is accessible in our scientific libraries at the present time.

1853. The earliest dated essay containing plates of the fundus is by A. C. Van Trigt, entitled *De Speculo Oculi*, and published "ad Rhenum," (Utrecht), in 1853. It is in Latin, and gives seven primitive lithographs in black and white, small in size. He describes conditions, but the illustrations, except one of detached retina, do not correspond.

1854. The above-named work seems to have met with some success, for, a year later, a translation by C. H. Schauenburg was published at Lahr in Baden under the title *Der Augenspiegel, seine Anwendung und Modificationen*. It is clear that from the first the apparatus of Helmholtz did not satisfy those who adopted it, and in the early years of ophthalmoscopy every investigator appears to have been convinced that there was more to be seen in the fundus than was possible with the instrument at his command, and accordingly he sought for something better, resorting to complicated machinery for his purpose. The refractive error of the patient, and possibly of the observer, must have been a stumbling-block, and there must have been many exasperating moments when a lesion, which the observer felt ought to be visible, baffled his efforts to focus it with his imperfect appliances.

The same year saw further publications. In the *Annales d'Oculistique* for 28 February, Dr. Anagnostakis appended to an *Essai sur l'Exploration de la Rétine*, a few rough plates, etched by Dr. Barre, and coloured by hand. They are very elementary, and have no special significance.

Two months later, on 27 April, Jaeger presented his paper, *Ergebnisse der Untersuchung des menschlichen Auges mit*

dem Augenspiegel. This was accompanied by eight large plates in colour, and was afterwards published in the *Transactions of the Imperial-Royal Academy of Science*, Vienna, in February, 1855. The drawings were destined to lay the foundations of that spacious gallery of pictures which is, perhaps, the most enduring monument of this pioneer ophthalmologist. We shall have occasion to refer once again to his work, but meanwhile we will follow the chronological sequence.

In this year also we find the first and second parts of the large folio by Ruete, *Physikalische Untersuchung des Auges*, issued at Leipzig, and completed in 1860, with the ninth part. The drawings are on copper-plate, and coloured by hand. The majority illustrate external diseases, and are executed with great minuteness; but there are many of the fundus as well. These are represented as seen through the pupil; the iris, lids, and eyebrow being included without any clear object. The fundi are only an inch in diameter, and the technique is remarkable in showing so much in so tiny a space. They do not all convey appearances which can be identified in the light of experience. With an imperfect instrument this was to be expected, the more so as Ruete had to depend entirely upon his own observation for his inferences; but they are the first attempt to plan systematically an atlas on an extensive scale. His pictures evidently set the fashion, not only as regards size and technique, but also, and not always with acknowledgment, as regards subject and detail. They attracted attention in this country, for in some English publications, presently to be referred to, we shall find several reproduced.

1855. The second edition of *Ophthalmic Medicine and Surgery*, by Wharton Jones, bears this date. One plate of the fundus, or "bottom of the eye," is given, but it conveys nothing, and the ophthalmoscope is dismissed in a couple of pages. In the French edition, a translation from the third English edition, by Foucher, published in Paris in 1862, there are three coloured prints of the fundus. One shows the arteries confined to the temporal side of the disc and retina, and the veins only on the nasal side. The other two—one after Follin—show all the vessels having a common origin, arteries and veins being traced to one main trunk. There are, besides, very rough wood-cuts, which need the description in the text to explain them.

1856. In this year, Dr. Louis De La Calle presented his Thesis *De l'Ophthalmoscope*,* for his degree of Doctor of Medicine. He shows eleven lithographs in monochrome, on a reduced scale, with thread-like vessels. They do not throw any light on pathological conditions.

* In the French works cited the more classic orthography, "ophth.," had not yet been displaced by the form now in use.

