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A CASE OF TUMOUR OF THE OPTIC NERVE.

By George Lawson,

Surgeon to the Royal London Ophthalmic Hospital and the Middlesex Hospital.

Retro-ocular Tumour of the Optic Nerve; Removal of the Eye with the Tumour; Pathological Report.

Tumours of the optic nerve behind the eye but within the orbit are rare. In my own practice this is only the third case I have had. The first case was recorded in the Ophthalmic Hospital Reports, vol. x, p. 296; the second in the fifth edition of my "Manual of Disease and Injuries of the Eye," p. 238; and the third is the case I have now to relate. In each of these cases the eye was blind.

The late Von Graefe recorded a case of tumour of the optic nerve behind the globe, in which the sight was lost ("Archiv f. Ophthalm.," x, 1, 194).

Mr. Hulke has also related a case of retro-ocular tumour of the optic nerve in the Ophthalmic Hospital Reports, vol. x, p. 293, in which the vision was reduced to a quantitative perception of light.
The symptoms in the following case were sufficiently pronounced to enable me to suggest that the growth in the orbit was probably a tumour of the optic nerve behind the eye. They were—

1. A protrusion of the eye downwards and forwards, but the proptosis of only a moderate degree.

2. Steady loss of sight, first noticed with the commencement of the proptosis, and terminating in complete blindness.

3. White atrophy of the optic nerve.

The prominent symptoms which seem to indicate tumour connected with the optic nerve are proptosis, with early impairment of vision. The loss of sight in orbital tumours not connected with the optic nerve is caused either by the stretching of the optic nerve from the proptosis, or by the pressure of the growth on the nerve. There is seldom complete blindness, unless the growth by its size has destroyed the functions of the optic nerve, either by pressure or stretching.

In this patient the defect of sight was an early symptom, which progressed to blindness before there was a sufficient stretching of the optic nerve to account for it, or a large enough growth in the orbit to produce it by pressure.

Lastly, with the ophthalmoscope there was seen white atrophy of the optic nerve, with enlarged retinal veins, evidently due to the pressure of a tumour on the nerve; and from its comparatively small size probably directly connected with it.


History.—Two months ago his left eye was first noticed to be "larger" than his right, since that time it has gradually increased, and the sight has gradually failed in it; he has not had any pain in the eye, but headache, frontal and behind the ear on his left side at times. He has never had any injury to
the eye or head. He is the eldest of five, four of whom are living; one died aged 2 years, "in a fit."

State on Admission.—Left eye proptosed and displaced forwards and downwards; movements of eyeball good. At the upper and inner part of the orbit is felt a hard mass, extending backwards in close contact to the roof of the orbit. There is no nasal obstruction or deafness, no posterior palatine growth, and no glandular enlargement.

He has no perception of light with the left eye; the pupil is inactive to light. By ophthalmoscopic examination the optic disc is seen to be white, and the margin blurred, the veins big and tortuous, and obliterated in places near the margin of the disc. T.n.

In the right eye the pupil is active; optic disc normal. T.n.

and vision = 20

July 29th. Operation under chloroform and ether.

Mr. Lawson first made an exploratory incision through the upper eyelid in a line parallel with the roof of the orbit. He then passed his finger into the orbit, and was able to detect a tumour entirely surrounding the optic nerve. He next introduced a speculum between the lids, and excised the eye with the tumour around the nerve en masse. The wound in the upper lid was closed with fine sutures, and a pad of sublimate wool tied over the whole. The patient soon recovered from the operation, and has since continued well.

Pathological Notes. By J. B. Lawford, Curator of Museum.

The left eyeball with the tumour attached were examined immediately after removal. The eyeball externally presented nothing abnormal. Its measurements were vertically 22.5 mm., and transversely 23 mm. When opened antero-posteriorly the only noticeable change was slight but appreciable swelling of the optic papilla.

Behind the globe was a tumour surrounding the optic nerve, and extending backwards from the sclerotic a dis-
tance of 23 mm. In its widest part its diameter was 18·5 mm. Irregularly pear-shaped, with the smaller end forwards, and with a lobulated surface, it was entirely enclosed in the dilated optic nerve sheath. At the posterior limit of the growth where the nerve emerged, it and the sheath were in contact, but the nerve was somewhat thickened. The tumour was fairly firm to the touch, and near its anterior end were felt one or two small cysts beneath the capsule.

After hardening, the eyeball and growth were divided into two lateral halves by an incision, which passed close to the inner edge of the disc. The sketch by Mr. Lapidge (Fig. 1) was made immediately after the section, from the temporal half of the eye and growth. That by Mr. Collins was done from the fresh specimen, shortly after its removal.

Immediately behind the eyeball is a fusiform swelling of the nerve, which, beginning close to the papilla, increases rapidly till, at a distance of 9 or 10 mm. from the sclerotic, it measures 10·5 mm. in its vertical diameter, the greatest width it attains; it then gradually thins down again to the point at which it has been divided, 23 mm. from the eyeball, at which point it is of greater diameter than normal. The outlines of the swollen nerve are quite distinct (see Fig. 1). Between it and the dural sheath is the new growth, which has a somewhat porous speckled surface. It appears to be intimately connected with the nerve, but much less closely with the sheath, from which it can be easily separated. Though surrounding the nerve completely, the greater part is situated on its upper surface. There are several small points of extravasation in the growth, especially in the upper and anterior part close to the eyeball (where there is a tiny cystic cavity) and in the narrow part below the nerve. There is another small cyst close to the capsule, at the posterior superior part of the tumour. The sheath of the nerve, although greatly dilated, is apparently otherwise unaffected.
Fig. 1

Fig. 2

M. H. Lapidge, lith

Danielsson & Co, imp.
**Microscopical Examination.**—The new growth is a sarcoma of loose connective tissue type, which in parts is undergoing myxomatous degeneration.

In those parts which are apparently free from this change, the stroma is finely fibrous, and forms in places a delicate reticulum resembling that met with in lympho-sarcoma, with this difference, that there are no cells in the meshes. It is natural to suppose that these empty spaces contained degenerated cells and stroma which disappeared during the manipulation of the sections; and, though after careful examination and comparison of these areas with those in which degeneration is evident, I am inclined to think that this reticular structure is the original type of the tumour, and not the result of degeneration, it is impossible to be quite certain that such is the case. Throughout the growth the cells are very loosely arranged, and there are no clumps of cells, such as are usually met with in the true myxo-sarcomata. The cells are round and oval, but the former largely predominate. No spindles were found. There are numerous small areas of myxomatous degeneration, but in no section were there found the translucent spherules, described in tumours like this one, by Vossius, Leber, and others. A few of the vessels in the growth show very marked hyaline degeneration of their walls, which are greatly thickened and their lumen almost obliterated, but in none of the sections examined were there any hyaline appendages to the degenerated vessels.

Scattered through the optic nerve are large numbers of cells, which are identical in appearance with the cells of the new growth. The nerve-fibres show little if any change, but the trabeculae are thickened. The pial sheath can be traced unbroken over the thickened nerve, but it is being invaded by the tumour-cells. The dural sheath, which is but loosely attached to the tumour, is not implicated.

In the parts in which extravasations occurred, there
are several very large bloodvessels, with thin delicate walls, being little more than mere channels in the growth. Though it is impossible to tell with certainty the site of origin of the tumour, it is most probable that it grew from the connective tissue of the inner sheath, or from the loose tissue of the intersheath space.
ON CONVERGENT STRABISMUS.

By W. Lang, F.R.C.S.,
Assistant-Surgeon to the Hospital, and Ophthalmic Surgeon to the Middlesex Hospital; and
JAMES W. BARRETT, M.D., B.S., F.R.C.S.,
Demonstrator and Examiner in Physiology in the University of Melbourne.

I. Result of Treatment of Convergent Strabismus by the Correction of the Refraction Error, with and without Tenotomy.

We have been engaged in collecting data on this subject for the past four years; during this time we have had about 350 cases of this disease under observation.

In 102 of these the observations are sufficiently accurate and have extended over a sufficient period to be available for the purposes of the present communication. Our generalisations are inductions from the complex facts ascertained by the periodic observation of these 102 cases.

Method of observation—
1. The distant vision was tested for each eye with and without glasses.
2. The power of fixation of each eye was tested.
3. The movements of the eyes were examined, particular attention being given to the extent of the excursion outwards of the squinting eye.
4. The angle of convergence was measured by a modification of Landolt's method.
5. The iris and ciliary muscle were completely paralysed by atropine, or by homatropine with cocaine.
6. The angle of convergence was again measured.
7. The refraction was estimated by retinoscopy, and the vision with the correcting glasses determined when practicable.
8. The full correction was ordered for each eye, the
glasses were obtained and worn, and then, and not till then, was the use of mydriatics discontinued.

9. The patients returned at intervals of three to six months. At these visits they were examined with respect to—

(A.) The angle of convergence whilst the glasses were worn.
(B.) The angle of convergence when the glasses were removed.
(C.) The vision in each eye.
(D.) The presence of binocular or monocular vision as ascertained by the coloured letter test.

10. In those cases in which this treatment did not produce satisfactory results, the internal rectus was divided. The angle of convergence was measured immediately before and after the operation, and at the usual intervals of three to six months. In no case were the two internal recti divided at the same time, and in very few was it necessary to divide both. No other operative procedure was ever resorted to.

The Method of Measuring the Angle of Convergence.

A McHardy's perimeter was fitted with a large, flat, black screen, having a perforation 5 mm. in diameter, which was placed just above the central fixation point. The head was placed in the usual position, the eyes being on a level with this aperture. The squinting eye was placed in the axis of the instrument, and the patient was then directed to look through this aperture at a distant object. Thus very little or no accommodation could be employed. The deviation could be read off easily by the usual "candle method." This method does not give the deviation with absolute accuracy, since we never troubled to measure the angle \( \alpha \), but as the error for the same individual does not vary, it answers its purpose admirably in a purely comparative investigation.
CONVERGENT STRABISMUS.

It may be as well to state that the 102 cases include no case of convergent strabismus from congenital or other paralysis of the sixth nerve, that the ages of the sufferers varied from 4 to 30 years, and that the cases include a few squinting myopic eyes, and eyes with corneal nebulae.

These points will be again referred to; for the present it is sufficient to state that they are 102 cases which were indiscriminately collected at the Moorfields clinic, and subjected to methodic treatment and observation.

The spectacles ordered were usually large circular ones, the centres being adjusted for distant vision.

Tables I and II show the results of the constant use of glasses during periods of 6 to 24 months.

**Table I,—Cases Improved or not Improved by Glasses.**

<table>
<thead>
<tr>
<th>10 years of age and under (61 cases)</th>
<th>Over 10 years of age (41 cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases in which some improvement was effected.</td>
<td>Cases in which no improvement was effected.</td>
</tr>
<tr>
<td>53 or 86·9 p.c.</td>
<td>8 or 13·1 p.c.</td>
</tr>
</tbody>
</table>

Taking all the cases together—

87 or 85·3 per cent. 15 or 14·7 per cent.

It will therefore be seen that cases 10 years of age and under are more amenable to the spectacle treatment than those over 10 years of age.

In some of the cases, however, the improvement only remained so long as the glasses were worn; so soon as they were removed the convergence was as marked, or even more marked, than before.


**Table II.**—Cases Improved only whilst Glasses were worn and also when Glasses were removed.

<table>
<thead>
<tr>
<th>10 years of age and under.</th>
<th>Over 10 years of age.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases in which improvement was noticeable only whilst the glasses were worn.</td>
<td>Cases in which improvement remained after removal of glasses.</td>
</tr>
<tr>
<td>15 or 28·3 p.c.</td>
<td>38 or 71·7 p.c.</td>
</tr>
</tbody>
</table>

Taking all the cases together—

- Improvement only whilst glasses were worn.
- Improvement after removal of glasses.
- 25 or 29·4 per cent.
- 60 or 70·6 per cent.

Of 102 cases of strabismus then, 60 were permanently benefited by the use of glasses. Again it will be noticed that there is a slight difference in favour of those 10 years of age and under.

*Amount of Improvement.*—The numbers used refer to the degrees indicated by the perimeter.

**Table III.**—Amount of Improvement whilst wearing Glasses.

<table>
<thead>
<tr>
<th>10 years of age and under (53 cases).</th>
<th></th>
<th>Over 10 years of age (34 cases).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average original convergence.</td>
<td>Average amount remaining whilst glasses were worn.</td>
<td>Average amount of improvement.</td>
</tr>
<tr>
<td>22·5°</td>
<td>6·9°</td>
<td>15·6°</td>
</tr>
<tr>
<td>24·2°</td>
<td>12·4°</td>
<td>11·8°</td>
</tr>
</tbody>
</table>

The effect in the cases 10 years of age and under was very striking, since 6·9° was the average amount remaining, and the remaining convergence of 5° may be considered as a fair result of any treatment in hospital practice where the time cannot be expended to bring about a restoration of binocular vision.
The effect in the cases over 10 years of age was not nearly so good, and in fact the details of observations show that the older the individual the less amenable is he to the spectacle treatment.

But it must be remembered that the results stated in the preceding table were only obtained whilst the glasses were worn.

**Table IV.**—Amount of Improvement without the Glasses.

<table>
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<th>Average original convergence.</th>
<th>Average amount remaining without glasses.</th>
<th>Average amount of improvement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years of age and under (38 cases).</td>
<td>24.5°</td>
<td>12.8°</td>
<td>11.7°</td>
</tr>
<tr>
<td>Over 10 years of age (22 cases).</td>
<td>22.7°</td>
<td>14.7°</td>
<td>8°</td>
</tr>
</tbody>
</table>

Again the difference in the result between those of different ages is very marked indeed.

Combining Tables III and IV we get—

**Table V.**

(87 Cases).

<table>
<thead>
<tr>
<th></th>
<th>Average original convergence.</th>
<th>Average amount remaining whilst glasses were worn.</th>
<th>Average amount of improvement.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23.2°</td>
<td>9.1°</td>
<td>14.1°</td>
</tr>
</tbody>
</table>

(60 Cases).

<table>
<thead>
<tr>
<th></th>
<th>Average amount remaining without glasses.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>23.8°</td>
</tr>
<tr>
<td></td>
<td>13.5°</td>
</tr>
<tr>
<td></td>
<td>10.3°</td>
</tr>
</tbody>
</table>

As before stated the length of time the glasses were worn was usually from 6 to 24 months. As a general rule the longer they were worn the greater was the beneficial result. This remark applies with greater force to those under than to those over 10 years of age.

As is necessarily implied by the foregoing tables, in a considerable number of cases absolute cure of the deformity
was effected by this treatment, even when the spectacles were removed; and in a larger number cure was effected so long as the glasses were worn.

In the following table all cases in which the convergence did not exceed 5° are regarded as cured. When one remembers the variability of the normal angle α, it will be seen that this is not giving too much latitude. In several of the cases the treatment produced slight apparent divergence.

**Table VI.—Cases of Cure.**

<table>
<thead>
<tr>
<th></th>
<th>Whilst the glasses were worn</th>
<th>When the glasses were removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years of age and under</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>Over 10 years of age</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>37</td>
<td>11</td>
</tr>
</tbody>
</table>

Thus out of 102 cases, 37 or 36·3 per cent. were cured so long as the glasses were worn, and 11 or 10·8 per cent. were permanently cured. Inasmuch as no case was under observation more than two years, it follows that the table is incomplete, since it is exceedingly probable that in the course of a few years a larger number of the 37 cases and others will cease to squint, even when the glasses are removed. The error of refraction being fully corrected, they steadily improve as maturity approaches.

