distance of the eye. (See *Hypermetropia.*) Should the disease be connected with nephritis, we shall of course find albumen in the water; symptoms of derangement of the digestive organs will be present, and in the majority of instances hypertrophy and dilatation of the left ventricle exist; but, as I have before observed, I feel convinced this so-called nephritic retinitis may run its course without evidence of kidney disease.

Albuminuria.

Ophthalmoscopic appearances.

It would be almost impossible from an ophthalmoscopic examination, to distinguish between the early stages of nephritic retinitis and the premonitory stages of other forms of inflammation of the retina.

Œdema.

There is the same swollen œdematous and hazy optic disc; its outline is indistinct, being covered in by the bluish-grey serous infiltration. The vessels are involved in this cloud. After a time, however, the appearances change, and there is distinct evidence of great venous congestion; the cloud over the optic disc becomes denser, and extends far over the retina; in it faint whitish striæ are observable due to sclerosis of the connective tissue (Fig. 2, Plate V.).

Venous congestion.

Spots of extravasated blood will be noticed over various parts of the retina and optic disc; they occur chiefly in the internal layers of the retina, and have a somewhat striated appearance; but the hæmorrhage may be more superficial, covering in a part of one or more of the retinal vessels.

Extravasation.

As the disease progresses, we may observe around the circumference of the swollen disc numerous white patches. These coalesce and form a ring round the papilla most marked on its inner side. This ring is separated internally by a zone of a greyish colour from the circumference of the disc, and externally it sends out processes which extend along the walls of the retinal vessels. In the region of the yellow spot small grey-white or milky points form in the retina, which rapidly increase, often uniting after a time, and becoming fused into the zone surrounding the optic disc.

White patches.

Prognosis.

These changes may advance until the optic disc and retina become atrophied. In other cases much of the fatty matter formed in the retina may become absorbed, the patient's sight improves, and although the changes due to sclerosis do not disappear, nevertheless he regains a very fair amount of useful vision. The disease seldom leads to complete blindness.

Treatment.

Treatment.—In cases of Bright's disease, it is hardly necessary to say that the retinal affection is as incurable as the principal malady, and no improvement can be looked for.

Must vary with the cause.

I have watched several cases of neuro-retinitis following malarious fevers, and have certainly seen them improve under a steady and well-regulated course of arsenic, strychnine, and iron. But above all things we must bear in mind that change of air, and in fact absolute removal from malarious influences, is necessary for the cure of miasmatic diseases.

Removal from malarial influences.

When therefore a patient comes under our notice, suffering from symptoms such as I have above described, and which we can trace to malarious influences, we certainly have it in our power to save him from irrecoverable blindness by ordering him off to sea. As far as India is concerned, no change from one part of the country to another will be of any use; all are impregnated with miasma, and hence our inability to stop the ravages of the disease I am now considering among native patients. It is useless, of course, ordering *them* to sea; and the disease will surely terminate in blindness if depending on the causes above indicated.

Improved habits of life.

In instances occurring from the effects of alcohol, we must attempt to stop the use of all intoxicating fluids, and by wholesome food, tonics, and improved habits of life, endeavour to restore our patient's general health; for we know of no means more likely to improve the condition of his blood, and hence of the local disease.

Cases of Brain tumour and Bright's disease.

It is well to bear in mind the fact that disease of the brain may produce appearances in the retina similar to those of nephritic retinitis, as the following cases demonstrate. Both cases were observed during life, and the post-mortem conditions were studied in a thorough and competent manner. The broad facts are that a female, aged twenty-three, exhibited in both eyes the appearances which belong to the most complete picture of Bright's disease, had no albumen or other evidence of kidney-trouble, and not until a short time before death had she any symptoms to cause suspicion of brain-disease. The autopsy disclosed a tumour at and in the region of the septum lucidum. Another girl, aged fifteen, had the same ophthalmoscopic symptoms, with clear signs of Bright's

disease, and, having died, gave opportunity for microscopic examination of the retina and optic nerves.