1857 (?) About this date Liebreich appears with his *Atlas of Ophthalmoscopy*; but this is conjectural, for the first Edition is alluded to as having been published in Paris and Berlin in 1863. The second edition was translated by Swanzy and published in London in 1870. This Atlas, whatever its date, was in existence before Jaeger brought out his larger series of plates, for the Viennese ophthalmologist roundly condemned it for incorrectness of anatomical and pathological details. It is possible that Liebreich was familiar with Jaeger's first drawings, and being himself an artist and connoisseur, endeavoured to outstrip Jaeger, as Jaeger had outstripped Ruete. Whatever the private and personal grounds for the attack, it is undoubted that Jaeger's strictures were justified in many instances, but, as will be seen later, there was a sharp rejoinder, on the part, too, of one who, if not a compatriot, was at least co-lingual.

This Atlas was the first complete work of its kind to depart from the minute scale favoured by Ruete. Liebreich went to the opposite extreme, and in filling in the details of his large plates did not allow himself to be beaten by mere anatomical trifles. It is, nevertheless, an achievement which, far from being overshadowed by contemporary work, stands out as a landmark in ophthalmoscopy, and Jaeger himself need not have been ashamed to sign many of the drawings.

1857-59. The first volume of our *Royal London Ophthalmic Hospital Reports* refers to these years, and it and the following volume, 1859-60, contain small drawings, illustrative of papers by C. Bader. These drawings were published separately in the form of a small Atlas in 1868. In spite of the fact that Jaeger had standardized, as it were, the style and manner in which the fundus should be depicted, we find the example of Ruete perpetuated in these drawings, and the inference is that Bader wished to show his skill with the ophthalmoscope rather than to represent actual appearances with accuracy. In some instances discs are drawn less than four millimetres in diameter, and the minuteness of the scale suggests that the indirect method was used. The draughtsman was one Schweitzer, and the lithography, as was the practice in illustrations by this process in this period, was carried out in Germany.

1858. In this year the first book in English on the Ophthalmoscope appeared. It was by Jabez Hogg, and was a reprint of his paper in the *Lancet* of the preceding year. Its illustrations consisted of wood-blocks which the author, with some justification, excused as they "imperfectly represent the appearances described," and eight tiny coloured lithographs, four taken from Ruete and one from Wharton Jones. The conditions in these miniatures call for some imagination if they are to be interpreted in the light of our

present-day knowledge. Hogg enlarged his little pamphlet in 1863, under the title of *A Manual of Ophthalmoscopic Surgery*, and repeated the drawings of the smaller work with the addition of several more.

1862. The next book in chronological order is Zander's *Augenspiegel*, the second edition of which was published in 1862, followed in 1864 by an English edition translated by R. Brudenell Carter. Both editions contain decidedly quaint lithographs in colour by Singer of Leipzig. In one, a detachment of the retina is represented as bright blue, and the reds are indifferent in quality.

In this year Italy contributes to the list. Gritti published in Milan an extensive treatise, *Dell'Ottalmoscopo e delle Malattie end-oculari per esso riconoscibili*. This has lithographs in black and white by himself, somewhat coarse in execution, but recognizable as showing retinitis albuminurica, hæmorrhagica, and pigmentosa, sclerosis and cupping. These conditions are correctly described in the text, although his nomenclature is different from that adopted in modern practice.

1866. By this time ophthalmologists were directing their attention to ocular manifestations of diseases in the brain, and in this year Bouchut published his work entitled, *Du Diagnostic des Maladies du Système Nerveux par l'Ophthalmoscopie*, with a small *Atlas* of plates. Illustrations of papilloedema can be recognized, although the drawings are incomplete in detail. He also shows the fundus of a dog and of a rabbit in which the characteristics are fairly well observed. These drawings are the earliest that I have come across in this sphere of ophthalmology.