*The amount of improvement was often considerable.*

**Table VII.—Cases in which the use of Glasses produced an Improvement of 30° or more.**

<table>
<thead>
<tr>
<th></th>
<th>Whilst the glasses were worn</th>
<th>After removal of the glasses</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years of age and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>under</td>
<td>4 (maxm. 45°)</td>
<td>2 (maxm. 38°)</td>
</tr>
<tr>
<td>Over 10 years of age</td>
<td>2 (maxm. 35°)</td>
<td>0</td>
</tr>
</tbody>
</table>
Table VIII.—Cases in which the use of Glasses produced an Improvement of 20° to 30°.

<table>
<thead>
<tr>
<th></th>
<th>Whilst the glasses were worn</th>
<th>After removal of the glasses</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years of age and under</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Over 10 years of age</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

A survey of Tables VII and VIII again illustrates the greater effect the treatment produces on those under than those over 10 years of age.

At the final examination there was often a considerable difference in the convergence whilst the glasses were worn and after their removal. The change following this removal or application was often instantaneous.

Table IX.—Amount of Alteration in Squint on removing the Glasses at the Final Examination.

In 59 cases, 10 years of age and under, the average difference was 6.9°
In 30 cases, over 10 years of age, the average difference was 5.7°

In most cases even of cure monocular vision alone was obtained; when binocular vision was obtained it was usually only whilst the glasses were worn, on their removal it became monocular.

Table X.—Result of Removal of Glasses when Binocular Vision had been obtained.

<table>
<thead>
<tr>
<th></th>
<th>10 years of age and under (19 cases)</th>
<th>Over 10 years of age (7 cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>(including 2 cases of alternating strabismus)</td>
<td>(including 2 cases of alternating strabismus)</td>
<td></td>
</tr>
</tbody>
</table>
In 27 cases in which the spectacle treatment failed to effect sufficient improvement, simple tenotomy of one rectus was practised.

**Table XI.—Difference between amount of Convergence before operation with Glasses, and amount three months after operation with Glasses.**

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Average Difference</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years of age and under</td>
<td>14° (maxm. 25°)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average of 7 cases</td>
<td>14° (maxm. 25°)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 10 years of age</td>
<td>13-7° (maxm. 25°)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average of 18 cases</td>
<td>13-7° (maxm. 25°)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Taking all the 25 cases the average difference was therefore 13-8°.

**Table XII.—Difference between amount of Convergence before Operation with Glasses, and three months after operation without Glasses.**

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Average Difference</th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years of age and under</td>
<td>17-5° (maxm. 23°)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average of 9 cases</td>
<td>17-5° (maxm. 23°)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over 10 years of age</td>
<td>14-6° (maxm. 22°)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average of 12 cases</td>
<td>14-6° (maxm. 22°)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Or, taking all the 21 cases, the average difference was 15-8°.

A summary of Tables XI and XII shows that the effect of the operation is similar at both series of ages.

A summary of these tables enables us to arrive at certain conclusions, and suggests further investigation.

In 85-3 per cent. the spectacle treatment produced improvement, but in 14-7 per cent. it absolutely failed to do so. What then is the cause of the failure? These cases did not, as far as we can tell, differ from the others in any particular of refraction or other optical condition.

The permanent improvement which takes place after the constant wearing of glasses is probably due to a progressive improvement in the tone of the external rectus.
due to an avoidance of over-use of the internal rectus consequent on the use of glasses. A squint cured with glasses will often reappear within a few seconds after their removal.

Table V shows that the average amount of improvement whilst the glasses were worn was $14.1^\circ$; when they were removed $10.3^\circ$.

Tables XI and XII show that the effect of tenotomy was $14.7^\circ$; therefore the effect of the spectacle treatment is about equal to that of division of one internal rectus (but not necessarily equal to half the effect of the division of both), whilst the glasses are worn, and equal to about two-thirds the effect of simple division when they are not worn; i.e., the permanent effect of the spectacle treatment, followed during 6 to 24 months, is equal to two-thirds the effect of the division of one internal rectus.

**Conclusions.**

1. The spectacle treatment of convergent strabismus produces a rapid and complete cure in about 10 per cent. of cases.

2. In a larger number (33 per cent.) the cure continues so long as the glasses are worn. In these cases it would probably become permanent in course of time.

3. The effect of this treatment is in direct ratio to the youth of the patient.

4. Spectacle treatment should therefore in the great majority of cases be adopted as an indispensable preliminary adjunct to any operative treatment. By this treatment there is no chance of producing the absolute divergence which occurs sometimes after tenotomy. Exceptional cases occur in which the treatment is inapplicable on account of the occupation of the patients.

5. If the spectacle treatment fails to produce absolute cure, a division of the internal recti generally suffices, together with the use of glasses, to remedy the deformity.
In some few cases the opposite internal rectus must be subsequently divided.

II. The Refraction in Cases of Convergent Strabismus.

The following results have been obtained by the systematic examination of a large number of cases of strabismus (about 260). The examination consisted in—

1. The determination of the distant vision for each eye, with and without glasses.

2. Retinoscopy practised at the yellow spot after the ciliary muscle and iris had been completely paralysed by either atropine or homatropine with cocaine.

3. The subsequent determination of the vision with the correcting glasses.

Thus the basis of our estimate was a purely “Objective Method.”

From the cases referred to we have eliminated any in which the strabismus was due to paralysis of the external rectus; and we have usually separated in the tables the cases of ordinary convergent and of alternating convergent strabismus.

The right eye converged in 53 per cent. of the cases, the left in 47 per cent.

I. As to the proportion of cases in which the refraction was similar and different in the two eyes—

| Refraction the same in both eyes | 107 |
| Refraction different in the two eyes | 98 |

These cases include both alternating and ordinary cases. We have considered the refraction to be different in the two eyes only when either the spherical or the cylindrical error in the two eyes differed by at least 1 D.

II. As to the refractive character of these 410 eyes—

Both eyes were myopic in one case.

The squinting eye was myopic or mixed astigmatic in five cases, whilst the non-squinting eye was either hyper-
metropic (2 cases), hypermetropic and astigmatic (2 cases),
or emmetropic (1 case).
The cornea of the squinting eye in some of these five cases was nebulous. Both eyes were hypermetropic or hypermetropic and astigmatic in the remaining 199 cases. Thus of 205 cases, in only two could the influence of hypermetropia in causing strabismus be positively excluded.

III. As to the nature of the difference in the cases in which the refraction in the two eyes was dissimilar—
In 98 cases the refraction in the squinting and non-squinting eyes differed by more than 1 D. either of spherical or cylindrical error.
These cases include 10 cases of alternating strabismus.
Of these 10 the two eyes differed as follows:—
In 5 one eye only was astigmatic.
In 3 one eye was more astigmatic than the other.
In 2 one eye was more hypermetropic than the other.
Of the 88 cases of ordinary convergent strabismus, the squinting differed from the non-squinting eye as follows:—

In 7 in the squinting eye there was no astigmatism.
In 24 " " " astigmatism.
In 15 " " " more astigmatism.
In 8 " " " less astigmatism.
In 18 " " " more hypermetropia.
In 11 " " " less hypermetropia.
In 5 " " " myopia or mixed astigmatism.

IV. As to the average amount of the dissimilarity in the refraction between the two eyes—
In 81 of the cases in which the refraction of the two eyes differed, and in which observations were sufficiently accurate, the average amount of hypermetropia present in the squinting eye was 4.3 D., and the average amount of
astigmatism present (65 cases) was 1.7 D. In the non-squinting eye the average amount of hypermetropia present (81 cases) was 4.1 D., and the average amount of astigmatism present (65 cases) was 1 D.

Thus it will be seen that although the amount of hypermetropia in the two eyes was nearly the same, the squinting was distinctly more astigmatic than the non-squinting eye.

V. Taking all the cases together—

In 29 cases of alternating convergent strabismus the average amount of hypermetropia was 3.5 D. in one eye and 3.4 D. in the other, while the average amount of astigmatism (20 cases) was 0.9 D. in the one eye and 1.2 D. in the other.

Taking the cases of ordinary convergent strabismus—

The average amount of hypermetropia in the squinting eye (107 cases) was 4.1 D.; in the non-squinting eye 3.9 D. The average amount of astigmatism in the squinting eye (98 cases) was 1.6 D., in the non-squinting eye 1.1 D.

In a future paper we intend to publish the conclusions we have drawn from these figures which have been obtained by the objective examination of the refraction of the eyes, in a large number of cases of convergent strabismus.
SOME OF THE COMPLICATIONS AFTER EXTRACTION OF CATARACT.

By E. TREACHER COLLINS, Senior House Surgeon.

In my capacity of House Surgeon I have had entrusted to me the after treatment of all cases of extraction of cataract, and have consequently during the last two years had ample opportunity of observing the more usual complications.

Of all these complications, the most fatal is suppuration; it is so rapid and unexpected in its onset and so intractable to any form of treatment. I have thought therefore that by collecting a large number of these cases, and then comparing and contrasting them, it might be possible to gain some indication as to its causes and the treatment for its prevention. With this view I have tabulated the following 50 cases taken from the Hospital case books for several years past.

Besides the more usual complications, I have had some exceptional ones which I will here record in full. These were, first, a series of cases in which, after the completion of the operation, some solution of the biniodide of mercury was injected into the anterior chamber for the purpose of rendering the parts aseptic, with the result that a permanent opacity of the cornea was set up, and vision consequently only slightly improved by the operation; and, secondly, a series of cases which for want of a better name may be termed glaucoma after extraction, and of which I have not been able to find any mention in our text-books.
<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Age</th>
<th>Date of operation</th>
<th>Condition of eye and patient previous to operation</th>
<th>Operation</th>
<th>Manner and date of commencement of suppuration</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Elizabeth T.</td>
<td>68</td>
<td>Oct. 30</td>
<td>Pain in eye for last four months</td>
<td>Lens came away with difficulty; a quantity of soft matter left</td>
<td>2nd day pain, mucopurulent discharge and swelling of lids; suppuration of cornea noted on 8th day</td>
<td>Shrinking globe; sympathetic ophthalmitis.</td>
</tr>
<tr>
<td>2</td>
<td>George L.</td>
<td>45</td>
<td>March 3</td>
<td>Preliminary iridectomy; pupil noted to be irregular before iridectomy</td>
<td>Uncomplicated</td>
<td>Pain, edema of lids, haze of cornea commencing on 13th day, and hypopyon formed the next day</td>
<td>Excision.</td>
</tr>
<tr>
<td>3</td>
<td>Sarah P.</td>
<td>65</td>
<td>March 7</td>
<td>Wound enlarged with secondary knife</td>
<td>Uncomplicated</td>
<td>Pain next day, swelling of lids 2nd day, purulent discharge 3rd day; cornea seen to be suppuring on 4th day</td>
<td>Excision.</td>
</tr>
<tr>
<td>4</td>
<td>William S.</td>
<td>62</td>
<td>March 25</td>
<td>Paralytic cecropion of lower lid, epiphora</td>
<td>Uncomplicated</td>
<td>Pain and swelling of lids on 2nd night; note on 5th day says &quot;cornea completely infiltrated&quot;</td>
<td>Excision.</td>
</tr>
<tr>
<td>5</td>
<td>John S.</td>
<td>62</td>
<td>April 29</td>
<td>Vitreous lost, lens extracted with scoop; section did not fall well together</td>
<td></td>
<td>Pain and swelling next day; cornea noted to be steamy on 3rd day, and sloughing on 5th day</td>
<td>Closed pupil, bare p.I.</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Age</td>
<td>Date of operation</td>
<td>Condition of eye and patient previous to operation</td>
<td>Operation</td>
<td>Manner and date of commencement of suppuration</td>
<td>Result</td>
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<tr>
<td>6</td>
<td>John MacK.</td>
<td>63</td>
<td>May 15</td>
<td>Lens soft and milky</td>
<td></td>
<td>3rd day oedema of lids, purulent discharge, and suppurative keratitis</td>
<td>Closed pupil, T.n.; n.o.a.c. V. = shadows.</td>
</tr>
<tr>
<td>7</td>
<td>Hugh H.</td>
<td>66</td>
<td>Oct. 24</td>
<td>Catarrh of conjunctiva</td>
<td>Uncomplicated</td>
<td></td>
<td>Excision</td>
</tr>
<tr>
<td>8</td>
<td>Matilda G.</td>
<td>51</td>
<td>Jan. 20</td>
<td>Preliminary iridectomy; projection bad; had had increased tension in 1882, and lacrimal regurgitation in 1881</td>
<td>Uncomplicated; scoop used</td>
<td>Pain 2nd night; discharge on 3rd day, and suppuration of cornea noted on the 4th</td>
<td>Excision</td>
</tr>
<tr>
<td>9</td>
<td>Mary Ann W.</td>
<td>70</td>
<td>Feb. 7</td>
<td>Weak and restless</td>
<td>Uncomplicated</td>
<td>Pain and swelling commenced on 2nd night; section noted to be sloughing on 3rd day</td>
<td>Excision</td>
</tr>
<tr>
<td>10</td>
<td>Jane A.</td>
<td>75</td>
<td>Feb. 13</td>
<td>Weak, sleeps badly; preliminary iridectomy; myopic</td>
<td>Cornea flaccid</td>
<td>Purulent discharge and haze of cornea on 4th day, and purulent infiltration on 6th</td>
<td>Excision</td>
</tr>
<tr>
<td>11</td>
<td>Elizabeth K.</td>
<td>42</td>
<td>April 19</td>
<td>Had been getting thin; menorrhagia; preliminary iridectomy</td>
<td>Uncomplicated</td>
<td>Vomited the same evening, free discharge and section opaque 2nd day</td>
<td>Excision</td>
</tr>
<tr>
<td>12</td>
<td>James H.</td>
<td>59</td>
<td>May 17</td>
<td>Nebulae in both eyes; posterior synechiae in other eye</td>
<td>Uncomplicated</td>
<td>Pain on 2nd day; cornea noted hazy on 5th day, and sloughing on 6th</td>
<td>Excision</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Age</td>
<td>Date of operation</td>
<td>Condition of eye and patient previous to operation</td>
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<td>Result</td>
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</tr>
<tr>
<td>13</td>
<td>Tabitha C.</td>
<td>56</td>
<td>June 5</td>
<td>Stye and conjunctivitis noted three months previous</td>
<td>Uncomplicated</td>
<td>Pain and swelling 2nd day, and on 3rd day cornea seen to be infiltrated throughout</td>
<td>Excision</td>
</tr>
<tr>
<td>14</td>
<td>John L.</td>
<td>68</td>
<td>July 4</td>
<td>Lacrymal obstruction and lippitudo</td>
<td>Uncomplicated</td>
<td>Pain, redness, and swelling of lids, and suppuration of cornea next day</td>
<td>Excision</td>
</tr>
<tr>
<td>15</td>
<td>Joseph W.</td>
<td>81</td>
<td>July 23</td>
<td></td>
<td>Uncomplicated</td>
<td>Pain and discharge commenced on 3rd day; on 4th day cornea clear; 5th cornea dull, and the evening of 5th opaque at seat of section</td>
<td>Excision</td>
</tr>
<tr>
<td>16</td>
<td>Mary W.</td>
<td>81</td>
<td>July 24</td>
<td>Lacrymal obstruction</td>
<td>Uncomplicated</td>
<td>On the 2nd evening pain, discharge, and redness of lids; 3rd day whole cornea opaque and hypopyon</td>
<td>Excision</td>
</tr>
<tr>
<td>17</td>
<td>J. S.</td>
<td>75</td>
<td>Sept. 14</td>
<td></td>
<td>Uncomplicated</td>
<td>Pain on the 2nd night; on 7th day hypopyon section noted healthy; on the 9th dulness of cornea</td>
<td>Closed pupil; shrinking globe</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Age</td>
<td>Date of operation</td>
<td>Condition of eye and patient previous to operation</td>
<td>Operation</td>
<td>Manner and date of commencement of suppuration</td>
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</tr>
<tr>
<td>18</td>
<td>Mary B.</td>
<td>59</td>
<td>Oct. 18</td>
<td>Conjunctivitis in February, T. — ? myopic</td>
<td>Uncomplicated</td>
<td>Bronchitis came on on 9th day; discharge, dulness of cornea, and hypopyon on the 11th day</td>
<td>Excision.</td>
</tr>
<tr>
<td>19</td>
<td>Eliza H.</td>
<td>75</td>
<td>Nov. 15</td>
<td>Weak</td>
<td>Cornea flaccid; vomited after operation</td>
<td>Discharge and cornea opaque at seat of section on 2nd day</td>
<td>Excision.</td>
</tr>
<tr>
<td>20</td>
<td>James K.</td>
<td>60</td>
<td>Nov. 28</td>
<td></td>
<td>Uncomplicated</td>
<td>On 2nd day swelling of lids, pain and discharge; cornea noted yellow on 5th day</td>
<td>Excision.</td>
</tr>
<tr>
<td>21</td>
<td>James F.</td>
<td>61</td>
<td>April 4</td>
<td>Preliminary iridectomy; slight conjunctival catarrh</td>
<td>Vitreous lost</td>
<td>Swelling and pain next day; wound yellow 3rd day</td>
<td>Excision.</td>
</tr>
<tr>
<td>22</td>
<td>Thomas P.</td>
<td>61</td>
<td>April 30</td>
<td>Had been in infirmary five months and in hospital a week on account of a cold previous to operation; intemperate</td>
<td>Vitreous lost</td>
<td>Wound seen to be hazy the same evening, and yellow the next day</td>
<td>Excision.</td>
</tr>
<tr>
<td>23</td>
<td>Charles C.</td>
<td>67</td>
<td>May 28</td>
<td>Eyes noted to be blood-shot and puncta everted in March; preliminary iridectomy</td>
<td>Uncomplicated</td>
<td>Slight conjunctivitis on 7th day; on 8th pain, swelling, and infiltrated ring of suppuration behind cornea, (?) on iris and hypopyon</td>
<td>Excision.</td>
</tr>
</tbody>
</table>

