

XXIV.—*On a New Property of the Retina.* By Sir DAVID BREWSTER, K.H.,
D.C.L., F.R.S., &c.

(Read 19th February 1866.)

In a paper on Hemiosis, published in the present volume of the Transactions (p. 15), I have mentioned the remarkable fact, that the parts of the retina which are insensible to visual, are sensible to luminous impressions, the light being occasioned by irradiation from the adjacent parts of the retina. The parts thus affected in hemiosis extend irregularly from the *foramen centrale* to the margin of the retina; but the space which they occupy is so small, their distribution so irregular, and the time of their continuance so short, that it is difficult to make such observations upon them as would establish a general property of the retina.

Mr AIRY, our distinguished Astronomer-Royal, who has had more than twenty attacks of hemiosis, has been induced, by the perusal of my paper, to describe their character, and delineate the form of the parts insensible to visual impressions.* The hemiosis, in his case, commences at the *foramen centrale* c, Fig. 1, and extends outwards in a zig-zag curve line, the curve "being small at first, and gradually increasing in dimensions," as shown in the figure. It is accompanied with "tremor and boiling so oppressive, that if produced only in one eye, they may nearly extinguish the corresponding vision in the other," and it lasts from twenty to thirty minutes. It occurs sometimes on one side, and sometimes on the other side, of the foramen; and Mr AIRY has "never been able to decide with certainty whether the disease really affects both eyes." On one occasion, when under its influence, he lost "his usual command of speech, and his memory failed so much that he did not know what he had said, or had attempted to say, and that he might be talking incoherently." He, therefore, entertained "no doubt that the seat of the disease was in the brain; that the disease is a species of paralysis; and that the ocular affection is only a secondary symptom."

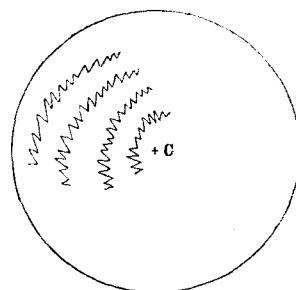


Fig. 1.

From these important facts, it will be seen that Mr AIRY's case differs essentially from mine, in which the locality of the indistinctness occurs in irregular

* Philosophical Magazine, July 1865, vol. xxx. p. 19.

zig-zag lines proceeding, as in Fig. 2, from the foramen outwards, and not in a circular arch, as shown in Fig 1. The "general obscuration," mentioned by Mr AIRY, shows that the luminous impression on the affected parts is not so strong in his case as in mine, and that the retina is still sensible to light derived from the surrounding parts by irradiation. The severity of the affection in Mr AIRY's case is remarkable. In mine the attack is little more than disagreeable, and I have never experienced the slightest effect either upon the speech or the memory. I have given this brief abstract of Mr AIRY's interesting paper from the relation of hemiopsy to the permanent affection of the retina which I am about to describe.

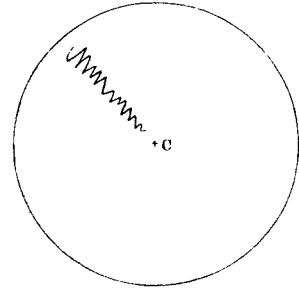


Fig. 2.

When without the hope of obtaining any precise information respecting the irradiation into the parts of the retina affected with hemiopsy, an accidental observation revealed to me the disagreeable fact that a considerable portion of the retina of my right eye was absolutely blind, or insensible to visual impressions; and I have thus been enabled, from the extent and permanence of the affection, to make whatever observations were necessary to ascertain the true character of the phenomenon.

The portion of the retina thus affected with what may be called *local amaurosis* is situated, in the field of vision, about 15° from the foramen, in a line to the left inclined 45° to the horizon. Its angular magnitude is about 6° in its greatest breadth, which corresponds to a space about the twenty-eighth of an inch on the retina.

When the image of a bright object covers the whole, or any part of this spot, it is invisible. If the image is the flame of a candle, or of the moon, or of the sun near the horizon, it is wholly invisible. The eye is therefore at this part of it absolutely insensible to light falling upon it from without. If we now direct the eye to the sky, to the white ceiling of a room, or to any extended white surface, no dark spot, even of the slightest shade, is seen in the field of vision. The portion of the retina, therefore, insensible to light incident upon it directly, or from without, has been illuminated by irradiation from the surrounding parts. But for this wise provision, an eye affected with local amaurosis would carry about with it a black spot, disfiguring the aspects of nature, and ever reminding the patient of his misfortune.

How long this condition of my retina has existed, I cannot discover. It may have existed for half a century, or more; and, but for a casual observation, its existence might never have been discovered. Whether it came on gradually, or was produced in some of the experiments in which the eye was exposed to the light of the sun, I have no means of ascertaining. If from the first of these

causes, it is likely to extend itself; if from the second, it may remain as it is. Having observed it only for a year without noticing any enlargement, it is probable that it was produced by the strong action of light.

Owing to the compound structure of the retina, consisting of different layers, and these layers composed of bodies of different shapes, it is very difficult to discover the part which each of them performs in the act of vision; but considering each element of the retina as a *rod*, the end of which next the vitreous humour is an expansion of the optic nerve, we know that distinct vision of external objects arises from the law of visible direction, by which every ray of light, at whatever angle it may fall, gives us vision of the point from which it proceeds, in a direction perpendicular to the part of the membrane on which it is incident. When this outer layer of the retina is insensible to the light of external objects, its luminosity, or the light which it exhibits, may be received from the surrounding parts of the expanded nerve by irradiation, or from the parts of the elemental rods behind it, if they were not paralysed, or if they are, by the action of the unparalysed rods around them.

Although in hemiopsy, and in the case of local amaurosis which I have described, the paralysed parts are still luminous, yet there are cases in which these parts are absolutely black, and into which no light is introduced by irradiation. An example of this fact presented itself to me in the morning of the 16th October 1837, and is represented in Fig. 3, where two black curved lines proceeded from the *foramen centrale* of the retina of the right eye. These lines were so black that, in the memorandum which I made at the time, I state that they were blacker than the black ink lines upon the paper. The lines continued only about *ten* minutes, and were probably produced by the pressure of blood-vessels, as I had, the day before, been subject to much giddiness. In this case, the elementary rods of the retina beneath these lines must have been paralysed throughout their length; and, therefore, it is probable that in the cases of hemiopsy and local amaurosis, the paralysis affects only the end of the rods in contact with the vitreous humour, and formed by the expansion of the optic nerve.

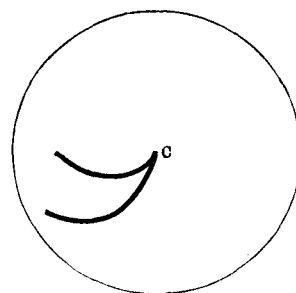


Fig. 3.

In concluding this notice, I would suggest to philosophers and medical practitioners the importance of studying the manner in which sight and hearing are, in their own case, gradually impaired, for it is in the decay or decomposition of organic structures, as well as in their origin and growth, that valuable results may be presented to the physiologist; and facts of this kind have a peculiar value when the patient is himself a practised observer.