1870. Our sequence at this point becomes confused owing to lack of information as to when the first edition of Jaeger's *Beitraege zur Pathologie des Auges* was published. The second edition is dated 1870, and is in small folio. The plates are large-scale representations of many of those given in the first edition of the *Traité des Maladies du Fond de l'Œil et Atlas d'Ophthalmoscopie*, which Jaeger, in collaboration with de Wecker, published in Paris and Vienna in that year. The de Wecker and Jaeger work is valuable in that each author writes his own preface, dealing with the condition of ophthalmology at that time; but the interest for us, at any rate as far as this investigation is concerned, lies in Jaeger's criticisms of contemporary illustrations. Bader, who made out the macula to be blue, is shown scant mercy, while Ruete, upon whom he, apparently, based his style, is commended. The criticisms of Liebreich, already referred to, and of Bouchut and Magnus, to be discussed presently, are harsh; but I have not been able to trace a copy of Martin's *Traité pratique des Maladies des Yeux*, published in Paris in 1863, which likewise is not spared.

In these strictures it is difficult to discriminate between Jaeger the acute observer, and Jaeger the skilled artist jealous for his handiwork. There is little doubt in my mind that when Ruete's large folio became accessible, pernicious and dangerous conventions associated with mere names of diseases were adopted by draughtsmen, who depicted not what they themselves had seen, but what others had noted. It is not going too far to say that many colour-illustrations of typical examples that abound in modern text-books bear the traces of their pedigrees and ancestry, and this seems to be due to a desire to produce a nice picture rather than a veracious aspect of the thing seen.

After a study of the works which Jaeger catalogued in his *index expurgatorius*, it is clear that he was right. But even he is not beyond reproach. He enters a plea, admittedly justifiable, for the expense and costliness of producing an Atlas within reasonable price, and we readily make allowances for the monotony of colour that predominates in many of his plates. At the same time we have to remember that between 1870 and 1890, when the English edition was published with the identical plates, some progress had been made in printing and the finer reds had become articles of commerce. When, therefore, the edition of 1890 was issued, some care should have been taken to maintain the goodly repute of the artist-ophthalmologist who had taken advantage of the opportunity for aspersing the work of his contemporaries and predecessors.

But the mote in their eye was the beam in his: different in size, shape, and colour, but still a beam. We can accept all that he says about pathological conditions, but his plates do not invariably show what he describes, particularly as to colour. It may be that he used oil as his illuminant, which would make the reds of the fundus appear more yellow than when electric light is employed. In favour of this supposition is his making atrophic conditions of the disc greenish rather than blue. In his preface to the French edition of 1870, partly quoted in the English edition of 1890, he refers to the large number of sittings which he obtained for each case, amounting to 40 or even 50, and it is not unlikely that the prolonged strain of studying one tint fatigued his sense for red. The colouring is better in the large plates of the *Beitraege* than in the reduced facsimiles in the *Atlas*. The eight plates drawn by his editor, Hardmann, and added to the edition of 1890, more nearly approach the tone of the fundus as we expect to find it represented nowadays. Jaeger claimed that he had drawn each fundus in "natural size, form, colour, and position," but the vessels are too diagrammatic, and, particularly at the disc, conform to a type without individuality. Still, the highest testimony to his fidelity towards his theme, and his anxiety to serve the art of medicine, lies in the fact that his *Atlas* is upheld as an authority.

But Jaeger was not to have things all his own way when exposing the shortcomings of adventurers in the same field as himself. Liebreich was to have his champion, for in 1870 there was published in Paris yet another Atlas, this time by A. de Montméja, called *Pathologie iconographique du Fond de l'Œil*. The drawings are by one Triollier, who contrived some strange devices. A green detachment of the retina is shown, with the vessels also green; opaque nerve fibres appear as black; a normal disc presents itself as blue, and veins cross veins and arteries cross arteries with fine impartiality. But the preface is our main concern here. Zehender is quoted, without, however, reference to the original source of his remarks, and he replies with vigour to Jaeger's attack upon Liebreich, although Montméja's drawings would have entitled Jaeger to yet another scalp. Justly or unjustly, Zehender gives us a hint of strong personal bias by asking why Jaeger never alludes to any of his colleagues in Vienna, and leaves us to infer that professional jealousy, quite as much as a desire for scientific accuracy, was at the root of Jaeger's unsparing criticisms.