**AFTER EXTRACTION OF CATARACT.**
<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Age</th>
<th>Date of operation</th>
<th>Condition of eye and patient previous to operation</th>
<th>Operation</th>
<th>Manner and date of commencement of suppuration</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Richard D.</td>
<td>58</td>
<td>Oct. 24</td>
<td>From the workhouse; old wound of cornea and iris; diarrhoea previous to operation</td>
<td>Uncomplicated</td>
<td>Commenced with discharge, pain, and swelling on 2nd day</td>
<td>Excision</td>
</tr>
<tr>
<td>25</td>
<td>William C.</td>
<td>70</td>
<td>Oct. 28</td>
<td>When working used to drink six or eight pots of beer daily</td>
<td>Uncomplicated</td>
<td>Discharge and pain on 2nd day; cornea infiltrated on 4th day</td>
<td>Excision</td>
</tr>
<tr>
<td>26</td>
<td>Elizabeth H.</td>
<td>73</td>
<td>Nov. 14</td>
<td></td>
<td>Brussels operation uncomplicated</td>
<td>Chemosis, pain, and infiltration of cornea commenced next day</td>
<td>Excision</td>
</tr>
<tr>
<td>27</td>
<td>Anne A.</td>
<td>60</td>
<td>Nov. 14; same day as Case 26</td>
<td>Brussels operation uncomplicated</td>
<td>Iris prolapsed; cornea steamy; chemosis and pain next day</td>
<td></td>
<td>Excision</td>
</tr>
<tr>
<td>28</td>
<td>Emma P.</td>
<td>72</td>
<td>Dec. 10</td>
<td></td>
<td>Uncomplicated</td>
<td>On the 2nd day pain and discharge; on the 3rd cornea infiltrated and yellow</td>
<td>Excision</td>
</tr>
<tr>
<td>29</td>
<td>Martha T.</td>
<td>72</td>
<td>Jan. 2</td>
<td>Lacrymal obstruction</td>
<td>Uncomplicated</td>
<td>Discharge and pain commenced the 1st day; cornea affected 2nd day</td>
<td>Excision</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Age</td>
<td>Date of operation</td>
<td>Condition of eye and patient previous to operation</td>
<td>Operation</td>
<td>Manner and date of commencement of suppuration</td>
<td>Result</td>
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<tr>
<td>30</td>
<td>William C.</td>
<td>67</td>
<td>Feb. 23</td>
<td>From the workhouse</td>
<td>Uncomplicated</td>
<td>Swelling, pain, and discharge 1st day; cornea affected 2nd day</td>
<td>Excision.</td>
</tr>
<tr>
<td>31</td>
<td>Eliza A.</td>
<td>67</td>
<td>Nov. 4</td>
<td>Preliminary iridectomy</td>
<td>Uncomplicated</td>
<td>Discharge and pain commenced on the 2nd day; cornea noted to be affected on 5th day</td>
<td>Excision.</td>
</tr>
<tr>
<td>32</td>
<td>Maria K.</td>
<td>65</td>
<td>Nov. 27</td>
<td>Central leukemia and iris adherent; preliminary iridectomy</td>
<td>Uncomplicated</td>
<td>Swelling, pain, and discharge 1st day; cornea hazy 2nd day</td>
<td>Excision.</td>
</tr>
<tr>
<td>33</td>
<td>Annie C.</td>
<td>45</td>
<td>Jan. 12</td>
<td></td>
<td>Uncomplicated</td>
<td>Was doing well up to 7th day, then pain commenced and iritis; next day there was an hypopyon and infiltration of cornea</td>
<td>Excision.</td>
</tr>
<tr>
<td>34</td>
<td>Richard S.</td>
<td>48</td>
<td>March 29</td>
<td>Diabetes two years; very thin</td>
<td>Uncomplicated; a large quantity of soft matter removed after nucleus</td>
<td>2nd day slight discharge, 3rd day infiltration of cornea and hypopyon</td>
<td>Closed pupil.</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Age</td>
<td>Date of operation</td>
<td>Condition of eye and patient previous to operation</td>
<td>Operation</td>
<td>Manner and date of commencement of suppurative inflammation</td>
<td>Result</td>
</tr>
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</tr>
<tr>
<td>35</td>
<td>Mary L.</td>
<td>58</td>
<td>April 5</td>
<td></td>
<td>Uncomplicated</td>
<td>Discharge and swelling of lids 2nd day; infiltration of cornea and chemosis 3rd day</td>
<td>Shrinking globe.</td>
</tr>
<tr>
<td>36</td>
<td>Richard D.</td>
<td>62</td>
<td>April 9, 1 year and 5 months after other eye</td>
<td>The second eye of Case 24; nebulæ, from the workhouse</td>
<td>Uncomplicated</td>
<td>Commenced with pain, swelling of lids, and discharge on 2nd night; yellow infiltration of cornea noted on 3rd day</td>
<td>Shrinking globe.</td>
</tr>
<tr>
<td>37</td>
<td>Henry J.</td>
<td>73</td>
<td>April 22</td>
<td></td>
<td>Uncomplicated</td>
<td>Discharge and infiltration of cornea 2nd day</td>
<td>Excision.</td>
</tr>
<tr>
<td>38</td>
<td>Mary P.</td>
<td>72</td>
<td>May 12</td>
<td>Conjunctivitis a week before operation</td>
<td>Uncomplicated</td>
<td>Discharge and infiltration of cornea commenced 2nd day</td>
<td>Shrinking globe.</td>
</tr>
<tr>
<td>39</td>
<td>Thomas P.</td>
<td>69</td>
<td>June 9</td>
<td>Nebulæ; preliminary iridectomy</td>
<td>Uncomplicated</td>
<td>Swelling and discharge on 3rd day, cornea infiltrated on 4th day</td>
<td>Excision.</td>
</tr>
<tr>
<td>40</td>
<td>Abigail J.</td>
<td>64</td>
<td>June 18</td>
<td>Nebulæ; lacrimal obstruction in other eye; projection defective</td>
<td>Brussels operation, uncomplicated</td>
<td>Pain, discharge, and infiltration of cornea 2nd day; hypopyon, 4th day</td>
<td>Closed pupil, T.n. V. = Hand reflex.</td>
</tr>
<tr>
<td>41</td>
<td>Ann S.</td>
<td>55</td>
<td>June 23</td>
<td>Corpulent; yellowish sclerotic; blepharitis in April</td>
<td>Bulky lens; incisions small</td>
<td>Discharge, swelling of lid, and infiltration of cornea commenced 3rd day; no pain</td>
<td>Closed pupil, T.n.</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Age</td>
<td>Date of operation</td>
<td>Condition of eye and patient previous to operation</td>
<td>Operation</td>
<td>Manner and date of commencement of suppuration</td>
<td>Result</td>
</tr>
<tr>
<td>--------</td>
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<td>-------------------</td>
<td>----------------------------------------------------</td>
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<td>-------------</td>
</tr>
<tr>
<td>42</td>
<td>Elizabeth W.</td>
<td>60</td>
<td>Sept. 1</td>
<td>Feeble</td>
<td>Uncomplicated</td>
<td>Discharge commenced on 5th day, pain, swelling of lids, and infiltration of cornea on 6th day</td>
<td>Excision</td>
</tr>
<tr>
<td>43</td>
<td>Edward D.</td>
<td>53</td>
<td>Dec. 10</td>
<td></td>
<td>Uncomplicated</td>
<td>Diarrhoea two days after operation, discharge and pain commenced on 8th day, corneal infiltration on 9th day; a blister that formed spontaneously on hand suppurred</td>
<td>Excision</td>
</tr>
<tr>
<td>44</td>
<td>John H.</td>
<td>66</td>
<td>Feb. 7</td>
<td></td>
<td>Uncomplicated</td>
<td>Discharge; infiltration of cornea and hypopyon first noticed on 5th day</td>
<td>Shrinking globe</td>
</tr>
<tr>
<td>45</td>
<td>Henry A.</td>
<td>63</td>
<td>May 5</td>
<td>Anæmic</td>
<td>Uncomplicated</td>
<td>Commenced with iritis on 5th day, swelling of conjunctiva on the 6th, and hypopyon formed on the 9th day</td>
<td>Excision</td>
</tr>
<tr>
<td>46</td>
<td>George R.</td>
<td>76</td>
<td>June 2</td>
<td>Myopic</td>
<td>Uncomplicated</td>
<td>Pain the first night, discharge and haziness of wound next morning. Purulent infiltration 2nd day</td>
<td>Excision</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Age</td>
<td>Date of operation</td>
<td>Condition of eye and patient previous to operation</td>
<td>Operation</td>
<td>Manner and date of commencement of suppuration</td>
<td>Result</td>
</tr>
<tr>
<td>--------</td>
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<td>---------------------------------------------------</td>
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<td>--------</td>
</tr>
<tr>
<td>47</td>
<td>Richard D.</td>
<td>67</td>
<td>June 8</td>
<td>Old choroiditis in the other eye</td>
<td>Small escape of vitreous</td>
<td>Commenced with discharge on the 1st day; swelling of lids and opacity of cornea, 2nd day</td>
<td>Excision</td>
</tr>
<tr>
<td>48</td>
<td>Caroline G.</td>
<td>63</td>
<td>July 21</td>
<td>Morgagnian cataract</td>
<td>Uncomplicated</td>
<td>Pain the 1st night, swelling of lids, discharge, and yellow infiltration of cornea commenced 2nd day</td>
<td>Excision</td>
</tr>
<tr>
<td>49</td>
<td>Caroline G.</td>
<td>63</td>
<td>Nov. 23; 4 months after the first eye</td>
<td>The second eye of Case 48; acute glaucoma at time of operation</td>
<td>Uncomplicated</td>
<td>No pain at all; slight discharge the 1st day, and purulent infiltration of wound the 2nd night</td>
<td>Shrinking globe</td>
</tr>
<tr>
<td>50</td>
<td>Hannah B.</td>
<td>67</td>
<td>Oct. 27</td>
<td>From the workhouse, no p.l. in the other eye</td>
<td>Uncomplicated</td>
<td>Pain on the 2nd night, swelling, redness of lids, and infiltration of cornea on 3rd day</td>
<td>Shrinking globe</td>
</tr>
</tbody>
</table>
1. *Age.*—The ages of the above cases may be summarised as follows:

Between 30 and 50, 4 or 8 per cent.
   ,, 50 ,, 60, 8 ,, 16 ,,  
   ,, 60 ,, 70, 25 ,, 50 ,,  
   ,, 70 ,, 80, 11 ,, 22 ,,  
   ,, 80 ,, 90, 2 ,, 4  

I have taken to compare with these the ages of 300 consecutive cases of extraction in 1886, thus:

Between 30 and 50, 41 or 13.6 per cent.
   ,, 50 ,, 60, 65 ,, 21.6 ,,  
   ,, 60 ,, 70, 113 ,, 37.6 ,,  
   ,, 70 ,, 80, 74 ,, 24.6 ,,  
   ,, 80 ,, 90, 7 ,, 2.3 

These figures seem to prove that there is a greater tendency to suppuration in old people than in young, but they also seem to show that this tendency is greater between 60 and 70 than between 70 and 80; though it is certainly greater between 80 and 90 than between 60 and 70.

2. *Season of Year.*—I have arranged in two parallel columns the number of suppurations according to the month in which they occurred, and the total number of cases of extraction in each month in the year 1886:—*

<table>
<thead>
<tr>
<th>Suppuration</th>
<th>Extractions in 1886</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>3</td>
</tr>
<tr>
<td>February</td>
<td>4</td>
</tr>
<tr>
<td>March</td>
<td>4</td>
</tr>
<tr>
<td>April</td>
<td>7</td>
</tr>
<tr>
<td>May</td>
<td>5</td>
</tr>
<tr>
<td>June</td>
<td>6</td>
</tr>
<tr>
<td>July</td>
<td>4</td>
</tr>
<tr>
<td>August</td>
<td>0</td>
</tr>
</tbody>
</table>

* It must be borne in mind that the suppurations were spread over several years, while the extractions tabulated here were all performed in one year: the columns cannot therefore be compared except in the manner employed by the author.—(Ed.)
<table>
<thead>
<tr>
<th>Suppuration</th>
<th>Extractions in 1886</th>
</tr>
</thead>
<tbody>
<tr>
<td>September .... 2</td>
<td>21</td>
</tr>
<tr>
<td>October .... 6</td>
<td>42</td>
</tr>
<tr>
<td>November .... 7</td>
<td>32</td>
</tr>
<tr>
<td>December .... 2</td>
<td>20</td>
</tr>
</tbody>
</table>

If the number of cases in the six winter months, viz., January, February, March, October, November, and December, be added together and compared with those in the six summer months, viz., April, May, June, July, August, and September, we find that in the former 26 suppurations occurred, while there were 160 cases of extraction in the corresponding period of 1886; and in the summer months there were 24 suppurations as compared with 157 cases in 1886. I think this proves that suppuration has no relation to the time of year at which the operation is performed.

3. *General Condition of Patient, and Ocular Complications.*—My next column describes the condition of the eye and of the patient previous to the operation. In 25 of the cases there was nothing detected, nor was there any suspicion that there was anything wrong in the eye. Of the remaining 25, 6 had some lacrymal complication, 5 had conjunctivitis, 1 blepharitis, 6 nebulae of the cornea (some of these with synechiae), 1 posterior synechiae alone, 1 had acute glaucoma, 2 myopia, 1 choroiditis in the other eye, 1 no perception of light in the other eye, and 1 had had pain in the eye for four months previous to operation.

