A DISCUSSION ON A CONTRIBUTION TO THE STUDY OF HEMIANOPSIA, WITH SPECIAL REFERENCE TO ACQUIRED COLOUR-BLINDNESS,

In the Section of Ophthalmology at the Annual Meeting of the
British Medical Association held in Glasgow, August, 1888.

By GEORGE MACKAY, M.D., F.R.C.S.E., M.R.C.S.,

Assistant-Surgeon Eye Dispensary of Edinburgh, Ophthalmic Surgeon New
Town Dispensary, Lecturer on Practical Ophthalmoscopy.

MR. PRESIDENT AND GENTLEMEN,—My purpose in addressing you to-day is to draw attention to the desirability of investigating cases of hemianopsia of all kinds with more thoroughness and precision than is usually shown in the published reports of such cases.

Starting, then, from a physiological standpoint, I shall first invite your attention to some preliminary remarks on the

COMPOUND NATURE OF THE VISUAL SENSE.

For practical purposes, physiologists and ophthalmologists have for many years (at least on the Continent) regarded the sense of light as primarily consisting in three special perceptions, namely, the light-sense, form-sense, and colour-sense. In this country the practical utility and full significance of this differentiation has been more tardily recognised, but in two recent works by British ophthalmologists¹ it has received due recognition and adoption. Though perhaps neither complete nor scientifically exact, this subdivision is undoubtedly of value, as suggesting a convenient method of estimating the state of the visual functions in health and disease.

The order in which these three kinds of perception have been mentioned expresses rightly their relative importance for useful vision since neither the second (the form-sense) nor the third (the colour-sense) are able to manifest themselves as existent if the first (the light-sense) be destroyed; and, again, the third may be markedly defective without failure in the other two becoming apparent, for example, in congenital colour-blindness. The precise nature of their mutual relation has not yet been ascertained, and it is, therefore, all the more desirable that in suitable cases of disordered vision, we should neglect no opportunity of estimating their condition. This at least is self-evident that, provided the musculature and refractive media of the eyes be normal, these three kinds of perception, when objectively evoked in the normal act of vision, are dependent on a healthy condition of the visual nervous apparatus, namely, the two retinae, optic nerves, chiasmic crossing, optic tracts in their extra- and intra-cerebral course, and, finally, their central and cortical terminations.

When we endeavour to discriminate between them more nicely, and allot each to its proper place of origin or seat in the visual nerve mechanism, our task becomes more difficult. In the present instance, I shall go no further than the assertion that it is the function of the retina, when stimulated by light vibrations, to initiate the nerve commotions on which these sensations are dependent; that it is the function of the optic nerves and tracts to conduct these commotions to the cerebrum; and that it is the function of the cortical substance of some part or the whole of the occipital lobe to bring them into the sphere of our conscious perception. It is more than probable that the basal ganglia with which the optic tracts are connected are not directly concerned in the production of visual sensations.

Lastly, with a view to investigating the condition of these sensations, it is important to remember that, since they may arise when one eye alone or both, or different parts of one or both, are exposed to objective stimulation, we must not be content with examining the central parts of the visual field of each eye separately, but must extend our inquiry to the peripheral parts also. As I shall have occasion to refer to the methods of investigation later on, I pass now to the consideration of that form of hemianopsia which I have taken as the title of my paper.

HEMIANOPSIA OF CENTRAL ORIGIN.

It may now be said to be a well constituted fact in cerebral pathology that a lesion of an optic tract in its extra- or intra-cerebral portion or of one occipital lobe produces blindness of the visual half fields on the side opposite to the lesion (lateral homonymous hemianopsia), and according to the extent of the neural or cerebral injury the homonymous defect may be of the nature of a small scotoma at any part of the field, may be sector-like, or involve the entire half of each visual field.

As regards its extent, then, the hemianopsia may be *incomplete* or *complete*. There is, however, another aspect in which we ought to regard these cases, namely, in relation to the degree of impairment of the visual power in the affected half fields. This seems to me to be deserving of much more attention than it has hitherto received, and is the text of my discourse to day.

In many cases of hemianopsia the lesion has been so destructive that not only the sense of colour and form, but even that of light, is lost, and the blindness in the affected areas may then be very properly termed *absolute*. But in some it has been found that the visual loss is *partial*, and it is said that such cases may be divided into two main groups:

1. Loss of colour-sense with perfect retention of form- and light-senses.
2. Loss of colour- and form-sense, but light-sense intact in the affected areas.