1872. The *Ophthalmoscopischer Atlas*, by Hugo Magnus, that I have seen is dated 1872, but the plates must have been published before 1870, for this author is one of those whose drawings stirred Jaeger to wrath. The earlier edition, if one exists, has not been traced. There are 14 plates, poor and ludicrous, and the author seems to have relied upon his imagination and a good deal of Liebreich for some of his material.

1876. Bouchut's *Atlas d'Ophthalmoscopie médicale et de Cérébroscopie* is dated 1876, and is an amplification of the earlier work mentioned above. It cannot be said of many of the drawings that they represent the abnormalities referred to in their titles.

In the same year, Jaeger continued his studies and brought out his *Ergebnisse*, containing good lithographic drawings in black and white.

1879. This year is interesting as it is the date when Gowers published his *Manual and Atlas of Medical Ophthalmoscopy*. In spite of the drawback that only two of the plates were in colour, while the rest were autotype reproductions of his sketches, it immediately became a standard work, and it and Jaeger's *Atlas* appear to have held the field for the next few years.

1881. The first volume of the *Transactions of the Ophthalmological Society* was issued in 1881, and we find that from its earliest days the Society gave attention to drawings of cases. This volume contains plates of the fundus in monochrome, and two drawings in colour by E. Burgess, illustrating the fundi of an infant: difficult enough subjects which account for the somewhat unsatisfactory result.

But in the following volume there are remarkable pencil drawings

by Stanford Morton and A. H. Benson, which show not only immense patience, but also masterly technique with the material.

Evidently the importance of drawings was recognized by the Society, for the third volume contains the description and illustration of an ophthalmoscope for artists, devised by the late James Adams. The demand for it, however, was not sufficient to induce the makers to put it on the market. By this time the technique of fundus drawings had advanced to a stage when it was clear that they must reach an assured standard if destined for publication, and names that have become familiar in this sphere are to be found as signatures to the plates in the *Transactions*. It is interesting to follow, year by year, the work of that master of his craft, Mr. A. W. Head, and it is somewhat singular that with these specimens, which could not have failed to be accessible to ophthalmologists, the year 1886 should have seen the publication of two books with plates far behind in the quality demanded by the Ophthalmological Society for its *Transactions*.

Of these books, Loring's *Textbook of Ophthalmology* is the lesser offender, but his drawings are coarse, and the colouring, especially in the first volume, is weak.

The other is Galezowski's *Traité Iconographique d'Ophthalmologie*, but as it is only the second edition that I have traced, and as the date of the first is not given, there may be extenuating circumstances in his case. Nevertheless, it is strange that at any date after the appearance of Jaeger's *Atlas*, anyone should have considered the primitive and often meaningless drawings of Galezowski to have been worthy of publication.

The year is redeemed by the issue of Schmidt-Rimpler's *Augenheilkunde und Ophthalmologie* in a second edition. It has seven good coloured lithographs, signed by Dr. L. Justi.

From this date draughtsmen of the fundus appear to have vied with one another in producing work which had to be accurate in order to lay a claim to possess permanent value. Their plates are in the hands of every ophthalmologist now a days, and no detailed reference to them is necessary with the exception of two. That admirable achievement, *The Fundus Oculi*, by Adams Frost, with A. W. Head as his illustrator, is now a classic, and a word must be given to Kurt Adam's *Ophthalmoscopic Diagnosis*, in which the plates have been brought to a high and enviable degree of artistic technique.

This chronological record cannot be anything more than an attempt to give the ophthalmologist an idea of the birth and progress of this modest handmaid and minister to his more serious endeavours. When we consider the importance of the ophthalmoscope in everyday practice, we cannot easily reconstruct a period in which its use was seriously belittled, and with our perfected

knowledge we are apt to overlook the pioneer efforts of those early investigators and enthusiasts, who, with some bits of glass, began to explore, and to depict, the wonders of a small area of the human body which had lain hid from all conception since the birth of time. Babbage, one of the first, as far as we know, to have seen the fundus oculi, must have been so struck by the simplicity and obviousness of the apparatus required that he did not trouble himself about his discovery.