Retinal appearances identical.

The features common to both cases, in the ophthalmoscopic picture, were great swelling of both optic nerves, redness and infiltration, edges indistinct, vessels swollen—in the case of tumour there was ecchymosis of one papilla; near the nerve, opaque white patches of the rounded form, and dotted edges, seen in nephritic retinitis; at the macula the usual radiating figure, extravasations of blood in various places. Both cases were as similar as two cases of the same disease could be, and were studied by Graefe and others.

Structural changes similar.

In the tumour patient, the ocular lesion was confined strictly to the eye—the optic nerve-trunks, close up to the globes, possessed a normal structure as seen by the microscope. The lesions in the retinæ in both cases were extremely alike, making the diagnosis by the microscope almost as impossible as by the ophthalmoscope. There were in both cases sclerosis of the fibres of the optic-nerve layer—the ganglion cells atrophied or sclerosed—the granular layers studded with or almost transformed into fat granule-cells—hypertrophy of the connective tissue of the nerve and retina—blood-discs, and brownish pigment—the choroidal vessels were somewhat sclerosed. The only difference in the two cases was that, in the patient with cerebral tumour, the swelling of the retina belonged more to hypertrophy of the inner retinal layers and papilla, while in the patient with Bright's disease the swelling affected principally the radiating fibres of the external granular layer. In neither case could the rods and cones be well examined, because of cadaverous changes.

Difficulties of diagnosis.

The outcome of the matter is, that we cannot any longer assert the infallibility of diagnosticating Bright's disease by the ophthalmoscope. Many good observers have denied the possibility of mistake, and have recorded their opinion (*vide* Liebreich, Mauthner, &c.), but the retinal pictures may be completely simulated by neuro-retinitis from cerebral tumour, and from diabetes mellitus, malarial and alcoholic poisoning. Graefe records a case of cerebral tumour producing the retinal lesions in question,* and states some minutiæ

* "Archiv f. Oph." B. xii., 2, 120.

for differential diagnosis, but these points are rendered valueless by the two observations above recorded.

We are therefore compelled to examine the urine as well as the eye, and to study the signs of cerebral disturbance, however obscure they may be in some cases. But it remains true that the retinal lesions above described do belong in the large majority of instances to Bright's disease. A point to be studied is, what causes the neuro-retinitis in some cases of Bright's disease?—Can there be any analogy to the incarceration which belongs to the pathogenesis of the *Stanung's papilla* in neuritis descendens?*

Retinitis Pigmentosa.

Retinitis Pigmentosa (Plate VII. Fig. 2) is said to be most commonly met with among the offspring of persons nearly related to one another;† but this can hardly be the cause of the disease among the natives of India, as they are most scrupulous in observing the restrictions they place upon the intermarriage of relatives; and yet I have seen a considerable number of instances of this disease among native patients. The disease is, however, hereditary, and occurs therefore frequently among several members of a family. Free colouring matter from the blood may be deposited in the retina, giving rise to the formation of black, irregular-shaped bodies, and ultimately to atrophy of its nervous structure; but these cases are not to be confounded with those now under consideration.

Differs from pigmentary deposits.

Vision impaired from childhood.

In the majority of instances of retinitis pigmentosa which I have seen, there has been a history of impairment of vision commencing soon after birth, not sufficiently marked to attract much attention in early life; nevertheless, if careful inquiries be made, a history of defective vision may usually be traced. I am disposed to look upon the disease as one of the results of inherited syphilis. I have never been able to refer these symptoms to the effects of any of the so-called inflammatory changes; the disease seems to me to be one of a degenerative character, progressing very slowly, and often becoming stationary for years. The facts which in my mind are opposed to the relation of retinitis pig-

Probably of syphilitic origin.

* Idem, Bd. xv., Abth. 111, s. 253-275.