Now of the first of the above groups there have been published by different observers a few cases under the title of hemiachromatopsia (*Farbenhemianopsie* or homonymous half-blindness for colours).

The characteristic features of these cases have been stated to be—retention of good central (direct) vision; good perception of colour, form, and light in one pair of half fields, while in the opposite half fields all colours appeared grey, but the senses of form and light were not only retained, but believed to be intact.

It has seemed reasonable to conclude that a lesion which can thus dissociate the visual functions, maiming one and sparing the others, has its seat in the cerebral cortical substance, or in other words the visual centres, and not in the optic tract or radiation, whose function is purely passive and conductive, unless, indeed, one accepts the theory that some nerve-fibres conduct only colour, others form, and the remainder light impressions, and that they form separate bundles in the optic tracts. And the above view has been further supported in the recorded cases by the fact that though there have been threatenings or previous attacks of hemiplegia or hemianæsthesia in one or two, the combined symptoms at the time of observation have not pointed to the base of the brain or internal capsule as the seat of the lesion, and that the only marked complaint has been of the visual disturbance.

Thus, to quote the words of Mr. Swanzy, of Dublin² in reference to the first four cases recorded (see Analysis), these cases “go to prove that the centre for colour-perception is situated in the brain, and not in the eye or peripheral parts of the optic nerve, and moreover that in the brain it is a separate centre, distinct from that for the form-sense and for ordinary light-perception.”

Dr. Gowers, in his recently-published work on *Diseases of the Nervous System*, p. 146, mentions all the recorded cases, and states that “the symptom (hemiachromatopsia) probably depends on disease of some part of the occipital lobe, and is proof of a separate centre for colour-vision.” In making this assertion, however, he only follows the footsteps of Dr. Wilbrand, of Hamburg, who has taken up this opinion very strongly.³ Indeed, a consideration of these cases seems to have been the basis of his most ingenious theory of the constitution of the hemiopic visual centre, namely, that there is a special centre for colour, another for form, and a third for light. He believes these three centres may be disposed in the occipital cortex, either in a strata-like or in a superficial (side-by-side) arrangement; but whichever it be, their connection to one another is such that all the nerve filaments enter the light centre; those concerned in light impressions end here, those for form pass into the next centre accompanied by those for colour, but the latter terminate in the third (most distant or most superficial) centre.

This theory of a threefold centre, inasmuch as it has appeared to accord with clinical experience, seems to have been gaining ground. Mr. Swanzy gives it prominence in the second edition

² *Trans. Ophth. Soc.*, vol. iii, p. 188.

³ *Ophthalmiatriche Beiträge zur Diagnostik der Gehirn-krankheiten*, von Hermann Wilbrand, 1884.

¹ *Subjective Symptoms in Eye Diseases*, by G. A. Berry, M.B. *A Handbook of Diseases of the Eye*, 2nd edition, 1888. By H. E. Swanzy, M.B.

Table to accompany the paper, "A Contribution to the Study of Hemianopsia of Central Origin, with special reference to Acquired Colour Blindness,"
by DR. GEORGE MACKAY (Edinburgh).