With regard to their general health, 5 of them were from the workhouse, 6 were noted to be weak or anaemic, 2 intemperate, and 1 diabetic.

In two of the patients both eyes suppurated, and are recorded in the table as four cases.

Those cases with lacrymal complication, conjunctivitis, and blepharitis may be put down as caused by infection; are the remaining 38 also due to infection introduced at the time of the operation by the instruments or operator?
I think not all of them. In some I believe that the corneal flap sloughed from want of sufficient nutrition, and that the inflammation which followed may have afterwards become septic, but that in the first place suppuration started without any infection. My reasons for this belief are the following:—

1st. That in two patients both eyes suppurred, though in both strict antiseptic precautions were taken, and in cases 24 and 36 there was an interval of 1 year and 5 months between the operations on the two eyes, and in cases 48 and 49 an interval of 4 months.

2nd. A large proportion of the 50 cases had nebulae of the cornea or other evidence or suspicion of past inflammation, by which the nutrition of the cornea or eye would be impaired.

3rd. That several of the patients were from the workhouse, or in a feeble state of health at the time of operation.

4th. That the old have been shown to be more liable to suppuration than the young.

5th. That the old flap incision in which a large section of the cornea was made, was abandoned in favour of Von Graefe’s operation, partly because it was found that there was less tendency to suppuration in the latter.

6th. Because the cornea is a fibrous structure and further removed from the blood-vessels than almost any other tissue.

4. Operation.—The operation was a modified Von Graeef’s extraction in all except three of the cases, in which a Brussels operation was performed. Nine of the cases had had a preliminary iridectomy; in 43 the operation was uncomplicated; in 4 vitreous was lost; in 3 the incision was too small, and in one of these it had to be enlarged with a secondary knife. The proportion of
suppurations after the Brussels extraction was large, as this form of operation was but rarely performed. The proportion after preliminary iridectomy was also large, though this may be accounted for by the fact that a preliminary iridectomy was often performed as a precautionary measure in unfavourable cases.

5. Manner and Date of Commencement of Suppuration.—In the majority of cases the symptoms of suppuration commenced on the 1st, 2nd, or 3rd day, but in 8 of the 50 cases they did not appear until on or after the 5th day, and in one of these not until as late as the 13th day. Some of the late cases, I think, commence as an iritis, the intensity of the inflammation being so great that pus is thrown out from the iris, and an hypopyon formed; we know that this sometimes occurs when no perforation of the cornea has taken place, the infiltration of the cornea being then secondary to the iritis. Case 33 is a typical one of this sort; the patient was doing perfectly well up to the 7th day, and the wound had apparently healed,
when an acute attack of iritis set in, in the evening of the same day there was an hypopyon, and the next day the cornea was infiltrated.

6. Treatment.—On looking at the last column, it will be seen how unsatisfactory is the treatment of these cases. In 13 of the 50 cases suppuration was checked, but in 8 of these the globe was noted to be shrinking; the remaining 5 had normal tension but closed pupils.

Six of the 50 cases as I have said had some lacrymal complication; if this is detected previous to extraction, what measure can be taken to prevent a disastrous result? Mr. Streatfeild* and others have recommended the total obliteration of the lacrymal sac, the canaliculi, and all the lacrymal mucous surface with the actual cautery. In the following consecutive eight cases a less heroic procedure was adopted with success:—

* "On a Preliminary Precaution to be taken in cases of Cataract Extraction, when there is or has been any Lacrymal Obstruction or Catarrh," see Trans. Ophth. Soc., vol. iv.

<table>
<thead>
<tr>
<th>Treatment previous to operation.</th>
<th>Operation.</th>
<th>Treatment after operation.</th>
<th>Result.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two hours previous to operation lacrymal duct and sac syringed out with Boracic acid lotion</td>
<td>Uncomplicated</td>
<td>Dressed twice daily (first dressing changed the same evening) with Unguentum Acidi Borici, and the lids bathed with some Condy's fluid and water</td>
<td>Feb. 1, V. = 0 + 10, 20 + 14 J.1.</td>
</tr>
<tr>
<td>Lower canaliculus slit, and duct probed; the lacrymal sac and duct were afterwards syringed out daily for 17 days with Boracic acid lotion</td>
<td>Uncomplicated</td>
<td>Dressing same as in Case 1</td>
<td>April 16, R. needled, after which V. = 0 glasses 20 partly and 20 J.1; Oct. 30, again admitted with sympathetic ophthalmitis in L., the vision of R. remaining good.</td>
</tr>
<tr>
<td>Number</td>
<td>Name</td>
<td>Date of admission</td>
<td>Age</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>-------------------</td>
<td>-----</td>
</tr>
<tr>
<td>3</td>
<td>Nathaniel S.</td>
<td>Feb. 14, 1886</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Mary T.</td>
<td>Aug. 7, 1886</td>
<td>53</td>
</tr>
<tr>
<td>5</td>
<td>Abigail J.</td>
<td>Oct. 1, 1886</td>
<td>65</td>
</tr>
<tr>
<td>6</td>
<td>George T.</td>
<td>Jan. 7, 1887</td>
<td>66</td>
</tr>
<tr>
<td>7</td>
<td>Rebecca S.</td>
<td>March 2, 1887</td>
<td>53</td>
</tr>
<tr>
<td>8</td>
<td>Caroline A.</td>
<td>Oct. 1, 1887</td>
<td>57</td>
</tr>
<tr>
<td>Treatment previous to operation</td>
<td>Operation</td>
<td>Treatment after operation</td>
<td>Result</td>
</tr>
<tr>
<td>---------------------------------</td>
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<td>--------</td>
</tr>
<tr>
<td>Feb. 18, lower canaliculus slit, and duct probed; lacrimal sac and duct syringed with Boracic acid lotion just previous to operation</td>
<td>Feb. 11, iridectomy upwards and inwards; April 15, extraction uncomplicated</td>
<td>Dressing same as in Case 1</td>
<td>Good.</td>
</tr>
<tr>
<td>Two hours previous to operation lacrimal duct and sac syringed out with Boracic acid lotion</td>
<td>Uncomplicated</td>
<td>Dressing same as in Case 1</td>
<td>Oct. 9, ( V = \frac{c + 13}{20} + \frac{17}{50} ) J. 4.</td>
</tr>
<tr>
<td>Lacrimal sac and duct syringed out on alternate days with Boracic acid lotion for 12 days previous to iridectomy, and for 13 days previous to extraction</td>
<td>Oct. 31, preliminary iridectomy; April 22, extraction uncomplicated</td>
<td>Dressed with a pad of Alembroth gauze tissue, first dressing changed the same evening; lids bathed with Lotio Hydragyri Perchloridi, and Unguentum Iodol applied to the margins, and twice daily afterwards</td>
<td>May 2, ( c + 15 ), the time by a watch: illiterate.</td>
</tr>
<tr>
<td>Lower canaliculus slit; duct and sac syringed alternate days with Boracic acid lotion for 11 days previous to iridectomy, and for another 11 days previous to extraction</td>
<td>Jan. 19, preliminary iridectomy; April 22, extraction uncomplicated</td>
<td>Dressing same as in Case 5</td>
<td>Good.</td>
</tr>
<tr>
<td>Lacrimal duct and sac probed and syringed daily with Boracic acid lotion for 5 days previous to extraction</td>
<td>Uncomplicated</td>
<td>Dressing same as in Case 5</td>
<td>Knocked her eye on the sixth day, and had some haemorrhage into the anterior chamber, otherwise progressed favourably.</td>
</tr>
<tr>
<td>Lower canaliculus slit; lacrimal duct and sac probed and syringed with Boracic acid lotion daily for 9 days previous to extraction, and an iodoform style inserted just before</td>
<td>Uncomplicated</td>
<td>Dressing same as in Case 5</td>
<td>Good.</td>
</tr>
</tbody>
</table>
The chief points in the treatment of these eight cases were, the syringing of the lacrymal sac and duct with an antiseptic lotion and the frequent dressing and bathing after the operation. The syringe used had that part that passes down the duct shaped like a lacrymal probe, and about the size of a number 5, with several perforations on all its sides but none at the end; to this was attached an apparatus similar to a Higginson’s syringe. By this means a large quantity of lotion was easily injected. I think the passing of an iodoform style immediately before the operation, as was done in Case 8, an additional precaution.

Since the biniodide of mercury is rapidly coming into use as an antiseptic, and since it has been strongly recommended as a lotion in cases of extraction of cataract by Professor Panas, the following cases are of interest:—

**Case I.—** John L., æt. 66. Admitted December 3rd, 1885.
Right eye. Mature cataract; sight failing seven months.
V. = fingers at 1 foot; projection good; pupil normal.
Left eye. Immature cataract; sight failing three months.
V. = ⚫\(\frac{5}{20}\)\(\frac{70}{70}\).

December 4th. R. Extraction, under cocaine. Operation uncomplicated. Anterior chamber after completion of operation washed out with a solution of biniodide of mercury, 1 in 25,000.

December 9th. Opacity of cornea noted.

December 24th. The opacity of the cornea still present; it is striated, whitish, with clear spaces left here and there; more marked at the centre and upper part than the lower.

May 13th, 1886. There is still a general haze of the cornea, and a white opacity at the upper part; the epithelium of the surface looks rough and finely granular.

A cataract was subsequently extracted from the L. eye; the anterior chamber was not washed out, and a good result was obtained.
AFTER EXTRACTION OF CATARACT.

Case II.—Charles D., æt. 44. Admitted November 19th, 1885.
  Right eye. Has had a cataract extracted successfully six months ago.
  Left eye. Nearly mature cataract. V. = hand reflex; projection good; pupil active.
  November 20th. L. Extraction, under cocaine; operation uncomplicated. Anterior chamber washed out with a solution of biniodide of mercury, 1 in 25,000.
  December 1st. A white infiltration of cornea, extending downwards from the wound.
  December 18th. Opacity of cornea still continues.

  Right eye. Mature cataract. V. = hand reflex; projection good; pupil active.
  Left eye. Opacities in lens. V. = $\bar{c} + 1\cdot5 \frac{20}{70}$.
  November 20th. R. Extraction, under cocaine; operation uncomplicated. Anterior chamber washed out with a solution of biniodide of mercury, 1 in 25,000.
  November 27th. White opacity of cornea extending downwards from wound.
  December 14th. Opacity still continues.
  November 1st, 1886. Still a haze of cornea, extending from cicatrix of incision. V. = $\bar{c} + 10 \frac{20}{100}$.
  The left cataract was extracted, and a good result obtained; the anterior chamber was not washed out, and there was no opacity of the cornea.
  March 7th, 1887. A white opacity in the posterior surface, at the upper part of the right cornea. V. c $\frac{+11}{+2\text{ cyl.}}$ 80° down and in = $\frac{20}{70}$, and $\frac{+15}{+2\text{ cyl.}}$ 80° down and in, 8 J.
  March 8th. R. Needled, under cocaine.
  March 13th. The haze of cornea has increased. V. c glasses as above $\frac{20}{200}$ only, unimproved.
Case IV.—Eliza G., æt. 55. Admitted November 5th, 1885, suffering from diabetes and with mature cataract in the left eye. V. = fingers at 2 feet, and a commencing cataract in right eye. V. = \[\frac{15}{200}\].

November 6th. L. Extraction, under cocaine; operation uncomplicated. Anterior chamber washed out with a solution of biniodide of mercury, 1 in 25,000.

November 16th. Anterior chamber has not re-formed.

November 20th. A shallow anterior chamber and a milky-white opacity of the cornea.

December 7th. Opacity of cornea still continues.

February 22nd, 1886. A general haze of cornea and roughness of epithelium and vertical striæ.

Case V.—George S., æt. 41. Admitted November 11th, 1885.

Right eye. Operated on last June. V. = c +11 \[\frac{20}{30}\] +15 1 J.

Left eye. A nearly mature cataract. V. = fingers at 3 feet; projection good; pupil active.

November 13th. L. Extraction, under cocaine; operation uncomplicated. Anterior chamber washed out with a solution of biniodide of mercury, 1 in 25,000.

November 20th. Slight striated haze of cornea, extending downwards from wound.

November 27th. Haze still continues; a thick opaque membrane in the pupil.

June 8th, 1886. L. Needled, under cocaine.

May 19th, 1887. Haze of cornea and new vessels in it; opaque membrane in coloboma and iris bombe. T. n. V. = hand-reflex.

November 7th. Haze of cornea and superficial ulceration in the centre. V. = hand movement; eye very painful.

November 8th. L. excision.

There can be no doubt that the keratitis in these cases was set up by the biniodide of mercury solution which was injected into the anterior chamber, for in all the cases it was noticed when first the eye was looked at after the
operation, and those four patients who had the cataract extracted from the other eye, when the anterior chamber was not washed out, obtained a good result and had no keratitis. The opacity caused has also some special characteristics of its own, in which it differs from the ordinary striated keratitis sometimes seen after operations on the cornea; it has a peculiar milky-white appearance, and is seen to be chiefly at the posterior surface, though afterwards in some of the cases was added to this a superficial roughness, then again it is permanent, at any rate it has not cleared up yet in any of the cases, and it has lasted two years and appears not amenable to treatment.

Increased tension after extraction of cataract may be brought about in different ways. 1. It may occur after there has been a severe attack of iritis, which has led to the formation of a membrane with numerous posterior synechiae, and to closure of the pupil, a bombe condition of the iris and increased tension. 2. It may occur in connection with that form of iritis which sometimes follows on extraction, and which is characterised by a deep anterior chamber and dotted opacities of the cornea. 3. There is a third form of increased tension after extraction in which there is not any or only slight iritis, no blocking of the pupil, and no increase in the depth of the anterior chamber or keratitis punctata. The following cases belong to this last class:

Case I.—Mary Ann D., æt. 70.
Admitted December 6th, 1884. Mature cataract in both eyes; sight failing in left five or six years; shadows; projection good; in right two years; shadows; projection good.

December 10th, 1884. L. Extraction; cocaine; modified Graefe, uncomplicated.

December 29th. L. V. = 5 + 10 20 + 14 J. 16.

Feb. 25th, 1885. L. V. = 5 + 6 spherical + 11 cylinder axis horizontal = 20

+ 10 spherical

+ 11 cylinder axis horizontal = 50',

= J. 1.
Soon after she obtained these glasses the sight gradually became dim, and she noticed rings of coloured light around lamp lights.

March 13th, 1886. L. Cornea steamy and bulged forwards; pupil dilated. T. +2. Optic disc indistinctly seen, cupped, and very oblong; can count fingers at one foot distant. The right eye was subsequently operated on and a good result obtained.

Case II.—Joseph H., âet. 48. Senile cataracts in both eyes. Projection good and T. n. Left operation on June, 1885, and V. c glasses afterwards $\frac{20}{20}$ and J. 1.

August 4th, 1885. R. Extraction, cocaine, modified Graefe's uncomplicated; a large amount of soft matter left.

August 31st. A large quantity of opaque matter in coloboma.

September 20th, 1886. R. Limbs of coloboma adherent to corneal cicatrix; a thick opaque membrane in coloboma also adherent to cicatrix; T +2; no p.l.; no pain.

Case III.—Sarah B., âet. 60.


August 7th. L. Preliminary iridectomy, cocaine.

November 3rd. L. Extraction, cocaine, uncomplicated.

September 9th, 1886. L. Both limbs of coloboma adherent to cornea; capsule in coloboma also adherent to cicatrix; optic disc could not be seen through it. V. = $5 + 10 \frac{5}{200}$, unimproved with cylinders, estimated to have about 6 D. of astigmatism by retinoscopy; T. +1, field tested roughly appeared normal.

September 10th. L. Needled; needle passing through old cicatrix in cornea left by extraction.

September 11th. L. T. n.