† "Atlas d'Ophthalmoscopie," par le Dr. Liebreich, p. 16.

mentosa to syphilis are, that I have not noticed the notched teeth of syphilis in this disease, and it does not seem to be influenced by any treatment with which I am acquainted.

Case confirming this view.

Since the first edition of this work appeared, my attention has been directed to an account of "A peculiar form of Retinitis Pigmentosa in connexion with inherited Syphilis," by Mr. H. R. Swanzy, who quotes some observations by Mr. Hutchinson, as to the occasional syphilitic origin of this malady. Mr. Swanzy's patient was a child, aged eleven years and a half; there was imperfect vision of the right eye and hemeralopia, but no concentric contraction of the visual field. Numerous pigmentary deposits occupied the retinal periphery, and changes in the choroid were commencing. The deposits differed from those of ordinary retinitis pigmentosa in their form, and in not following the vessels. The child's teeth and the family history afforded unequivocal evidence of inherited syphilis.*

Symptoms.

Not striking.

Loss of sight after sunset.

Periphery of retina first affected.

Symptoms.—As I have before stated, although retinitis pigmentosa is a disease which commences in early life, it may long escape notice. It runs its course, in fact, without the slightest pain, and the external appearance of the affected eye is probably healthy. The symptom first complained of is a gradual loss of sight, most marked after sunset, or when the patient is subjected to a dim light. The central portion of the retina remains unaffected long after its peripheral parts have been destroyed; direct vision, therefore, remains comparatively good, while objects immediately around the central portion of the visual field are hazy, or even imperceptible. For this reason a patient suffering from this malady may be able to read small type, but cannot walk about with safety.†

Contraction of visual field.

Pupil active.

As the disease progresses the field of vision steadily contracts, and ultimately the patient's sight is almost lost. Notwithstanding this, until an advanced stage of retinitis pigmentosa, the iris may remain healthy, and the pupil, though greatly contracted, respond to the stimulus of light.

* *Ophthalmic Notes*, by H. R. Swanzy, M.B., p. 7. Dublin, 1871.

† Dr. Mooren on "Retinitis Pigmentosa:" *Ophthalmic Review*, vol. i. p. 51.

Opacity of the lens.

Opacity of the vitreous is rare in this disease, but the lens is more often affected, the opacity commencing at its poles.*

Pigment spots on retina,

spreading from its vessels,

On examining the eye with the ophthalmoscope in the early stages of the disease, the optic disc and retinal vessels appear of normal size; towards the ora serrata patches of colouring matter may be noticed. These spots seem to grow from without the walls of the vessels—that is, the external coat, particularly of the smaller vessels, is lined with pigment, and the calibre of the vessels themselves is often diminished from the thickening of the membrana limitans. Other authorities consider that the pigment matter seen in the retina is an infiltration of choroidal pigment into the part, and no doubt, in some instances, pigmentary deposits are thus produced in the retina; but it appears to me that in retinitis pigmentosa the colouring matter is formed in the retina itself, spreading at the expense of its proper structures; and, indeed, there are good reasons for supposing that the black spots are simply the result of a progressive atrophy of its nervous elements.

the product of nervous atrophy.

Experiments of Mantegazza.

The experiments of Mantegazza seem to throw some light on this kind of degeneration. It appears that "the transplantations of Brain substance in the frog are chiefly remarkable for the quantity of pigment, either under the form of round or oval cells, or in that of the more common stellate and irregular shapes; such a condition is a frequent result, it might indeed be called a pigmentous degeneration."† We can suppose that similar changes may, under certain circumstances, be set up in the retina during life; and it is more probable that such should be the case, rather than that the pigment formed in the retina in this disease is derived from the choroid.

Choroid atrophied.

It is nevertheless true that as the pigment spots grow in the retina, changes may be observed in the stroma of the choroid: it becomes atrophied, and the circumference of the optic disc is consequently flattened, the calibre of the choroidal vessels is contracted, but their channels are not closed, so that the dioptric media remain comparatively transparent.