Author and Reference.	History.	Direct Visual Acuity.		Left Half Fields for			Position of line of Demarcation.	Right Half Fields for			Ophthalmoscopic Examination.	Extra-ocular Muscles.	Reaction of Pupil.	Onset Duration.	Other and Later Sympt. ms.	Post-Mortem.
		L.V.	R.V.	Colour.	Form.	Light.		Colour.	Form.	Light.						
1877. Charpentier, "De la vision avec les divers parties de la rétine," <i>Thèse de Paris</i> , 1881.																
1881. Biering, <i>Centr. f. Augenheilk.</i> , p. 471.	A tobacco worker complained of 14 days severe headache with dimness of sight after 2 days. Required to hold objects nearer.	Normal		Red, green, blue, and yellow all appeared grey.	Normal as tested by fingers.	Unfortu- nately not tested; good field for white.	Vertical and through point of fixation.	Normal	Normal (to fingers).	Not tested; good field for white.	Normal	—	—	Sudden.	Severe headache seen on day after first allowed of abscess in left temporal region opened; no evidence of bone disease; no hemiplegia; next night delirium, collapse, death.	Not
1881. Samelsohn, <i>Centr. f. Ophth. f. Med. Wsch.</i> , Nos. 47 and 50.	In March, 1875, had a right hemiplegia, with slight loss of consciousness. First seen 9 months later when a slight paresis was still present and impaired vision.	$\frac{20}{20}$ $H=1.25D.$	$\frac{20}{20}$	All colours seen as shades of grey.	Appeared normal because Shellen's types were recognised by induction vision as well as in right half fields.	Appeared normal "as far as could be tested." Good field for white.	Ditto	Ditto	Normal	Normal	Normal	Parais of right superior rectus which passed off in one month after first examination.	—	Sudden.	Remained unchanged till death by apoplexy in 1880.	Not
1883. Swamy, <i>Trans. Ophth. Soc.</i> , vol. iii, p. 185.	Alcergyan, on morning, felt giddy, lay down, was unconscious till evening. In a few days quite well, save defective sight and confusion of ideas on mental effort. Had a difficulty in recognising people.	$\frac{5}{10}$ $H=1.5D.$		Red, green, and blue (probably all colours) not appreciated.	Not specially tested.	Peripheral defect in upper quadrants as tested by white.	Ditto	Red, green, and blue recognised, but field so much contracted.	Not specially tested.	As tested by white, good field.	Normal	—	—	Sudden.	Had existed five months when seen.	—
1884. Wilbrand, <i>Beiträge zur Diagnostik der Gehirnerkrankheiten</i> , pp. 23 and 51.	Had suffered at one time from epilepsy. Was awakened suddenly one day by arrival of visitor during headache and stesla; felt disturbance of visual impressions. NO loss of consciousness, nor other cerebral manifestations.	Normal		Sense lost in upper quadrants. Absolute blindness in lower quadrants.	(No note of its examination.)	Some contraction of field for white.	Vertical between greater part of lower quadrants then inclined up and to the left avoiding point of fixation in right eye but involving it in the left.	Normal	Normal	Normal	Normal	Normal	Right pupil larger than left. Reactions normal.	Sudden.	After 14 days left upper quadrants entirely re-gained colour, form, and light sense. In left lower quadrants all three senses still entirely absent. Three months later patient lost power of left arm from an apoplectic attack.	Pa-

On Page 6, in treating of the importance of studying the state of the visual power throughout the whole extent of the retina, Charpentier writes: "We have lately seen a remarkable example of this in the case of a young man who, independently (?) of a cerebral affection, presented a disturbance of vision which neither the ophthalmoscope, nor the examination of the general field of vision could account for. On examining the limits of the field for colours we were able to determine the presence of a perfectly characteristic hemipia, affecting the visual function, however, only in this particular manner." There is no further published record of this case.

lost. Eperon, D'Optalm. Julliet, D'Aut.	M to About 3 months before I was seen awake one day with feeling of numbness and paralysis of right side and limbs. This passed off in a few days, but some difficulty in reading remained.	H = 225D. = perfect single let- ters, but there was a verbal dyslexia of mental origin. <i>Ce- cile re- late.</i>	Sense present, but fields constricted except un- der direct solar illumi- nation.	Appeared normal.	Vertical and point of fixa- tion.	All col- ours ap- peared grey and dim.	Greatly di- minished this nor- mal acui- ty, and though white pe- ter test- types ap- peared held to either side.	Diminished to 1-4th of normal acui- ty, and though white pe- ter test- types ap- peared held to either side.	Discoloured, of herwise normal.	Perfectly and mus- cular sense very good.	Had ex- isted for twelve months & remained unchang- ed for 9 months of what he written; but he could not do this for a phrase written from his own inspira- tion. He could read short and fam- ilar words more easily than long and rare ones.	Sud- den.
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In Bjerrum's case (left sided), it was only estimated by counting fingers held to either side—a method which I shall be able to show is not sufficiently precise.

In Samelsohn's (left sided), it was estimated with a grater degree of accuracy by Snellen's types, and appeared to have been specially tested.

In Swanzy's (left sided), there was an absolute extinction of all the visual perceptions in the lower quadrants, and there is no published record of the form sense having been tested in the upper quadrants.