September 20th. L. Needle puncture has not closed; aqueous leaks through it; T. +1.

September 24th. L. Descemet's membrane or lens capsule bulging into needle puncture.

February 24th, 1887. L. T. + 2; V. = hand movement only; projection defective, the part of the cornea lying between the
upper margin and the cicatrix appears to have stretched and bulged.

April 21st. L. V. = hand movement; T. +3. The cataract was subsequently extracted from the right and a good result obtained.

Case IV.—Eliza C.

May 26th, 1887. Senile cataract both eyes; L. complete; V. = hand movement; projection defective on inner side; R. incomplete; V. = J. 10.

May 27th. L. Extraction, cocaine, modified Graefe's operation, uncomplicated.

June 4th. L. Wound not completely closed; good anterior chamber; pupil well dilated; patient complained of pain in head and eye.

June 16th. L. V. = \( \frac{10}{200} \) and J. 18.

August 3rd. L. T. full; optic disc well seen, not cupped; slight bulging of wound; pupil well dilated; limbs of coloboma free; capsule adherent to cicatrix (?).

Sept. 13th. L. V. = \( \frac{10}{20} \) spherical +14

partly.

+8 cylinder axis horizontal 30

+14 spherical

+8 cylinder axis horizontal J. 1,
slowly.


Sept. 26th. L. V. = with combination as above \( \frac{20}{50} \) partly; cornea bulged; T +1; no cupping of optic disc; field contracted.

Sept. 27th. L. Sclerotomy upwards.

Sept. 30th. L. T. n.


Oct. 10th. V. = with same combination as above, \( \frac{20}{70} \) and J. 10, unimproved.

That glaucoma should come on in an eye that has had a large iridectomy performed, and from which the lens has
been removed without the occurrence of any iritis, is so remarkable, that I think these cases worthy of special note. In three of the four cases the other eye had been or was subsequently operated on, and a good result obtained without any increase of tension; the inference from this I think is that it was something special in the operation itself, and not any peculiarity on the part of the patient, that was the primary cause of the glaucomatous symptoms. It will be also seen that in Cases 2 and 3 both limbs of the coloboma were noted to be adherent to the cicatrix, and not only the limbs of the coloboma but the lens capsule as well; in Case 4 also the lens capsule was probably adherent; but in Case 1 there is no note of any adhesion, though not having at that time been impressed with the importance of looking for it, I may not have mentioned it. Do these facts suggest any way in which the escape of fluids from the eye might be interfered with? I think they do, the dragging forward of the iris by the adhesion of the limbs of the coloboma to the cornea would tend to close the angle of the anterior chamber, and so obliterate the canal of Schlemm, and the adhesion of the lens capsule to the cicatrix might obliterate it above in the space left by the coloboma, and thus not only destroy the good effect of the iridectomy, but also assist in dragging forwards the iris. The obstruction thus set up to the outlet of fluids would cause the parts behind the cicatrix to bulge, as was specially noted in Cases 3 and 4, and this bulging would cause the alteration in the curvature of the cornea, setting up the very high grades of astigmatism seen in Cases 1, 3, and 4.

In conclusion, I have to thank the various members of the surgical staff for their kindness in allowing me to make use of the cases contained in this paper.
CURATOR'S PATHOLOGICAL REPORT.

FOUR CASES OF ORBITAL SARCOMA IN CHILDREN.

By J. B. Lawford,
Curator of Museum, Royal London Ophthalmic Hospital.

CASE I (Reg. No. 1960).—Percy N., æt. 4. Admitted to Moorfields Hospital, under Mr. Tweedy's care, on November 20th, 1885.

On admission: The left eye is protruded forwards, downwards, and slightly inwards. A solid mass can be felt between the globe and the upper orbital margin, and it seems to be slightly moveable. The upper outer angle of orbit is free from growth.

The exophthalmos has been noticed (according to the parents' statement) for two years. The growth has been painless.

On the day of admission the growth was removed, through a horizontal incision along the lower margin of the eyebrow; it was nearly the size of the eyeball, and firm to the feel.

The child left the hospital in a fortnight, the wound being quite healed; there was, however, inability to raise the upper lid more than half way.

This patient subsequently came under the care of Mr. Doyne, of Oxford, to whose kindness I am indebted for the further notes of the case, and also for a portion of the recurrent growth.

On October 30th, 1886, there was a small moveable tumour behind the left upper eyelid, the size of a pea. The boy was not seen again for six weeks, when he came with the left eye dislocated on to the cheek, and the orbit filled with new growth. On removal of the growth, it was found by Mr. Doyne to have an ill-defined capsule, and to contain some pinkish-brown soft matter. This specimen was unfortunately thrown away. The eye returned to its normal position, and sight remained good (the actual visual acuity not known).

A little more than two months later (March 3rd, 1887) a fresh nodule of growth had appeared in the upper lid. On operating this was found to be intimately connected with a
mass of cicatrical and new tissue, extending to the back of the orbit. This was removed as completely as was possible, without enucleating the eyeball, for which the parents' consent had not been obtained.

On April 12th, the eyeball was removed, and the contents of the orbit cleared out; chloride of zinc paste was applied two days later.

In July, a fluctuating swelling was felt behind the lids (? lacrimal retention), which on tapping allowed the withdrawal, on three occasions, of a small quantity of clear fluid.

On October 25th a large mass of new growth was again removed from the orbit, and this Mr. Doyne kindly sent to me. It is an irregular mass of very firm tissue, and has on section a distinctly fibrous appearance. It contained (Mr. Doyne tells me) a small cyst, which was situated at the upper and posterior part, and from which the fluid which was drawn off evidently came.

In December, 1887 (about the 15th), the growth having recurred at the inner and upper part of orbit, another operation was performed by Mr. Doyne, and a nodule removed; the inner wall of the orbit was partially removed, and two small suspicious nodules taken from the nasal cavity.

This operation entirely relieved severe pain in the brow and nose, of which the boy had been complaining.

**Microscopical Examination.**

(1.) Of the Original Growth removed November 20th, 1885.—This consists of a matrix of well-formed fibrous tissue, with connective tissue corpuscles scattered through it. The sarcoma cells, which are mainly oval and spindle-shaped, are generally collected in groups, and are of very varying size. There are, however, areas over which these cells are very sparsely distributed, and in which the appearances are to a great extent those of genuine fibroma. There is no gland structure. The growth has no capsule. In one part, near the margin of the tumour, are numerous rather large thin-walled blood-vessels.

(2.) Of the Recurrent Growth removed October 25th, 1887.
—The structure is essentially similar to that above described. The fibrous elements largely predominate, but there are groups of cells, and cells scattered through the stroma, just as in the original growth. These cells are round, oval, and spindle-shaped, the two former kinds being most numerous. The blood-vessels are not very numerous, but are more scattered than in the primary tumour.

(3.) Of the Recurrent Growth removed December, 1887.—The proportion existing between the cellular and fibrous elements appears to have changed somewhat in favour of the former. The fibrous tissue has in general very similar characters, but in parts it is not so well formed, and appears less developed than in the previous specimens. The cells are mainly round and oval; the blood supply not very abundant. Altogether this specimen has the appearance of a more rapidly-growing tumour, of a lower type than the two first growths.

Case II (Reg. No. 2138b).—Rebecca W., set. 10. Admitted to Moorfields Hospital, under Mr. Lang's care, August 11th, 1886, when the following notes were made:—

Family history good.

Early in June, 1886, the child had had a blow on the right eye by a piece of wood, and in consequence the lids became much swollen. She was brought to hospital as an out-patient on June 8th, and the note then made was, "Hæmatoma of right upper lid." The mother states that before the accident she had noticed "a pimple" on the child's eyelid.

Present condition: At inner upper angle of right orbit is a firm elastic swelling, the size of a walnut, extending deeply, so that its posterior limits cannot be felt. The skin is freely moveable over the growth. The vision of the right eye = \( \frac{6}{18} \) with -3 D.

No ophthalmoscopic changes.

August 16th. The tumour was removed in several portions through a horizontal incision in the upper lid. It was not
adherent to surrounding tissues. The wound healed rapidly, and the patient was discharged from hospital on August 25th. Three months later (on November 17th) she was readmitted, with a recurrence of the new growth, behind the inner end of the scar. The tumour now extended from the inner angle, half way across the orbit. Its posterior limit could not be felt. The upper lid drooped, but the skin was moveable over the growth. There were no changes in the eye.

November 18th. The entire contents of the right orbit were removed en masse, and after some dissection the position and size of the new growth were ascertained to be as follows:—

The tumour measures roughly 22 mm. antero-posteriorly by 15 mm. transversely, and is situated between the superior oblique and internal rectus muscles, to both of which it is loosely attached. Its anterior end extends forwards under the orbicularis and protrudes the upper lid. The infra-trochlear nerve is stretched over its posterior surface. On the temporal side of the anterior part of the tumour, and close behind the upper lid, is a mass of tough, nearly white cicatricial tissue, which is very closely adherent to the orbicularis muscle and to the tumour. This tissue, in the site of the primary growth, reaches to the mid-line of the upper lid. The new growth has a definite capsule, and has no close adhesions, except as mentioned, to the cicatrix on its outer side. When the capsule is cut the growth, which is soft and spongy, bulges through the incision. The lacrimal gland is quite separate from the tumour, and apparently healthy.

January 16th, 1888. There is at this date no recurrence of the growth.

Microscopical Examination.

Sections of the primary growth removed in August have the structure of a round-celled sarcoma. It is not a very compact growth, that is to say, there is a large amount of intercellular material, in which the cells are rather loosely arranged. This intercellular stroma has a faintly fibrous structure. The cells, which are well formed with a round central nucleus in each, tend to collect in small circular groups, each group containing 8—10 cells.
A delicate capsule is evident on the surface of the tumour, but it is impossible to say if this completely surrounded the growth. A very noticeable feature in the growth is the large size and number of the blood-vessels, which have well-formed and, in some instances, thick walls. No blood extravasations and no pigmentation met with.

Sections of the recurrent growth examined microscopically reveal a structure in many respects similar to that just described. The cells of the tumour are round, but much more closely packed than in the primary growth, and they exhibit no similar grouping.

In a few places there is evidence of a tendency to elongation of the cells.

The capsule of this tumour is a stronger structure than in the primary one, and the vascular supply is much less abundant, though the vessels throughout the growth are fairly numerous.

Case III.—O. J., male, aet. 2. Admitted to the Middlesex Hospital March 1st, 1887, under the care of Mr. Lang, who has kindly given me these notes of the case, and the tumour.

One month previously the child fell and struck his forehead; a week later he tumbled out of his perambulator, and struck the right temple. Muco-purulent discharge from nostril (?R. or L.) 14 days. Abscess in left thumb. Enlarged glands in neck.

Two other children, aet. 4 years and 11 months respectively. Both are healthy.

On admission: The right lower lid is bulged forwards by an irregular lobulated swelling. The eyeball is displaced upwards and forwards. Skin and conjunctiva normal.

March 8th. The growth is larger, and the globe more prominent. There is ecchymosis over the lower lid.

The eyeball was excised, and the growth with the entire contents of the orbit removed. The tumour consisted of an irregularly rounded imperfectly lobulated mass, yellowish in colour, and of firm consistence, measuring roughly 2.5 cm. by 2 cm.
January 16th, 1888. There has been no return of the growth; the orbit is filled with hard cicatricial tissue, which has undergone no change during the last six months. The child is plump and well.

Microscopical Examination.

The tumour is an unpigmented sarcoma, growing in the connective tissue of the orbit. It is not encapsulated. Its cells are generally circular, but in some places oval in shape, and not of uniform size. They are rather loosely set in a finely fibrillated matrix, which does not stain at all. The growth is extremely vascular, containing very numerous large-sized vessels. Many of these (and the largest of them) are merely blood-channels in the substance of the tumour, and have no distinct walls, though showing traces of a thin lining membrane—separating the blood from the sarcoma cells. The majority of the vessels, however, have thick walls, with an indistinctly fibrous structure, and a well-formed endothelium.

Case IV.—Ada E. N., aet. 10. Admitted to St. Thomas's Hospital, under Mr. Nettleship's care, March 30th, 1886.

Family history good.

The child has always been delicate. On February 21st, 1886, the right eye was first noticed to be more prominent than its fellow, and it was "bloodshot." The sight of this eye was also found to be defective.

On March 15th she was seen by Mr. Morton at the S.L.O.H., and with the right eye she could then read $\frac{6}{12}$ and 1 J.

March 23rd. Patient was brought to St. Thomas's Hospital. There was much proptosis of the right eye. Its upward movement was lost, and movements in other directions were much impaired. A firm lobulated mass could be felt in the situation of the lacrimal gland. $V. = \frac{6}{36} - 1 D. \frac{6}{18}$ ptly. Oph.: O.D. hazy.

March 30th. More proptosis; conjunctiva oedematous; mass has increased considerably. Pain at back of head and outer
CASES OF ORBITAL SARCOMA IN CHILDREN.

margin of orbit. The whole contents of the right orbit were removed, with the periosteum. The tumour adhered to the bone, but could be peeled off; it was traced to the apex of orbit, from which it appeared to spring. It was very firm to the touch.

May 6th. A recurrence of the growth has appeared in right temporal region, encroaching on outer side of orbit.

May 12th. The tumour in temporal region is rapidly increasing. The child has become unconscious on several occasions lately.

After this date she had frequent epileptiform fits, sometimes onesided, sometimes affecting both sides, with severe headache and vomiting. The growth in the right temporal fossa increased rapidly. Troublesome epistaxis occurred.

June 12th. Died.

Post-mortem Examination by Dr. Sharkey.—The following is a short extract from the notes:

Over surface of right cerebral hemisphere a thick layer of yellowish lymph with localised thickenings; (?) new growth. Dura mater of right anterior and middle fossæ of skull, is the seat of whitish new growth, and in right sphenoidal fissure, and on surface of right squamous bone is a mass of white homogeneous tumour, involving the periosteum. The bone beneath is rough and eroded, but nowhere perforated. No new growth in right orbit. The parts of the brain corresponding to the new growth are softened. Deposits of new growth were found in front of the bodies of the dorsal and lumbar vertebrae, and in the right pleura.

The growth removed from orbit is as large as a small peach, irregularly oval in shape, and firm to the touch. Its exact relations to the other contents of the orbit could not be made out accurately, as they were necessarily disturbed during removal.

Microscopical Examination.

The tumour is a round-celled sarcoma, unpigmented and unencapsuled. The cells are of small and fairly uniform size, and each contains a large central nucleus. Where spreading into neighbouring tissue, the cells have
an imperfectly columnar arrangement; elsewhere they are rather loosely set in a matrix containing a considerable amount of fibrous tissue; this is probably the orbital fibrous tissue which has been included in the growth. The vascular supply of the tumour is not very abundant, but a certain number of blood-vessels with well-formed walls are found in sections. The place at which or the tissue from which this growth originated, could not certainly be made out. Unfortunately, I did not obtain portions of the new growths in other parts of the body for microscopical examination.
OBSERVATIONS ON TOBACCO AMBLYOPIA.

By ROBERT W. DOYNE,

Surgeon to the Oxford Eye Hospital, and St. John's Hospital, Cowley.

The possibility of toxic amblyopia being limited to one eye has been demonstrated by a case reported by Mr. Jonathan Hutchinson, Jun., in the last volume of the Reports. I believe, however, that hitherto no case has been actually observed; the following, therefore, which has seemed to me to be unequivocal, may be of interest:—

I. Case of Monocular Central Amblyopia in a Tobacco Smoker.

Arthur Jones, æt. 38, gamekeeper, a fine, strongly-built, healthy-looking man, came under my observation on July 29th, 1887. He complained that the sight of the right eye had been failing rapidly the last month, so much so that he was unable to work; he could see better early in the morning than in the evening, usually worse midday, presumably, therefore, worse in bright light. His left eye had never failed, and he could see well with it. He denied any illness, nervous shock, alcoholism, or syphilis; there was no pain, or any other subjective symptom. So far as he knew there was no family predisposition to affection of sight in particular, or disease in general. He always smoked between 3 and 4 ozs. of black tobacco a week.