* Idem, vol. i. p. 49.

† *British and Foreign Med.-Chir. Rev.*, July, 1867, p. 163.

Extension of pigment spots.

Atrophy of retinal vessels.

With the further progress of the disease, the black pigment spots continue to increase in the retina, spreading gradually from the periphery to the axis of the eye; the retinal vessels become atrophied, and ultimately, when the patient has nearly lost his sight, the eye presents the following appearances:—Optic disc of normal size, and of a pale rose colour, looking flat, and no choroidal margin to be seen; the retinal vessels have dwindled away to mere threads, extending probably only a short distance beyond the margin of the disc; the fundus of the eye has a mottled appearance, the choroidal vessels are exposed, and a number of black, spider-shaped bodies are scattered over it; these are particularly distinct towards the ora serrata, Plate VII. Fig. 2.

Prognosis.

Total blindness rare.

No known remedy.

Prognosis.—I do not remember to have met with a case, in which a person, under forty years of age, has been rendered completely blind from the effects of this form of disease. It usually takes years to advance from the stage characterized by the symptoms of hemeralopia to that of general impairment of vision; but its progress, though slow, is sure. I have tried every means in my power to stop it, but have never succeeded in doing so; the atrophy of the choroidal stroma, and the increase of the pigment in the retina, continuing in spite of our best efforts.

Prognosis bad.

We must, therefore, give an unfavourable prognosis to patients suffering from retinitis pigmentosa; we may console them with the fact that its development will be slow, and may possibly be arrested by nature for several years at any stage; but beyond this, no reasonable hope can be entertained of improvement, much less of recovery.

Retinitis Apoplectica.

Characterized by hæmorrhage.

Retinitis Apoplectica.—This form of retinitis is generally met with among patients suffering from causes affecting the equilibrium of the general circulation; as, for instance, disease of the heart, liver, or uterus; obstructions of a local character, such as tumours or other growths pressing on the optic nerve and its vessels, may give rise to symptoms of this disease. The characteristic feature of retinitis apoplectica is indicated in its appellation: for in addition to the features presented in cases of idiopathic retinitis, we have more marked extravasation of blood into the retina; the effusion is in some instances so great as to

burst forwards into the vitreous, or it may be backwards into the choroid. The hæmorrhage may spread over the optic disc.

The extent of loss of sight in cases of this kind depends on the amount and position of the effusion of blood into the retina; but in offering a prognosis we must remember that the cause of the disease being generally constant, improvement in vision is too apt to be followed by a relapse, consequent on fresh extravasation of blood into the retina. P. 401.

Detachment of Retina.

Detachment of the Retina from the choroid may arise, either from the effects of a blow on the eye, or from disease. I had lately an instance under my care of the former class of cases.

Case. Partial; following a blow.

Detachment from a Blow.—The patient had been struck with a racket-ball on the left eye; immediately after receiving the blow, he found he had completely lost the sight of the eye. When I first saw this gentleman I observed that the pupil was widely dilated; he could only distinguish large objects in certain directions, the injury evidently being in the axis of vision.

Appearance of retina.

On examining the eye with the ophthalmoscope, a considerable portion of the retina, extending from the optic disc outwards and downwards, was found to be detached, and below this a clot of blood could be seen over which the retina appeared to hang. The fundus of the eye was intensely congested, as well as the optic disc, and there were several spots of extravasated blood scattered over the retina.

Extravasation.

Improved by time and rest.

I recommended this patient to keep the injured eye closed, and to rest the other one as much as possible. In a month's time I again saw him; the sight had improved, and the congestion and extravasation had almost disappeared: a considerable portion of the large clot noticed in the lower part of the eye had also become absorbed, but the appearance of the detached retina in the axis of vision remained unchanged.

Complete detachment.