In Eperon's (right sided), it was markedly defective when tested by Snellen's test-types, and was complicated by a peculiar form of dyslexia in direct vision.

2. *As regards the Light-Sense in the Eccentric and Peripheral Parts of the Field.*—Without enumerating all the names, it can be readily seen that only

Samelsohn and Eperon really tried to estimate it by diminishing the illumination under which the test-types were observed eccentrically. The former confesses that though the sense appeared normal, his test was only approximate; the latter found it markedly defective. The other observers employed no more precise method than tracing the field for white, which by many persons is thought to be quite sufficient, and is frequently employed as synonymous with the estimation of the light-sense. This is only true in one aspect, and is certainly not the whole truth, since, in ordinary daylight, it gives us no information as to the minimum of light perceptible, or the power of distinguishing differences in the amount of illumination. An instructive moral may be drawn from Eperon's case, where, notwithstanding the defective light- and form-senses, the field for white ap-
peared normal in extent, though admittedly the test-object seemed less bright on the defective side. But if we were to accept the field for white as a fair test of the peripheral light-sense, then be it observed there was a peripheral defect in the case reported by Swanzy, and a marked defect in that of Wilbrand.

Thus far the only case which seems to deserve the name it bears in a special, and restricted sense is that of Samelsohn, but it is not above sus-
picion. I shall presently show that the test employed by him for the form-
sense was not the most delicate, and since he only estimated the light-sense in
relation to this form-test, his investigation of it was both incomplete and im-
perfect.

It remains for me now to adduce the evidence on which I have based my
criticism of the methods employed in testing the peripheral form-sense. Since
October, 1887, I have had four patients under observation suffering from hemi-
anopsia, complete in extent but partial in degree. In two the right half fields
were affected, in two the left half fields. The line of demarcation passed
through the fixing point in all. The symptom common to all was hemiachro-
matopsia, but in none did I fail to find a defect of the peripheral form-sense on
careful examination, and I do not believe that the light-sense entirely escaped in
any.

The case most nearly typical of simple colour-defect was that of an active
and otherwise healthy man, aged 37, who complained of defective vision
of sudden onset. Examination revealed well-marked half colour-blindness
to the right, V = 3 in either eye, but to obtain this he had to turn his head
slightly towards his right shoulder. The field for white was excellent, in-

of his *Handbook of Diseases of the Eye*, and it has been favourably received in many quarters.

It may be worth our while to inquire for one moment how far the published records of these cases of hemiachromatopsia support this theory by showing that the colour-sense was really the only one involved in the visual defect.

In the accompanying analysis I have confined myself to the cases hitherto published under the name of—or, at least, up to this time adduced in argument as examples of—hemiachromatopsia, with the exception of two published by Dr. Noyes,* of New York, which were certainly not uncomplicated, and are more than doubtful examples. It is only right to say that Mr. Swanzy appears to accept only the first four as genuine cases. Wilbrand adds his own, and Dr. Gowers mentions all the six without, however, plunging himself to Wilbrand's theory in toto.⁵

From the analysis which I have prepared, I think it will be evident (1) that the cases are very few in number; (2) that the clinical examinations have been generally incomplete; (3) that there has been no *post-mortem* examination in any of them.

Now I ask your special attention to the columns headed left and right half fields. Under each of these I have endeavoured to bring out the state of the visual power in relation to the colour-, form-, and light-senses in the eccentric and peripheral parts of the field of vision, and in the preceding columns have stated the condition of the refraction (if recorded), and the *direct* visual acuity for form. This distinction is essential, because in cases of complete hemianopsia, where the line of demarcation passes through the macula, the patient can, by a little manoeuvring of his head and eyes, receive the image of the object, or enough of it for purposes of recognition, on the sound half of his retina, and thus unconsciously elude examination of the desired part, or falsify the result. The same fallacy, of course, is present in estimating the state of the colour- or light-sense by direct vision. But though the necessity for examination of the whole visual field for white and for colour is generally recognised and practised, the same cannot be said of the sense of form, which is seldom investigated at all in the peripheral parts of the field, or only in the roughest manner.