The first clear view of the fundus is to some—it ought to be to all—an eternal memory, and familiarity may have blunted the imagination so that we fail to think much about the sensations of an ophthalmologist of less than two generations past, whose descriptions of what he had seen must have aroused wild discussions, grave ponderings, and no doubt heated arguments. Thanks to them, in ophthalmology at least, we can confidently echo without vainglory,

ἡμεῖς τοι πατέρων μέγ' ἀμείνονες εὐχόμεθ' εἶναι.

It cannot but be that in the chronological list there are lacunae, inevitable owing to the times in which we live, but every endeavour has been made to search the accessible scientific libraries for material. Doubtless out-of-the-way publications, unobtainable and uncatalogued, may add to our list, but the present purpose is served if the references given are of help to those interested in the matter.

From this brief survey the reader will be able to consult these first studies of the fundus, and realize the obstacles with which the pioneers of ophthalmology had to contend. It is not uninteresting to turn over these delectable plates, executed when the science was in its infancy. Fantastic as many of the oldest are, we cannot question their having given immense joy to their authors.

Before concluding this subject, we may look ahead and ask what help photography may afford us in the future. I am not very sanguine, but science has her own way of circumventing difficulties, and I trust I may yet see photographs which will surpass the best drawings of to-day, just as our draughtsmen have thrown into the shade the pristine attempts which we have just been considering.

It is said that "satisfactory" photographs have been made, but hitherto I have not met with any that can replace drawings by hand. Even were we provided with a perfect apparatus which could focus the concavity of the fundus uniformly, avoiding reflexes, and were research and ingenuity to put at our disposal a wide range of colour, physical obstacles would still remain. The most serious of these is the state of the vitreous and lens. Many drawings have to be made with masses of haemorrhage in the vitreous, and with only a narrow gap through which the disc and a limited portion of the fundus can be made out. Central opacities

in the lens prevent a clear view except at an extreme angle, an adjustment which cannot be obtained for a camera. Detachments of the retina with bands of proliferation in the vitreous are at present outside the scope of photography. The representation of such conditions has to be a composite picture, so as to show the several planes. The human eye and hand at every turn have to make allowances and ignore opacities which in photography would give little else than a blurred negative, and the exposures necessary for focussing varying depths would put a severe tax upon the steadiness and endurance of the patient. Conceivably some means might be devised for capturing the inverted image, but as photography of this class would demand intelligent co-operation, not as a rule an outstanding virtue among hospital patients, the results would be disappointing.

These remarks, partaking of arguments which might be resorted to by an *advocatus diaboli*, are not intended to disparage the labours of others in photographing the fundus, but merely to indicate problems which must be solved before an accurate and instructive print can be obtained.

NOTE.—Since the above was written I have had the opportunity of seeing a number of drawings by that veteran ophthalmologist, Mr. Pridgin Teale, happily still with us. They were made in the year 1866, on the minute scale adopted about that time. No exception can be taken to his faithful records of detachment, opaque nerve fibres, and rupture of the choroid. They are far in advance of many published by his earlier contemporaries.

THREE CASES OF GAS INFECTION OF THE CORNEA, FOLLOWING GUNSHOT WOUNDS OF THE EYE

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DURING the present war gas gangrene has been so frequent a complication of gunshot wounds of other parts of the body that ophthalmic surgeons working at military hospitals must long ere this have been struck by the extreme rarity of the condition as affecting the eye. So far I do not know of any case having been recorded; in fact, I can discover no record of gas gangrene having occurred in face injuries of any sort. This immunity is probably due to two main factors—the extremely good blood supply of these parts, and the fact that dirty clothing is not carried into the wounds with the fragments of metal, with the added factor as far as the eye