It occasionally happens that the whole of the retina is dragged away from the choroid, and assumes a funnel-shaped form, the apex being at its point of attachment to the optic disc. The vitreous, however, must have passed into a fluid condition, to allow of the retina falling forward in this way.

Complete or partial detachment of the retina can

Appearance of retina. State of vessels.

hardly be mistaken for any other disease; the retinal vessels may be traced up to the margin of the wound, where they will be seen to terminate abruptly, or bend back, as in the above instance, at the point at which the detached retina deviates from the plane of the fundus of the eye. It is seldom necessary, however, to resort to minute distinctions of this kind, in order to determine the nature of the case. The jagged wound in the retina either leaves bare the hexagonal cells of the elastic lamina, or else, these having been destroyed, the choroid is exposed, and very frequently the white glistening sclerotic behind may be seen through the rent.

Separation of retina from effusion.

Detachment of the Retina from Effusion.—Separation of the retina from the choroid, the result of a collection of fluid behind the former structure, is not necessarily accompanied by any pain in the eye; but this symptom will of course vary with the nature of the cause which has given rise to the effusion. The patient probably complains only of gradually increasing imperfection of sight; and as only a portion of the retina is usually detached, the field of vision is more interrupted than absolutely destroyed; so that in looking at an object immediately in front of him the patient will lose perhaps half the figure, the rays which fall on the detached portion of the retina not being recognised, and for the same reason, objects appear to be bent, or their outlines distorted in various ways. In other cases the patient first notices that the field of vision is cloudy, the cloud having a wavy motion, due to changes of position of the retinal elements which receive and localize the impression of light. Vision is not only distorted, but objects under examination are fringed with a coloured ring or halo; this condition is characteristic of effusion and detachment of the retina.

Field of vision interrupted.

Worse if near the macula lutea.

If the retina be detached at or near the macula lutea, the impairment of vision will of course be far greater than if a more extensive detachment exist at its periphery; but even then, in certain directions, the visual field may still remain tolerably perfect.* Under any circumstances the patient complains of coloured or

* M. Wecker, "Maladies des Yeux," vol. ii. p. 364.

white balls, fiery wheels, flashes of light, and such like phenomena due to excitability of the visual organ.

Detached portion seen to bulge forwards.

If under these circumstances, a portion of the retina only has been torn away from the choroid, the detached piece will be seen (with the ophthalmoscope by means of the direct method of examination) bulging forward into the vitreous chamber, like a small bladder; its surface is usually relaxed and folded, trembling with every movement of the eye. The colour of the detached tissue varies: in the early stages of the disease it remains transparent, looking like a grey film upon the background formed by the choroid. By degrees, however, the nervous tissue degenerates and becomes opaque; in fact, the same changes occur as I described in cases of œdema. The opacity generally extends rather beyond the border of the actual line of detachment of the retina, and this border is deepened if the detachment be prominent, as a shadow is then thrown over the neighbouring fundus.

Looks grey.

If doubt exists as to the nature of the lesion, employing the indirect method of examination, we must follow up the retinal vessels from the optic disc to the point of apparent separation of the retina, and we shall notice that the vessels passing over the bladder-like projection are on a plane anterior to that of the fundus of the eye; and accordingly we shall have to alter our focal distance to see them distinctly. As they dip down on the other side of the projection they will again be indistinctly seen, till we re-adjust the focus. The calibre of the vessels as they pass over the retina is seldom altered, the vascular system being unimpaired; but to the practised eye, the vessels passing over the effusion have an undulating movement imparted to them on every slight turn of the eye: an appearance which, together with the bulging forward of the retina, cannot be mistaken if the detachment is considerable; but, on the other hand, requires much practice and dexterity to recognise if the detachment be only slight. The separation of the retina from the choroid may take place, apparently without any appreciable structural changes in the other tissues of the eye; on the other hand, it may be complicated with inflammatory or other abnormal appearances.