Taking these cases, then, in chronological order, we see that Charpentier's is a mere reference, which would probably have never been placed in the list but for a letter written by Dr. Landolt, of Paris, to Dr. Samelsohn, of Cologne, and acknowledged by the latter in the *Centbl. f. Med. Wiss.* (No. 50). Precise details of this case have never been published, so far as I am aware.

It will be convenient to discuss the other cases:

1. *As regards the Eccentric and Peripheral Form-Sense.*

⁴ *Arch. f. Augenhe.*, xlii. p. 123.

⁵ I have purposely omitted reference to some cases of partial hemianopsia, with colour defect, which may be found now on record under various titles, because they do not influence my present argument, except as showing cases insufficiently examined. There is, however, one notable exception—namely, the case just published by Verrey (*Arch. d'Optalm.*, Juillet-Août 1888, p. 289), which arrives most opportunely to support my contention for more careful clinical study, and affords the additional interest of a *post-mortem* examination. Still more recently Landolt has published a case in connection with the Donders Festival at Utrecht.

deed unusually large, and he appeared to count fingers with

equal facility to either side. To estimate the form sense more accurately I employed first (on the suggestion of Mr. Berry, but for whom this inquiry might not have been undertaken, and to whom I am under many obligations for kindnesses received during its progress), a test object, such as I now exhibit, consisting of a piece of white card-board 8.5 centimetres long by 2 centimetres broad. On one side it has two black squares, each 1.5 centimetre square, separated by a white space twice as long, and on the reverse a single black band equal to the combined extent of these. This card with its long axis vertical was brought along the arm of the perimeter, from the periphery of the horizontal meridian towards the centre of the field, first from one side and then from the other; each eye being of course separately examined

and the card frequently reversed. The patient was asked to tell successively:—1. The moment at which the object was seen entering the field. 2. Whether it appeared white or black. 3. Whether there was one spot or more. 4. What was the shape of the spot or spots.

The First Diagram represents the Right Eye, the Second the Left Eye.
(The half fields must be contrasted in the manner suggested by the arrows, namely, right inner with left inner, and right outer with left outer.)

The first reply is indicated by the broad white band; it shows complete uniformity on the two sides. That the object was recognised further out than the usual limit of the visual field was due to its unusually large size. The second reply is marked by the narrow vertical line; the third by the two dots; the fourth by two small white squares. All these latter indicate a slight peripheral failure to the right, most marked as one might expect on contrasting the outer halves; the maximum difference amounting to 20°. The same kind of test was applied in another way. A 1.5 centimetre square of white paper was taken, as ordi-

narly used for estimating the field for white. To one side of this a triangle of black paper was affixed so as partly to cover the white surface. The patient was asked to say: 1. When he saw anything entering the field. 2. Whether it appeared white or black. 3. What was its shape.

The First Diagram represents the Right Eye, the Second the Left Eye.

The same indicators are employed for the first and second replies, as in the former chart and the half fields must be similarly contrasted. The square and triangle are marked at the positions where their shapes were respectively recognised.

In order to control the patient's replies, the test was further varied by substituting a black square for the black triangle, as above. Here, then, as in the former chart, there is proof of a slight peripheral loss of the form-sense, amounting again to a maximum of 20° on the right side as compared with the left.

Unfortunately, in the course of a few days, and before I was aware that Snellen's types had been used by other observers, this patient's condition changed to almost absolute hemianopsia, so that I am unable to make any direct comparison in that respect. For the same reason I was also prevented in this case from investigating the state of the form-sense in other meridians than the horizontal; but I wish to take this opportunity of emphasising the importance of so doing, because I have found in other cases a marked difference in the condition of the upper and lower quadrants in the defective half fields. I also wish to lay stress on the preliminary questions about the recognition of black and white, since the replies to them will immediately reveal whether black and white test-objects are suitable. Thus, in one of my cases I found a marked defect for black and white, and therefore for all test-objects based on their use, associated with an apparently good power of recognising hand-movements in the periphery, and counting fingers or other equally large objects held eccentrically.

To return from this digression. I ask you to take notice that the first of these test-objects which I employed allowed of the form-sense being estimated on the sound side as far out as 45° and 65° respectively in the inner and outer half fields; and from personal observation I am satisfied that either of them supplies a more delicate method for the periphery than the use of Snellen's test-types, or any such figure of complex form. For the recognition of a complex figure it is necessary that it should be of such a size that we not only appreciate it as a whole, but discern its separate parts. A small test-type cannot be identified by a normal eye far from the point of direct fixation, and is, therefore, no proper test of the peripheral visual acuity. The smaller the type, the smaller the area tested. If a large test-type is taken, a larger surface of the retina is stimulated than by the test-objects shown to-day, and the test is less delicate.