On examination his vision was found to be—

R. \( \frac{6}{36} \) and J. 16 with difficulty.

L. \( \frac{6}{6} \) and J. 1.

The fields of vision for red and white were uncontracted, but that of the right showed a typical central scotoma for red and green; other colours were not tested.

The discs and maculae were carefully examined, but nothing abnormal was recognised, saving possibly some congestion of the right disc, as compared with the left.
The pupil reacted readily to direct and associated stimuli of light and accommodation.

There was no evidence of kidney mischief, no manifest symptoms of syphilis. Knee-jerks were normal. He was advised to give up smoking entirely, and was ordered liq. strychnia, m iv, thrice daily. I saw him again about two months later, but unfortunately have mislaid the notes taken on that occasion; the impression, however, left on my mind by a careful examination was that he was rapidly recovering. I can state positively from memory that the central scotoma in the right field had disappeared, and that the left eye had remained unaffected.

Being anxious to obtain a final record of the case, I wrote repeatedly to him; he as frequently promised to come, as frequently disappointed me. At last, through the intervention of his employer, who told me that he had been drinking rather heavily of late, I saw him again on December 17th. I then learned from him that his left eye had remained unaffected, and that his right had been very much better, but the last week or two had not been quite so well; this he attributed to heavy night work in bad weather. He admitted he had begun smoking again, but a lighter tobacco, and less of it, but denied drinking more than a glass of beer with his meals; the shakiness of his hands, however, combined with the information I had from his employer, led me to a different conclusion. Vision was then—

R. $\frac{6}{9}$ very imperfectly, and short words of Jaeger 1.

L. $\frac{6}{6}$ Jaeger 1.

Fields of vision for white and red normal. No trace of failure of central colour perception.

II. Case of Central Blind Area occurring in a Smoker.

W. H. Smith, æt. 29, cutler, from Sheffield. The patient came under my notice on May 30th of the past year. He gave me the following account of himself. At Christmas time of 1886, after three days' heavy drinking, he had a "fit," and on going to his employment the next day he found he could not see to do his work. He was under treatment for some time in hospitals
Field of vision on May 30th, 1887. Shows field for white, and inside this a dotted line marks outer limit of field for red. The central dark part represents an area of complete blindness. The scotoma for red extended also over the surrounding shaded area.

Field of vision on June 3rd, 1887. Shows outer limits of fields for white and red. Central shaded area marks out position of colour-scotoma.
Field of vision on May 30th, 1887. Shows outer limits of fields for white and red. Central shaded area represents scotoma for red.

Field of vision on June 3rd, 1887. Still small scotoma for red manifest.
in the north, but his sight continuing to get worse, he made up
his mind to tramp to London, to seek relief there. He appears
to have visited eye hospitals on his journey south. He had
been a very heavy drinker for three years previous to the fit,
when he was in work and had money to spend on it, but from
force of circumstances had been steady since. He had smoked
occasionally before he was 23, but since that age had consumed
regularly not less than 3 ozs. of black tobacco a week. He had
not been warned against it, but of his own accord had given it
up a week or two previously, because he noticed it gave him a
pain across his brows, and made him dizzy and stagger as if drunk.
He saw best in dull light. He denied syphilis. His sight had
been much worse the last few days, when he had been tramping
hard in a state of semi-starvation; his boots and appearance
fully bore out the latter statement. On examination he pre-
sented a gaunt, miserable, debilitated, dissipated appearance;
his manner and answers were straightforward, there was no
evidence of simulation.

His pupils were not dilated nor contracted, and they reacted
to all stimuli. The knee-jerks were active. I have no notes of
his urine, but from their absence I have no doubt that it was
examined with negative results.

His right field of vision was contracted for white and red,
the red not proportionately more so than the white; in the
centre of the field was a large area of complete blindness, sur-
rrounded by a narrow scotoma for red. The field was necessarily
difficult to take, but I can speak positively of its correctness,
for I marked out the blind area over and over again with both
red and white test discs, with practically the same results, the
red disc, whose colour had faded before, disappeared completely
at the same points as the white.

His left field was good at the periphery for white, but was
somewhat contracted for red, and centrally presented a scotoma
for red, but no blind area. (See Charts.)

The ophthalmoscopic examination showed transparent media;
discs very pale, their edges very decidedly blurred; vessels of
normal size, but the arterial walls were very manifest. No
noticeable difference between the two eyes. He could count
fingers held close up to his right eye, and with the left read
Jaeger 20 held close, but no distant types.
He was admitted into the hospital as an in-patient, and placed on a liberal diet. The right eye was strapped up. I have made no notes of medicinal treatment, possibly none was adopted.

June 1. There was great improvement in the right eye, and some in the left, which was, however, still the better eye of the two.

In right field, blind area had disappeared, replaced by smaller colour scotoma.

\[ \begin{align*}
R. &< \frac{6}{60} \text{ words of Jaeger 16.} \\
V. &< \frac{6}{60} \text{ words of Jaeger 16.} \\
L. &< \frac{6}{60} \text{ words of Jaeger 16.}
\end{align*} \]

Both eyes were strapped up.


\[ \begin{align*}
R. &< \frac{6}{60} \text{ words of Jaeger 16.} \\
V. &< \frac{6}{60} \text{ words of Jaeger 16.} \\
L. &< \frac{6}{60} \text{ words of Jaeger 16.}
\end{align*} \]

June 12. His bed was required for an urgent case, and he was discharged on his road to London, where I afterwards learnt he was under treatment as a "tobacco" case, till lost sight of.

On discharge from the Oxford Eye Hospital vision had improved to—

\[ \begin{align*}
R. & \frac{6}{60} \text{ some letters of Jaeger 14.} \\
L. & \frac{6}{60} \text{ some words of Jaeger 14.}
\end{align*} \]

Scotoma still present in both eyes.

In this case I adopted the plan of strapping up the eyes to exclude the light, on the following theory, for which I claim no clinical support,—I have only arrived at it by a process of reasoning and exclusion; a stern critic would doubtless say that I had merely worked out the least common multiple of many possibilities. Admitting
the hypothesis that there exists in the human retina a substance analogous to the visual purple, and that there is produced in it, by the action of light, a chemical change which gives the stimuli conveyed by the nerve fibres to the brain, exciting there visual impressions, I have deduced—

I. That tobacco and perhaps other agents may have a toxic influence on this substance, thereby degenerating it and causing retinal exhaustion, especially in those who are debilitated by any cause, or who may be especially susceptible to its influence.

II. That the exhaustion shows itself in the failure of the more delicate colour sense.

III. That the exhaustion naturally takes place at the point of greatest retinal activity, and where the light is proportionally stronger from the rays being more accurately focussed.

IV. That patients as a rule see better in dull light because there is less retinal exhaustion produced by its action.

In connection with these cases I should like to place on record the fact that I have noticed in patients suffering from tobacco amblyopia, a very peculiar "dry and dusty" smell; it is not that of breath impregnated with tobacco, nor does it seem to me to be merely that of stale tobacco. I cannot describe it accurately, but I have no doubt that most will recognise what I mean. The deduction is obvious, that it is only due to smoke hanging about those who are as a rule heavy consumers of tobacco. At the same time toxic symptoms are not by any means peculiar to the heaviest smokers, and without saying that the smell is peculiar to those only who have toxic symptoms, yet as far as my memory serves me, it is constantly present in all unequivocal "tobacco" cases, and at any rate frequently absent in heavy smokers. It would be interesting to ascertain whether there is any ground for the
suggestion that this smell co-exists with saturation of the system with nicotine, or whether this special connection only exists in my imagination.*

* The odour here described we have often remarked in cases of tobacco amblyopia, and indeed have not infrequently had our first suspicion aroused as to the true nature of the case by its detection.—(Ed.)
ON THE FREQUENCY OF CILIO-RETINAL VESSELS AND OF PULSATING VEINS.

By W. Lang, F.R.C.S. Eng.,
Assistant-Surgeon to the Hospital; and
James W. Barrett, M.D., B.S., F.R.C.S. Eng.,
Demonstrator and Examiner in Physiology to the University of Melbourne.

About 18 months since a discussion took place between the writers on the subject of the frequency of these two conditions, and as we could not agree, we determined to examine the eyes of a number of persons who presented themselves at the Moorfields clinic. We did not select them on any plan but took them indiscriminately.

The Presence of Cilio-Retinal Vessels.

We define a cilio-retinal vessel as one which dips into the nerve near the margin of the optic disc, and which can be seen to arch outwards, that is, away from the disc before it finally disappears from view. Many vessels emerge from the outer part of the disc, but we do not think that they can be justly regarded as cilio-retinal unless this curvature can be seen; where the curvature was not marked we have specified the vessel as a "doubtful cilio-retinal."

The eyes we examined were mostly those of young adults. The pupils were always dilated by our homatropine and cocaine solution in castor oil to permit of thorough examination.

In 37 or 77 per cent. there were no cilio-retinal vessels; in 3 or 6.3 per cent. there were doubtful cilio-retinal vessels, and in only 8 or 16.7 per cent. were they distinctly visible. They were usually on the outer side of the disc and single.
Pulsation of the Veins on the Disc.

At first we examined by the direct method without the previous use of any mydriatic, fearing lest any increase of tension caused by the mydriatic might cause pulsation. To settle this point we examined a few cases both before and after the application of our solution of homatropine and cocaine, and finding that there was no discernible difference with respect to the pulsation, we have since examined all cases after such application has been made.

The eyes examined were those of persons varying in age from 11 to 65, but mostly young adults. The refractive character varied, some being myopic, others hypermetropic and astigmatic.

Of 61 eyes examined: in 45 or 73.8 per cent. pulsation was distinct; in 9 or 14.8 per cent. it was doubtful; and in 7 or 11.4 per cent. it was absent altogether.

As far as our information goes there are no circumstances common to all the individuals in whom pulsation was absent which throw any light on its physiological causation.
The Royal London

Ophthalmic Hospital Reports.


Original Contributions.

CASES ILLUSTRATING QUESTIONS IN DIAGNOSIS AND TREATMENT.

By Jonathan Hutchinson, F.R.S., LL.D.

No. I.—Blow on the Eye causing numerous and long Lacerations of the Choroid. Subsequent Pigmentation of the Retina and Blindness.

The case of Mr. L., of Bradford, is of much interest in illustration of the results of a blow on the eye. It is remarkable also, because the blow was not inflicted by a hard body. When a boy at Christ's Hospital Mr. L. was struck on the right eye by a hollow india-rubber ball which had a hole in it. The effect of this hole was, he says, to allow the ball to collapse, and it is thus possible that it struck him edgewise. The blow gave him great pain, and, so far as he remembers, he was blind almost immediately afterwards. He was seen in the first instance by Mr. Stone, and subsequently by Mr. Power and Sir James Paget.

My examination of the eye was 12 or 15 years after the injury. It was then quite blind and diverged considerably. It was perfectly bright, moved easily, and I never saw a case in which it was more difficult to tell which eye the patient was using. Mr. L. said that this was a constant source of annoyance to him, and that in company, when addressing one person, he frequently

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got a reply from another who was under the impression that he was looking at him.

The pupil was not larger than that of the other eye.

On examination with the ophthalmoscope I found a number of linear scars in the choroid. These were very conspicuous, and some of them very long; and it was remarkable that they almost all of them ran horizontally across the eye and not as usual in curved directions from above downwards.

One of them formed a \( Y \) with an acute angle, and one was so long that I did not succeed in finding either end. Some of them were small. I had only a short examination, as it was made to satisfy my own curiosity, and he had not consulted me about his eye. In addition to these scars in the choroid there were innumerable stellate patches of pigment in the retina. These were irregularly scattered over the whole fundus. They were not attended with any patches of choroidal atrophy, and in many instances they covered retinal vessels. The disc was not much paler than natural, but had a slightly hazy or gelatinous look. The central retinal vessels were not diminished in size, and in many places could be seen crossing the choroidal rents without impediment. It is to be understood that the rents were nowhere wide, but were for the most part mere lines. The media were quite clear, and there were no indications of choroidal disorganisation excepting the scars.

That pigmentation of the retina often follows blows is, I suppose, a well-known fact. I have seen several examples of it, some of them in syphilitic patients, in whom the question as to whether the changes were of a specific nature was very important. If pigmentation in such a case be in an advanced degree, and in one eye only, the history of injury should always be asked for. Sometimes after blows it is very extensive indeed. I have seen the retina in one case almost black from the confluence of stellate pigment accumulations after a blow. Much, no doubt, depends upon the complexion of the patient and the quantity of movable pigment present. Those of dark complexion are the most likely to show this condition. The same explanation applies to pigmented scars in the skin. Their darkness is an indication of temperament rather than of diathesis.

I do not for a moment believe that the pigment spots described above were the remains of blood extravasations, but
rather that they resulted from a very slight form of chronic inflammation, consequent on concussion.

No. II.—On certain cases of Ulceration of the Cornea attended by very severe and paroxysmal Pain, and probably due to Gout.

It is an open question whether there are any cases in which ulceration of the cornea is due to gout. We well know that many forms of iritis and scleritis, cyclitis, &c., occur in that connection, but I do not think that anyone has as yet associated corneal ulceration with that cause. I have not myself met with many cases in which I entertained any suspicion in that direction; but the following is one in which it seems very difficult to avoid it. It is not by any means the only one which I have seen.

Mr. B. B., a gentleman of about 60 years of age, has suffered repeatedly and severely from true gout. He has been laid up for several months at a time with attacks in the great toe and instep. He is a man of robust habit, and although a total abstainer as regards stimulants, is a large consumer of meat and fruit. He enjoys a good appetite and excellent digestion. In the end of January of the present year, whilst staying at Hasting, Mr. B. had an attack of inflammation of his right eye. It was attended by considerable pain, and he was told that there was an ulcer, but it soon got well. I did not see him during this illness. About a month later his left eye was attacked, and much more severely, and for this he came up to London and was under my care. There was marginal ulceration of the cornea at its upper border, and extending over at least a third of its circumference. There was great congestion of the conjunctiva and sclerotic, and some slight haze of the cornea beneath the ulcer. The ulcer looked very threatening, and, occurring in a man of 60, I was quite prepared to see it spread and produce disorganisation. The pain was, however, beyond anything which the state of the ulcer would have led me to expect, and there was the peculiar feature about it, suggestive of gout, that it was always much worse at night. On some occasions it was entirely absent in the daytime, and would then keep him awake the whole night; disappearing completely.
in the morning. Mr. B. had had great experience of gout pains, and he said that the pain in his eye was exactly like what he was familiar with when he had gout in his toe. I prescribed for his attack on this hypothesis, putting him on low diet without any meat, and giving him alkalies, colchicum, and aconite. It may be briefly stated that under these measures the liability to pain entirely ceased and the eye was soon well. It is more than a year since the case was under care, and there has been no return of the disease.

No. III.—On the paramount importance of Change of Climate in the Treatment of Cases of Inflammation of the Eyes from Inherited Gout.

In the investigation of all forms of gout a clear distinction must be drawn between an inherited and an acquired tendency. In no department of the subject is this rule more important in its bearings than in respect of diseases of the eye. The forms of disease due to inheritance are wholly different from those which we see in the acquired disease, and, above all, they require a different treatment. They occur also for the most part at early periods of life, when acquired gout is rarely seen, and they very often show themselves in young females. In making these remarks, I by no means forget that there are but few cases of acquisition of gout in which there is not inheritance also. On the other hand, there are plenty where the inheritance is the sole cause of the disease, and in which the patient's personal life has not in the least conduced to it. In these latter the treatment by abstinence, alkalies, and colchicum would be most inappropriate.