Displacement of the vessels.

Circulation maintained.

Wavy motion of vessels.

Detachment of the retina, such as I have now

Separation usually below.

described, is generally noticed at its lower portion; this fact is explained by supposing that the fluid behind it gravitates downwards, and accumulating in the inferior part of the retina, produces these appearances.

Effusion of blood or pus.

Occasionally this fluid contains blood, or pus, which will of course alter the apparent colour of the detached part. Particles of lime and small plates of bone have been found lining the inner surface of a detached portion of the retina. But in detachment of the retina from serous effusion beneath it, there is no increased tension of the eyeball; but if the detachment results from the growth of a tumour in the choroid, the tension of the globe of the eye is invariably augmented.

Prognosis: unfavourable.

Prognosis.—The prognosis of these cases of detachment of the retina is unfavourable: some few cases remain stationary, others have been said to recover; but in by far the majority of instances the effusion behind the retina increases and causes irreparable damage to the eye.

Treatment.

Treatment,—Total loss of sight must be the inevitable result of an accumulating effusion behind the retina, and its separation from the choroid, unless the surgeon can quickly afford some relief to his patient. Fortunately this may be done, as has been proved by Von Graefe, and Mr. Bowman.* Their mode of treatment is to pass two needles from without through the effusion, so as to let it escape into the vitreous, or externally into the choroid. Successful cases of the kind are sufficiently numerous to allow of our admitting this proceeding into the list of approved ophthalmic operations.†

Puncture the sac from sclerotic.

First determine state of retina.

Before adopting this measure, however, in any particular case, it is necessary to determine whether the retina is comparatively healthy, so as to lead us to hope, in case the effused fluid is got rid of, and the retina restored to its normal position, that our patient will gain some advantage from the operation. We may judge of this pretty accurately by the appearance of the retina; if it looks dull and opaque, it is more

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* *Ophthalmic Hospital Reports*, vol. iv. p. 135.

† Mr. Haynes Walton on Detachment of the Retina: *Med. Times and Gaz.*, 1866, vol. ii. p. 311.

than probable that its nervous elements have degenerated, and in that case it will be of no use interfering.

Operation.

Our intention in operating should be, to make a free opening through the effusion, so as to allow it to escape into the vitreous chamber; the retina will then fall back into its normal position, and unless structurally altered, its functions may be restored and the patient regain almost perfect vision. The plan Mr. Bowman recommends appears to be the best adapted for this purpose:—The site of the separation of the retina having been carefully studied with the ophthalmoscope, the patient is placed on a couch; and a stop speculum having been introduced to keep the lids apart, the surgeon passes a needle through the sclerotic vertically into the eye, transfixing the retina at its point of separation from the choroid; another needle is then inserted through the same opening, and the handles of the two being separated the one from the other, their points are made to diverge like the blades of a pair of scissors. In this way the retina is torn through, and the fluid behind it escapes into the vitreous chamber; usually a small quantity passes out along the needles, and exudes beneath the conjunctiva, but this is not always the case. After the operation the retina falls back into apposition with the elastic lamina.

Directions.

Retina torn by two needles.

Avoid wounding lens.

In these cases, the chief point to attend to is to avoid wounding the lens; but an ordinary amount of anatomical knowledge and skill will prevent this accident, and if we do not touch the lens, we may be sure that no injury will result from passing the needle into the vitreous, even if we do not succeed in effecting a cure. After the operation, the only necessary treatment will be to keep the eye closed for a few days with a pad and bandage.

Detachment from staphyloma.

Detachment of the Retina from Staphyloma and Fluid Vitreous.—Besides detachment of the retina brought about by blows on the eye, and serous effusion between it and the choroid, other causes may produce a similar result. I mentioned one of these when discussing the subject of sclero-choroiditis anterior, observing that, as the sclerotic gradually yielded to the intra-ocular pressure, the choroid, being drawn into the staphyloma, might drag the retina after it, thus detaching it from its normal

position. A similar result occurs at times in posterior staphyloma; but in this last affection, in addition to the mechanical effects produced by the protrusion backwards of the sclerotic, there is a tendency to general congestion of the choroid, and a fluid state of the vitreous, which may itself lead to detachment of the retina.