I hope I shall not be thought too captious if I point out that the above remarks may be applied to Samelsohn's case with additional force. First, because it is questionable whether a patient whose direct visual acuity is below normal can have his peripheral form-sense equal to normal; and secondly, because this patient must have had a special difficulty, on account of his hypermetropia and presbyopia, in seeing objects, particularly those near at hand, even on the sound side. Two of my own cases afforded illustration of this difficulty, and showed further that the assistance to be derived from spectacles—as, indeed, is well known—is ordinarily limited to the central parts of the field of vision.

Lastly, one word about the light-sense. We have as yet no completely satisfactory method of investigating it in the periphery, so that any statement of its condition is apt to be imperfect and hazardous. Therefore, let us not theorise, but inquire.

Time will not permit of my giving further details of my own cases at present; but I shall take an early opportunity of recording them more fully. If the facts which I have exposed go to prove anything, it is surely that there is not yet any well constituted case where a hypothetical half-vision colour-centre has suffered alone,

and other senses have been left "intact." It may be said that the apparently great preponderance of the colour-defect over that of the other senses is highly suggestive, or only explicable on the presumption that there are special centres; but that, owing to their close proximity, it is hardly possible for one to be injured without the others. While I admit the plausibility of that argument, it in no way alters my position in respect to the assertions made by the writers whom I have quoted, nor does it diminish the necessity for careful inquiry, especially as to whether the preponderance is real or apparent.

I shall not in conclusion be so illogical as to say that there are no special centres, for, in connection with the colour-sense in particular, I know that there are other recorded cases, congenital and acquired, which lend some probability to the theory of a special centre for colour. On other grounds I am not disposed to favour that theory, but it is beside my present purpose to discuss these. I have endeavoured to show that the imperfect investigation of one group of cases has led to deductions unwarranted by the facts before us, and that a fresh inquiry is necessary. I feel confident that cases of partial hemianopsia are far more frequent than is usually supposed, and not less certain that their more careful investigation is calculated to throw much light on the nature, relations, and localisation of the visual senses.

Mr. HEWETSON said that he himself had hemianopsia at times. The form from which he suffered was that suddenly in the right half of both retinae he saw an appearance of an electrical discharge, which completely blotted out from that half of the field of vision all objects whatsoever; this was followed by severe pain on the left parietal region.—Dr. BENSON asked Mr. Hewetson if such appearances were not indicative of possible cerebral trouble?—Dr. KARL GROSSMANN thought that such cases were more like a scintillating scotoma. He had suffered from such attacks, and with him they were always followed by sickness and headache.—Dr. MACKAY thought such cases functional; they should, however, receive as careful investigation as those due to gross lesion.

GENERAL NEUROSES HAVING AN OPHTHALMIC ORIGIN.

Read in the Section of Ophthalmology at the Annual Meeting of the British Medical Association held in Glasgow, August, 1888.

By H. BENDELACK HEWETSON, M.R.C.S.,

Ophthalmic and Aural Surgeon, Leeds General Infirmary; late House-Surgeon Leeds Public Dispensary.

It is now some years since I first observed symptoms, many and varied, occurring in neurotic persons who were also the subjects of uncorrected optically defective sight. In investigating more particularly the relationship between the various optic errors and sick headache, or simple headache, I was occasionally startled by the apparent direct relationship between the long uncorrected disorder (with all its immediate train of nervous disorders) and general conditions of ill-health which seemed to be the direct outcome of a thus already demoralised nervous system. It is now well established that many cases of migraine or sick headache are directly attributable to the reflected irritation of the brain (and thence the gastric functions and heart's action) from some uncorrected optical state, chiefly on the side of hypermetropia, and always in a neurotic subject. It is also well proven that many of these cases are entirely relieved from their periodic attacks by the use of properly selected glasses; or, having passed an age when the activity of the accommodation ceases more or less, and the eye becomes presbyopic, the severity of the headache or migraine becomes greatly modified. It is further well known that a patient, the subject of hypermetropia, is liable, according to varying circumstances, such as extent of defect and use of the eyes, to more or less constant "head pains," not necessarily associated with very obviously defective vision, or aching eyes, but always peculiar in their position and character, and aggravated by close application of the sight. Although I have very fully published my observations some time ago on the relations between sick headache and optical defects, and utilised what was previously discovered as to the relation between headache (broadly defined as such) and hypermetropia, I had not felt my footing sufficiently to enable me to bring forward that which is now my desire to show, namely, that the neuroses growing and