I was recently asked in consultation in an obscure case of keratitis, in which the diagnosis lay between inherited gout and inherited syphilis, whether its establishment would make any difference in treatment. My friend suggested that in either case, as there was obvious inflammation, small doses of mercury and iodides with tonics would be the proper measures. Without controverting this proposition in its general bearing, I was yet inclined to attach great importance to another wholly different measure if the diagnosis of gout were made out. In all cases of inherited gout affecting the eye, whether serous iritis, cyclitis, relapsing iritis, sclerotitis, or any other special
pathological condition, the most efficient of all measures as regards cure is, I believe, a complete change of climate. It may be inferred from the mere fact of the initiation of the disease, that the place where the patient has been living has not wholly suited, and that a change is desirable. Any change to a drier or more elevated position is good, but if possible it should be out of England. The English climate with its cold and damp is very unfavourable in gout and rheumatism, and especially in those states of constitution which favour manifestations of it due to inherited peculiarity of tissues. I have published several cases in which those who were liable to that peculiar form of insidious iritis with vitreous opacities which I have ventured to associate with gout, have been quite cured by being sent abroad. I have seen several others in which the disease has persisted in spite of all other treatment in those who could not leave home.

I have recently had under care a young married lady of fragile development who inherited gout on both sides. She was the subject of iritis with corneal ulcers and some cyclitis in both eyes. The disease had alternated from one eye to the other, and for two years she had never been quite free. She had had much treatment under well skilled advice, and with only partial results. My advice that she should try a voyage to the Antipodes was resisted by a medical relation of hers, on the plea that she ought not to leave her surgeons as the eyes were still badly inflamed. I replied that this was precisely the reason why I wished her to go. She went, and the result was that she returned in a year with her eyes quite well, and having gained greatly in general health. The improvement began when she got into the tropics, but was only slow during a stay in Australia, where it was very hot. She did not get quite well until she reached Dunedin, New Zealand. The air of the latter place she described as suiting her case exactly, and there she wholly lost all remains of irritability in the eyes.

No. IV.—A Case of Double Optic Neuritis in possible connection with Gout. Important facts as to Prognosis.

A very interesting case of double, but unsymmetrical optic neuritis, in which there was a strong family history of gout, and no other cause discoverable, was brought to me by Dr.
Maurice of Marlboro'. On the first occasion I saw the patient in consultation with Dr. Hughlings Jackson also. This was in 1883. Dr. Jackson had carefully investigated the case in reference to any other cerebral symptoms, and could find none. When I saw the patient for a second time, more than two years later, they were still quite absent. The details of the case are the following:—Mr. H. F. M, æt. 18, is a strong, muscular young man, who has never suffered from any special illness. He has a large head, with rather heavy aspect, but never suffers from headaches, and never had convulsions. He sleeps well, and is said to be good-tempered. He is the seventh child in a family of eight, and all his brothers and sisters are healthy. He was brought up as a water drinker, but has recently taken beer. There is gout on both sides of his family. His paternal grandfather suffered very severely from it, and his mother has herself had some mild attacks. His eyesight had been failing for some months before I saw him; with his left he could only with difficulty read No. 12, but with the right he could make out 3 and 2/9.

It was very difficult to be exact as to dates. He thought that his left eye had never been so strong as the right, but he felt certain that he could formerly see much better with it than now. His left disc was uniformly white, its edges well defined, and perfectly clean. The central vessels were of good size. The disc of the right eye was pale, and especially so towards the yellow spot. There were no evidences of recent inflammation. The only subjective symptom which I could get him to admit as having been present during the failure of his sight, was a feeling "as if his eyes were being poked in."

The above notes were taken in April, 1883. I saw him again with Dr. Maurice on August 31, 1885. His right eye had considerably improved, and he could now see 2/9 and read No. 1. The left, however, had deteriorated, and he could barely count fingers. Both discs were uniformly pale, with perfectly clean edges, and central vessels of normal size. The left was much the whiter of the two. He was now 20 years of age, and Dr. Maurice confirmed his statement as to his having enjoyed excellent health since our last consultation.

No special treatment had been adopted, as we had been inclined to regard the symptoms as those of past disease. He had rested absolutely, and had done very little reading.
He said that he could read the newspaper through without its causing either eye-ache or head-ache. At this visit I learnt that one of his sisters had recently become the subject of phthisis, and further that one of his grandfathers had been epileptic. The changes which had taken place in vision between the two consultations made it certain that the morbid processes were not wholly at rest at the date of the first, and consequently that the conditions had not been present from childhood, as on the first occasion we had been half inclined to suspect. It is to be clearly admitted that the young man had never himself shown any symptoms of gout. If, however, we put aside the suggestion that his optic neuritis was of gouty origin, we have to admit that we are quite unable to suggest any cause for it, and further, that from first to last the case was wholly unattended by the more usual concomitants of that disease as met with in association with tumours and other intracranial lesion.

No. V.—A Case of Optic Neuritis in a Young Man without Obvious Cause. Details of the condition eleven years afterwards.

The case of a young man named Henry Falshaw was in some respects parallel to the one just mentioned. This man was under my care at the Ophthalmic Hospital about 10 years ago, when he came up from Sheffield on account of failure of sight. I did not see him again until recently, September 1st, 1885. During this long interval he had remained quite free from other symptoms of nerve disorder. His sight had got a little worse, but it still enabled him to go about, and with effort he could read large print. During the whole of the eleven years he said he had never been able to read a newspaper for pleasure, but by effort he could puzzle out a few lines. He had gained his living as "boots" at an hotel, next as ship's steward, and lastly as a warehouse porter. From each of these occupations he had been driven by his defective sight, yet he had not suffered from headache or any other ailment, and asserted that he was as capable of work as ever if he could only see. It did not appear that there had been any sudden increase in the defect, indeed it was by no means certain that he was much worse than was his state 11 years ago. I have not as yet been able to find my first notes of his case, but he assures me
that we took great interest in it. The conditions now present (1885) are: white atrophy of both discs without diminution of central vessels; one eye (the left) being much worse than the other. There is no history of true gout in his family, but his mother suffers from rheumatic gout.

When, as already stated in September, 1885, Henry Falshaw called on me, it was in the hope of assistance in getting some employment. He told me that since his attendance at Moorfields he had not had any illness with the exception of an attack of fever abroad. His sight had, however, become he thought somewhat worse. He appeared to be in excellent health, and said that he never suffered from headache, or any other symptom of nerve disturbance. I found both discs as white as paper, quite clean, and with central vessels of good size. The left was the most advanced in atrophy. With the left he could just see letters of 100 at 12"; with the right he could puzzle out words of large pica. He thought that he had got a little worse of late, but this did not appear very certain, for he admitted that he had never read a newspaper during the 11 years, and he could still by effort have managed to do so slowly.

He said that he was not ill in any way when his eyes first failed, and he believed that I was, when he was with me before, inclined to attribute his symptoms to smoking, but he added that I then told him that it was a very exceptional case.


The case of Mr. G. is of sufficient interest to lead me to mention it, although it is impossible to feel quite certain as to the diagnosis.

His father suffered severely from gout, and he himself, although only 27, has had several definite attacks. There is also no doubt that his eye has recently (that is some years after the attack of inflammation which destroyed it) been liable to irritability and congestion in association with gout tendencies.

Mr. G. is at present blind in his right eye to the extent that he can only just count the bars of a window. With his back turned to the light he cannot count fingers, indeed he can barely
distinguish the hand. The history is that the eye began to fail when he was 14 years of age, and passed into its present condition in the course of two or three years.

It has suffered from a choroido-neuro-retinitis which has left the retina pigmented in delicate irregular streaks, dots, and patches, whilst the choroid is diffusely thinned and somewhat patched, and the margins of the disc ill-defined. The conditions approach somewhat to those of retinitis pigmentosa, but are on a much coarser pattern. There are a few small opacities in the vitreous, and a few delicate striae in the periphery of the lens. The other eye is myopic but not otherwise diseased.

The state of the eye is exactly like that in a man named John W., in whom there was no doubt that syphilis was the cause. Mr. G. admits that he had some gonorrhoea in boyhood, and it is therefore possible that he had syphilis. His date of setat 14, when the eye began to fail, may perhaps be a mistake. I incline on the whole to think it probable that his choroido-retinitis was syphilitic rather than gouty. The recent attacks of congestion have been, however, probably gouty. He has just had an acute and very painful inflammation of one finger, no doubt gouty.

The two cases (John W. and Mr. G.) are of much interest as instances of the loss of one eye by choroido-retinitis, the other remaining quite free, and the patient continuing for many years without any relapse of syphilitic symptoms.

I may just add that Mr. G. came to me on account of an attack of acute congestion of the lost eye, and that he suffered a few days later from severe pain in one of his finger joints. I have not the least doubt that these ailments were of gouty nature. The important question is as to whether gout ever causes choroiditis. On this point further observation is needed.
A CASE OF INTRA-ORBITAL HÆMORRHAGE AND OTHER EYE COMPLICATIONS IN CONNECTION WITH HÆMOPHILIA.

By Priestley Smith,

Ophthalmic Surgeon to the Queen's Hospital, Birmingham.

Hæmophilia is so rarely met with as a cause of difficulty or danger in ophthalmic practice, that it seems well to put on record the following case, in which, after a slight accident and a trivial operation, the life of the patient was for some days in considerable danger. For the notes of the case, and for unremitting care of the patient during the critical period, I am indebted to Mr. J. F. Blurton, M.B., my house surgeon.

F. K., a boy aged 17, a tube-drawer, came to the hospital on May 29th, 1888. Four days previously, while at work, he had been struck by a piece of brass tube just above the middle of the left eyebrow. The boy looked ill, and was suffering much pain. The left eyeball was pushed considerably forwards; the eyelids were swollen, tense, and slightly discoloured; the conjunctiva was injected and chemosed. The margin of the lower lid was stretched very tightly across the globe and slightly inverted, so that the lashes were in contact with the cornea, and at the line of pressure the cornea was ulcerated and infiltrating in a manner which threatened destruction unless the pressure were speedily relieved. Vision, so far as it could be tested, appeared to be reduced to perception of light. The fellow eye was sound. The case was regarded as one of free hæmorrhage into the orbit caused by the blow on the brow. The boy was admitted to the wards.

To relieve the pressure on the cornea the external canthus was freely divided with scissors and the conjunctiva scarified; the inversion of the lower lid was corrected with strapping and collodion; ice compresses were applied. On the following day slight bleeding occurred from the wound, but was readily stopped by pressure. During the next two days it recurred
several times and was less readily stopped; meanwhile the proptosis and swelling of the lids diminished and the condition of the cornea improved.

On June 3rd a careful examination of the boy was made in consultation with Mr. Jordan Lloyd, and he was found to be the subject of well-marked haemophilia. There were many bruises on arms and legs, and swellings in both knees. Ergot and iron in a mixture and a free supply of green vegetables were ordered.

During the next twelve days the haemorrhage recurred from two to five and even six times during every 24 hours. The patient became weak and much blanched; the pulse rate increased. The temperature was normal throughout. There was no blood in urine or faeces. Various means were employed to check the haemorrhage. Before the haemophilia was diagnosed the divided canthus was closed with two hare-lip pins and figure-of-eight sutures; this stopped the bleeding for about 24 hours, but the recurrence seemed worse than before. Later were used pressure with dry lint, with lint saturated with perchloride of iron solution, with Ruspini's styptic and colloidion, with cocaine solution, solid perchloride of iron, tannin, iced water, hot water. The cocaine and the hot water appeared to have more influence over the haemorrhage than any other applications. Internally he took in succession ergot and iron, hamamelis and dilute sulphuric acid, sulphate of magnesia, sulphuric acid, and arsenic. His diet consisted of a full allowance of meat and green vegetables, milk, and a minimum of other fluids.

On June 14th, 15 days after the operation, the haemorrhage finally stopped, and the wound began to granulate well with slight suppuration. The patient rallied quickly from his extremely anaemic condition, and was discharged 10 days later with the cornea healed and vision almost completely restored. We learned afterwards that he had frequently suffered from obstinate epistaxis, and that if he cut his finger he found great difficulty in stopping the bleeding. No history of haemophilia in the family could be obtained.
ON THE PROGNOSIS IN CHRONIC GLAUCOMA.

(Three Clinical Lectures delivered at the Hospital in June, 1888.)

By E. Nettleship.

Lecture I.

GENTLEMEN,

There is, as you are aware, considerable difference of opinion as to the best treatment for chronic glaucoma, when to operate, and if we do operate what operation to perform; and as to the results. It is to these points and to facts that lead up to them that I wish to ask your chief attention.

One obstacle to the formation of a trustworthy decision on any of the clinical features of this formidable disease is found in the long duration of some cases even if they be left entirely untreated; another in the doubt which occasionally surrounds the diagnosis of the disease in its earlier stages; another in the optical inconvenience which a large iridectomy often occasions when performed on an eye with good acuteness of sight;* another in the common belief that if iridectomy be done when the field is already very much contracted, the operation is apt to be quickly followed by a further loss of visual area, actual harm thereby resulting from the interference. Differences in the size and situation of the wound may also account for some of the varying results.

* Yet even as to this there are the widest differences; some persons—often persons on the fanciful side—are intolerably worried by the "rays" and "streamers" to which the coloboma often gives rise when isolated flames are looked at. On the other hand I have notes of two men in whom large iridectomies had been made downwards and outwards merely for the premonitory symptoms of glaucoma; nine years after operation, one of them, then 56, had \( \frac{6}{6} \) with the operated eye; and fifteen years after operation the other, then 44, also had \( \frac{6}{6} \). Both were somewhat hypermetropic, but there was no measurable astigmatism in either of them.
In trying to come to any conclusion on this difficult and complex subject, it is of the first importance to have clear ideas about the natural history of the disease. I should like therefore to draw your attention first to some facts which should engender caution in drawing conclusions as to the effects of treatment in chronic glaucoma.

In most cases of chronic glaucoma, whether the developed disease have been preceded by a recognised premonitory stage or no, the changes and the symptoms progress steadily to total blindness in a time which is sometimes measured by months, but is more often perhaps a couple of years, less or more; in a great many cases the second eye suffers before very long; and when the stage of blindness has been reached the eyes usually remain quiet. It is also common knowledge that several of the factors in the glaucomatous process may vary much in relation to each other. I allude especially to the degree of tension, which in the quietest forms is sometimes never perceptibly increased, to the state of the pupil and anterior chamber, which may be almost, if not quite, natural; and to the changes at the optic nerve, where the depth of the excavation bears no constant relation either to the atrophic pallor of the disc or to the degree of tension of the eye. Many of these remarks are equally true of the acute forms of glaucoma.