From fluidity of vitreous.

A like alteration in the consistency of the vitreous has been known occasionally to follow severe contusions of the eye, and such an accident may, therefore, give rise to detachment of the retina. Under these circumstances the alterations in the consistency of the vitreous appear to progress with remarkable slowness, so that the fact of the injury may be almost forgotten; but symptoms of gradual impairment of sight, and constant muscæ floating about in the field of vision, attract the patient's notice, and we find on examining the eye that a fluid state of the vitreous exists, and detachment of the retina has commenced.

Embolia of Retinal Vessels.

Embolia of the Retinal Vessels.—The details of a case of this disease, and two plates illustrating it, are to be found in Liebreich's Atlas.* In the majority of the recorded instances, embolia of the retinal vessels has been met with among patients suffering from disease of the aortic valves.† The symptoms commonly appear suddenly, in a person who has previously enjoyed good sight: probably the patient has gone to bed perfectly well, and on rising in the morning discovers that he is almost blind in one or both eyes.

In aortic disease.

Symptoms sudden.

On making an ophthalmoscopic examination, the optic disc will appear of its normal size, and though rather pale, in other respects unaltered; the same remark applies to the retina. It is in the vascular system that we shall discover the most marked changes to have taken place; the arteries and veins, either in the whole or in a portion of the fundus of the eye, will be found to be very much contracted; the circulation seems almost to have ceased, and the

Changes in the fundus.

* "Atlas d'Ophthalmoscopie," par le Docteur R. Liebreich, p. 23, Tab. VIII., Figs. 4 and 5.

† *Lancet*, vol. ii. p. 491 for 1875. Mr. E. Nettleship "On Embolism of Central Artery of Retina."

vessels to have collapsed, except in one or two spots where they are distended with blood; this is chiefly noticed in the veins. The blood may be seen to move slowly on towards the optic disc, the walls of the vessels contracting behind it, and this contraction lasts till another wave passes through the vessel in a similar way; a sort of peristaltic movement is thus induced, which may be general, or confined to certain veins.

Vessels contracted.

Slow peristaltic circulation.

If the obstruction to the circulation continues, changes occur about the region of the yellow spot, due to serous effusion and fatty degeneration of the elements of the retina; the part becomes opaque and cloudy, the opacity shading off into the healthy retina.*

Retinal degeneration.

Virchow has described and explained the cause of these phenomena in the circulation; he believes they arise from the presence of small coagula (emboli) in one or more of the retinal vessels; they are most commonly met with near the lamina cribrosa. In some cases, the walls of the vessels have been found thickened and otherwise diseased.

Emboli found in the vessels.

Case.—A typical case of the kind is quoted by Zander from Ed. Jaeger. The individual was an old man, seventy-two years of age, the subject of hæmorrhoids. The ocular media, he states, "were perfectly transparent, the retina appeared of a medium yellowish-red, without visible morbid change. The optic nerve, slightly pigmented at the circumference, and somewhat yellow-tinted, exhibited slight indications of bluish spots.

Case.

The vascular system of the retina, generally of small development, exhibited to the large trunks more especially, a proportionably small diameter. The corresponding large arteries and veins were equal in diameter, and alike in their dark red colour. No double contour was apparent, so that veins and arteries could only be distinguished by their clearly visible, respectively centripetal and centrifugal, circulation. This had not the appearance of a pulsation, since the walls, especially of the larger vessels, remain undis-

Contracted vessels.

* "On the Use of the Ophthalmoscope in Diseases of the Nervous System." By Dr. T. C. Allbutt, p. 293.