arising from congenital optical error are more subtle in their nature, more varied in their distribution, and more demoralising to the right evolution of the nervous system than I was at first led to suppose.

I particularly wish it to be clearly understood I do not think all sick headaches come from an optic defect, for it is well known that decayed teeth or central irritation of the ear or nose are frequently causes as well as other more general neuroses. But I have patients who have been martyrs to sick headache; who are also astigmatic, and in whom a complete cure has been effected by the use of cylindrical lenses, showing that when sick headache and its accompanying dyspepsia is due to reflected irritation in a neurotic subject, from the eyes to the stomach, complete immunity from attacks of this kind may be obtained by glasses; and further, as I have observed, a very marked improvement in general cheerfulness and health. I may here remark that many persons who suffer from sick headache are astigmatic in an abnormal though slight degree, and it is only by straining their eyes by looking long and hard at some fine object, or exercising such feats of sight-seeing as "doing" the National Gallery and the Academy in one day, or severe microscopical study, reading, and the like, which will irritate the brain sufficiently to cause an attack. One patient says he always suffers from sick headache after watching a play; another actually brings on headache, vertigo, and vomiting by doing fine sewing; a third has sick headache only when reading for an examination; a fourth when she was at school, not since; but all proving to be ametropic, and completely cured by the systematic use of glasses constantly worn.

The most common forms of headache associated with that optical error known as hypermetropia are—either simply a heaviness or pain over the brows (this may or may not be combined with general headache), or very frequently a tender place on the top of the head, making it particularly painful to dress the hair—such a pain as occurs after a lock of hair has been "slept on the wrong way," in common parlance; there is also frequently pain at the back of the head. All these pains may be present together, or they may exist singly, but they all occasionally occur in conjunction with severe neuralgia at the back of the neck. This I have frequently noticed, and where it occurred, whether associated with the other head pains or not, it, as well as they, soon disappeared with the systematic use of accurately adapted correcting glasses. This symptom of pain at the back of the head and neck is not one which has long been associated with optical defect, but I have now seen a sufficient number of cases to show without doubt that such may be safely regarded as one of the symptoms of (frequently latent) optical error, perfectly remediable by the use of glasses, and, when such, by glasses only.

Dr. LAUDER BRUNTON wrote me that he has seen several cases of neuralgia of the back of the neck cured by glasses. It would not appear to need demonstration that with symptoms so severe and depressing to the general nervous system as are the various forms of headache—vertigo, which is associated with astigmatism; vomiting; possibly, as I have noted, palpitation, or neurotic dyspepsia between the attacks of migraine—other conditions should arise as a sequel in many constitutions. One which I particularly wish to draw attention to is insomnia. This particular symptom I observed in many cases the subjects of astigmatism. In one instance in particular, where the eyes had given much trouble during the examination period of an Oxford man's life, it was particularly remarked to me that after the astigmatic trouble was corrected by suitable glasses, with an equal amount of work, the insomnia disappeared, and the whole physical and nervous state of the gentleman improved greatly. One object of my paper will be to show what an important factor these optical errors are in, as it were, moulding during childhood and early life the nervous and constitutional state of the individual. As a proof of this I will quote two cases, both in ladies of education and refinement, which seem to give us some sort of clue to the possible effects on the constitution of persons who conscientiously struggle through a severe scholastic career with important optical errors entirely uncorrected.

The first case was that of a lady, aged 22, whom, some few years ago, I found to be the subject of compound hypermetropic astigmatism. Her health was not good, but she particularly complained of headache and general feelings of *malaise*. I corrected the astigmatism after very patient testing, since here great nervousness made it a very trying process for myself as well as the patient. There were other symptoms, such as would be ordinarily covered by the convenient but too easily accessible