Irregular circulation.

turbed; but it was a movement slower or quicker, uniform or interrupted, but not rhythmical, of an unequally coloured stream of blood.

In larger vessels stagnant.

In the larger vessels, the blood-stream exhibited, at distances of from one-fourth to the whole diameter of the vessels, intervals of lighter and darker red colouring; which, however, in the movements of the column, were continually changing, the lighter spaces becoming smaller and wholly disappearing, to be formed anew elsewhere. The movement of the blood appeared in such places uniform, but extremely sluggish. In the vessels of medium size the movement was quicker, and often for a short time pulsatile; the light intervals were of a paler red, and, as well as the dark portions, of a greater comparative length, being from twice to four times the diameter of the containing vessels. In the finest twigs visible upon the optic nerve, the movement of the blood was most rapid, and, at the same time, most disturbed. The extremely delicate stream of blood would be suddenly interrupted, the dark red part of the blood would disappear, and the little vessel, scarcely discernible upon its bright ground, would seem to have assumed the tint of the optic disc. Then, in interrupted course, a shorter or longer column of blood would pass through the vessel, followed at greater or less intervals by a larger or smaller mass of blood globules, so that the observer almost appeared to see single globules, and then suddenly the vessel would be filled in its whole course with dark red blood, the portions of which seemed rather to roll through than to flow quietly.

In medium sized less so.

In finest, quick, but interrupted.

In the medium-sized and smallest vessels not the slightest movement was visible; but in the large, by careful attention for one or two minutes, the lighter parts might be seen to diminish and disappear, at the same time reappearing in another place."*

Ischæmia of Retina.

Ischæmia of the Retina is indicated under the following circumstances:—The patient usually becomes suddenly blind without any apparent cause; the pupils are widely dilated, but beyond this the eyes (for both are usually involved) have the appearance of health.

Loss of sight and dilated pupils.

* Carter's translation of Zander "On the Ophthalmoscope," p. 137.

Retinal arteries empty.

On examining the retina with the ophthalmoscope the retinal arteries will be found almost empty, "dwindled to the size of hairs," and the veins distended. In all other respects the appearance of the fundus of the eye is natural.*

Pathology obscure.

The pathology of ischæmia of the retina is very obscure. The patients have generally been weak and anæmic subjects, and it is possible that embolism of some of the larger vessels may have induced these symptoms. In one instance a tumour of the brain was discovered after death, and in another the anæmia was only the first step in that degeneration of the retina which depends on Bright's disease.

Paracentesis of the cornea.

Treatment.—When the disease appears to depend on mechanical causes, paracentesis of the cornea, or iridectomy, has been followed by relief. But until we are able to discover the causes of the deranged circulation through the vessels of the retina with more certainty than we can do at present, our treatment must of necessity be unsatisfactory.

Atrophy of the Retina.

Atrophy of the Retina may be the termination of any one of the affections of this structure we have been considering; if the atrophy has been preceded by inflammation, the scarlet colour of the retina gradually disappears, and the fundus of the eye, in the native of India, becomes covered with black patches, the remains of the epithelium of the elastic lamina and choroid. In the early stages of atrophy, the calibre of the retinal vessels diminishes, and as the disease advances, they dwindle away to mere thread-like streaks. If the optic nerve is not involved in the disease, it retains its normal appearance; but in the majority of cases it becomes atrophied also, and then presents a white, glistening, and slightly depressed appearance which is very characteristic.

After retinitis.

Black patches.

Vessels atrophied.

Papilla involved.

I need hardly add that, if atrophy has taken place, we know of no remedial agents which can restore the nervous structure of the retina; it becomes converted, in fact, into a fibro-cellular tissue. Excluding retinitis as a cause of atrophy, this change most frequently follows diseases of the choroid, or arises from intra-

* Two cases of this form of disease will be found reported by Prof. Rothmund: *Ophth. Hospital Reports*, vol. v. p. 367.