One of the most important exceptions to these statements is found in the very wide range in the duration of different cases of chronic glaucoma when allowed to run their course; and another in the occasional occurrence of appearances at the disc very suggestive of glaucoma though without any symptoms or results of the disease. The latter observation shows the importance of any facts which tend to prove that chronic glaucoma begins, or may begin, rather in the optic nerve than in the ciliary region.*

* Brailey and Stilling have both adduced pathologico-anatomical evidence pointing in this direction.
I am convinced that chronic glaucoma is tolerably often much slower in its progress than we commonly think.* The most chronic case I have ever seen was that of—

Case 1.—Captain L. (P. 8, 103). This gentleman was told when he was about 25, by a high authority, that he had glaucoma in his right eye and would soon lose it unless he were operated on. This was about 1865, and the diagnosis was without doubt made after an ophthalmoscopic examination. He did not submit to operation. About five years later the same opinion was given again, and again he declined interference as he thought the eye was not getting worse. It was not until he was 45 that he took further advice, from myself (April, 1883), because this eye had lately become foggy, had seen halos around lights, and become subject to a sort of "dead pain." I found all the signs of well-marked chronic glaucoma, T. decidedly increased, anterior ciliary arteries enlarged and tortuous, disc rather gray and moderately cupped all over, the arteries showing marked spontaneous pulsation, pupil a little larger than the other, the eye M., 2·5 D., and sees when corrected $\frac{6}{9}$. F. moderately contracted all round, somewhat more so in the lower-inner quadrant. I again advised iridectomy, which he again deferred, preferring to use eserine. From this time the eye steadily failed, but did not become blind for another 3½ years, that is, till he was about 49. Almost as soon as the eye was blind it became gradually congested and increasingly painful, not at all an ordinary conclusion of chronic glaucoma, and it was excised in Edinburgh, much inflamed and very painful, in December, 1886, about 22 years after the first diagnosis had been given. The other remained perfect throughout with $-2·5$ s. and $-2·5$ c., seeing $\frac{6}{6}$ as lately as February, 1887. This case is remarkable, not only for its extreme length but for the final onset of congestive symptoms and pain, the escape, apparently permanent, of the second eye, and the coincidence of myopia which the patient said had been present

* Some very chronic cases are mentioned in Vol. V of the German Handbook.
since he was quite a young man, if not earlier; still I see no reason for regarding the case as other than uncomplicated glaucoma simplex.

**Case 2.**—Another very slow case is that of Miss M. (P. 5, 175), which will be referred to again under malignant glaucoma. Miss M., at the age of 43, was nearly blind of very chronic glaucoma, which from the account she gave of previous opinions seemed to have begun as long as nine years before.

**Case 3.**—Mr. R. (P. 4, 88) was told that he had a "glaucomatous tendency" in L. when he was 70. At 76 he still saw $\frac{6}{18}$ though F. was contracted, T. +1, and the disc cupped and gray. His other eye had been nearly blind from the same cause since he was 60.

With such cases as these before us we cannot but be very cautious in inferring that a person whose discs show changes resembling those of glaucoma is really safe, however free he may be from the symptoms or other signs, of the disease. Of eyes showing such disc-changes I have seen several examples, usually in elderly persons, thus:

**Case 4.**—Mrs. McR., 48 (P. 5, 118), showed in 1881 "both discs very suspiciously cupped, the R. especially so, ps. rather large;" and in 1885 "very suspicious looking cups, steep and almost up to the scleral edge. V. as before $\frac{6}{18}$, Hm. 0·75 D., T. quite n."

**Case 5.**—Mr. B. (P. 9, 57) has considerable M. In 1884 (wt. 57) complained that he could not read music quite so well as hitherto; V. corrected $= \frac{6}{18}$; no decided symptoms of glaucoma, but as o.d.s. were cupped and pale and T. slightly increased, I feared chronic glaucoma. However, four years later (1888) I heard that his sight was still quite good.

That such suspicious appearances may precede the outbreak of rapid glaucoma is proved by—
Case 6.—Mrs. G., æt. 40 (P. 6, 183), whose R. in September, 1887, showed a central, large, very steep "physiological" cup (quite different from that in the L.). The eye was attacked by subacute glaucoma three months later.

Then we see instances of real glaucoma in one eye with a very deep, or large, normal depression in the other, as in—

Case 7.—Dr. —— (P. 12, 75) has had one eye excised for absolute simple glaucoma with retinal hæmorrhages and pain. For at least 2½ years past the other eye has presented a pale disc cupped all over to the depth of about 1 mm., yet V. has remained $\frac{6}{6}$ F. of quite full size, and T. n. There were some hæmorrhages in this eye also for a time, but they became absorbed.

Case 8.—Edward S. (M. 1883, No. 1838) had subacute glaucoma of R. in 1883 cured by iridectomy; in August, 1885, the disc was noted as showing a large physiological cup, but with a good width of nerve substance at inner half; the whole disc too pale. The L. at same time with V. $\frac{6}{6}$ showed a deep physiological cup.

Case 9.—Mr. G. (P. 16, 8), æt. 50, has glaucoma simplex in L. with contraction of F., but in R. perfect F. and no symptoms. The discs, however, are much alike, showing a large deep cup on the y.s. side, leaving a broad belt of nerve substance on the nasal side.

Case 10.—John S., æt. 51 (T. 1879, No. 65), August, 1879, L. advanced chronic glaucoma. R. no glaucoma, V. $\frac{6}{9}$ with $-0.75$ D., but "physiological cup large, circular, and very deep." May, 1882, "L. now quite blind. R. as before, and o.d. still showing a very steep, deep, circular cup, but nerve substance of good colour."

In these and other cases of the same kind it is quite likely that glaucomatous disease is beginning in the optic
nerve, and that the malady will after a time show itself by the customary symptoms.

Glaucoma is sometimes markedly hereditary. See Cases 21 and 22 in father and daughter, &c., and Cases 26 and 27 in father and son. This liability to descend in successive generations has often been noted, and as opportunities occur observations should be made on the state of the discs in the children of glaucomatous patients.

The occasional extreme chronicity of glaucoma precludes us as yet from saying with certainty whether the disease ever really stops short of blindness. Such arrest of progress, however, seems now and then to occur in the acute forms, as in the following cases:

Case 11.—Richard B. (P. 2, 6), who had always been short-sighted, had an attack of redness of the eyes and fogginess of sight when he was 24. The sight got worse for about seven months, and then remained stationary. I saw him in 1873 when he was 26, with high M. (degree not measured), T. nearly n. V. 16 J. Discs atrophied and decidedly cupped. He wrote 2½ years later that his sight was no worse. This would seem to have been a subacute inflammatory attack coming to a natural ending. The existence of M. is to be carefully noted.

Case 12.—Miss M. (P. 3, 94) when 49 (May, 1878) had "bad inflammation" in R. with severe pain in the head; the attack was acute; there was no sticky discharge. She considered that the sight was somewhat damaged by the attack. I saw her a year later and several times afterwards. V. of R. was always very nearly as good as L., partly, but the disc, carefully examined more than once, was quite different from L., being somewhat grey, and decidedly cupped up to the edge nearly if not quite all round. The L. disc was quite natural. I saw her as recently as November, 1886, when the eyes were unchanged.

Case 13.—Miss S. (P. 8, 16). In 1883 (æt. 49) R. had slight +T., o. d. of fair colour but well cupped all over, V. with VOL. XII.
a weak — lens $= \frac{6}{6}$, and F. of full size. T. remained a little +

for more than a year, but as lately as May, 1887, it was noted as n., and F. still full; indeed but for the cupped disc the idea of glaucoma could not have occurred during the last two or three years. The other disc has all along shown a large though shelving cup.

Case 32 may also be referred to here.

Later, in speaking of the curative effect of operation in chronic glaucoma, we shall have to control our conclusions by asking whether the operated eyes would have behaved differently had no treatment been employed?; and this enquiry may conveniently be answered here in connection with the natural history of the disease. Now, on examining some 25 cases of far advanced double chronic glaucoma in which no operation had been performed, I find that in almost all of them the character of the disease had been throughout exactly alike in the two eyes, and that in 10 of them it began practically at the same time in the two eyes, whilst in the remaining 15 there was an interval. Hence it seems fair to infer that where one eye has been operated on and the other not, a permanent or prolonged arrest of downward progress in the operated eye is attributable to the operation; and the same reasoning will apply when both eyes have undergone operation.

We may here mention some other points in the natural course of the disease.

Though the type is usually as just stated the same in the two eyes, a few exceptions occur. Thus C. (T. 1883, No. 52) had quiet glaucoma in the right in 1877, and an acute attack in the left in 1883. Mrs. B. (T. 1881, No. 35) lost her left from chronic glaucoma, and about two years later had the acute disease in the right.

Another important point is as to symmetry. This is not easy to settle, since our decision must depend upon how long a time we allow for the manifestation of disease in the second eye. We may ask first, what is the probability
that the second eye will escape? Of 66 cases of chronic uncomplicated glaucoma, I find that the second eye was free from disease in 31. In 26, or all but 5 of these, at least a year was known to have elapsed since the disease in the first eye; and in no less than 13 of these 26, five years or more (5—10 years) had elapsed without the second eye being attacked. It might be supposed that there was very little probability of the second eye suffering after so long a period as five years, yet, as we shall presently see, this is by no means the case, and we therefore cannot say that any specified interval insures to the second eye complete immunity from risk.

If we inquire next what is the probability that the second eye will suffer? we find that in 35 of the 66 available cases both eyes are known to have been attacked, and as this of course represents less than the truth, we shall probably be safe in saying that in something like two-thirds the disease is, sooner or later, symmetrical. Of the 35 cases known to be double, the second eye was attacked within a year of the first in 13, or about one-third. Of the remaining 22, the interval between the two eyes varied between one year and four years in 15, and between five years and ten years or more in 7; in only 2, however, was it more than six years, namely, nine years in 1, and ten years or more in 1. So far as these numbers go, they show that if the second eye escapes for one year (22 cases), there is about one chance in three that it will escape for five years or more (7 cases); so that if in an old or feeble person one eye is still free from chronic glaucoma a year or two after the other eye has become affected, we may sometimes hesitate to operate on the affected eye, since there is a fair probability that the unaffected eye may continue free during the patient's lifetime. It may be observed incidentally here that in acute glaucoma the interval between the two eyes is usually short, and that a very long interval is exceedingly uncommon. I have only one case of acute glaucoma with an interval as long as nine years between
the two eyes, against five chronic cases with this interval; and four of acute glaucoma with an interval of six years or more against about 16 chronic cases.* It is probable, therefore, that the more chronic the disease in the first eye the longer the second eye is likely to escape.

*The Treatment of Chronic Glaucoma.*

I do not think that eserine, except very rarely, can stop the progress of chronic glaucoma. It is, however, a valuable means of lessening the frequency and severity of the threatenings which often for a long time precede the establishment of the permanent disease, and thus it certainly helps to keep the disease at bay for a time. It also undoubtedly checks recurrent threatenings and fluctuations after operation. The following are good instances of the failure of eserine in chronic glaucoma:—

Case 14.—Caroline A. (M. 1885, No. 566) came in August, 1883, at the age of 47, with R. already much damaged by simple glaucoma with slight attacks of pain. It had been in progress at least four months, probably more, but had not been noticed at first as the other eye was perfect. When first seen, R. showed T. + 2, F. much contracted in the typical manner (see Fig. 1), o. d. deeply cupped, and V. (corrected for

![Fig. 1.](image)

*The actual relative frequency of the chronic and acute (including sub-acute) forms is about as 45 chronic to 50 acute and subacute (deduced from Priestley Smith's paper in Ophth. Soc. Transactions, vol. vi, p. 294, Table I).*
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H. 4·5 D) 6/24, but still liable to variations and improved by eserine to 6/18. Eserine (about 0·25 per cent.) was used regularly thrice daily for the next 18 months (till February, 1885), when as it was causing conjunctivitis it had to be discontinued. By this time, F. had become smaller, V. worse, and T. was still +. Iridectomy performed in April, 1885, had no decided effect.

Case 15.—Mr. B. (P. 8, 178), at the age of 37 had nearly lost his R. by chronic glaucoma, which had been established for at least a year, after several years of threatening; T. was now + 2, V. = 20 J. barely, o. d. very pale and cupped.

The L. was now (June, 1883), threatened; variations of V., slight increase of T., and a large, palish, shelving cup, but a. c. and p. were quite n., F. full size, and V. (with his mixed As. corrected) = 6/9. He was a very punctilious patient, and used weak eserine quite regularly twice daily. At the end of six months' treatment there was no change, but after 14 months (end of July, 1884), V. had sunk to 6/24, and F. was contracting on nasal side (Fig. 2). Upward sclerotomy was done on August 1st, and eserine continued about once a day; V. improved to 6/18 soon after operation, and (subject to frequent temporary variations), remained stationary for 18 months when (in March, 1886), variations became worse and more frequent,
V. was barely $\frac{6}{18}$ and F. rather more contracted. A large iridectomy downwards with the result that far (July, 1888, or 2$\frac{1}{4}$ years) held his ground, $\frac{6}{18}$ with the proper lens; he has, however, still use of eserine necessary, and in fact has hardly used it since I first saw him five years ago. He has eserine to the other nearly blind eye, and with account or no, a little sight (letters of 20 J.) was late as three years after he first came to me (I in the latest examination).

Mr. B’s. case is very instructive in some other respects. He is very susceptible to the quality of his keeping or exposure, it always irritated the eye, not use it. I always prescribed for him the sare seemed not to have any better keeping power sulphate.

His sight has, throughout, been subject to variations, and I think that two factors, muscular and be recognised.

He is a small, thin, physically feeble man disposition, but very excitable and fidgety, entirely in examining carefully the texture of woollen broad-cloth. He said that before and done, he could sometimes see his work quite with glasses (in spite of 4 D. of mixed As. chiefly H.) times he could not do at all without them—accommodative asthenopia—the muscular factor.

Most of his variations, however, seemed directly upon variations in the blood supply the and ciliary muscle) than upon mere fatigue of and his case furnishes one illustration among
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the digestive organs. He is always very emphatic about the effects of weather and temperature on his eyes; in cold weather he always feels well, his eyes are less liable to mist, and he uses eserine only about once a day; in hot weather his eyes do not work so well, and he has to use eserine two or three times a day. And whilst "remaining in a decidedly warm room for some time" always has a bad effect on his sight. It must be added that cutaneous circulation is easily influenced, and that, even in cases of agitation or exertion, he sweats most profusely. Thus, whenever that dilates the capillaries of his skin or digestive tract, and his sight by interfering with the ocular blood supply, there is a disadvantage under which the arteria centralis retinae labours is increased by a somewhat augmented intra-ocular tension, and perhaps by a diminished elasticity of the arterial coats.

A case illustrating the combined influence of intra-ocular tension and defective arterial supply due to circulatory insufficiency, the whole resulting in extreme shrinkage, obliteration of retinal arteries and obliteration with stasis of the peripheral retinal veins, is given (with an excellent illustration) in the 4th volume of the Ophthalmological Society's Transactions, p. 111.

Lecture 2.

We now pass to the results of operative treatment—Iridectomy and Sclerotomy—in chronic glaucoma.

One cannot usefully employ the strictly scientific method in this inquiry, because the disease is not so uncommon as to supply a large material to a single investigator, whilst the subject is, in this aspect of it, too complex.
we speak of generally as cases of chronic glaucoma are not all alike. We must, if we wish to be fairly precise, take notice of, and, indeed, if anything, accentuate the varieties.

We have, first, simple glaucoma, which runs its steady course to blindness without variations, fogs, rainbows, or pain. Some of these cases are, as we have seen and shall see, very slow indeed, whilst others are comparatively rapid. If only one eye be affected, the disease may, of course, very easily be overlooked by the patient; and this may occur when both eyes are attacked if, as is sometimes the case, in spite of considerable loss of visual area the central acuteness of sight continues good.


Case 17.—Mr. B., æt. 73 (P. 4, 119). L. went blind painlessly about 10 years ago, now T. +2, and the other signs of old glaucoma. R., failure recognised only about three months; no variations, no pain, no rainbows; different opinions have been given; now (June, 1880) T. +1, a. c. n. $\frac{12}{30}$ with +1·5 D., o. d. gray and distinctly cupped all over, f. shows qualitative defect in nasal part.

Case 18.—Miss R., æt. 37 (P. 9, 209), July, 1884, failure of L. recognised 3 or 4 years; R. considered to be perfect. Now, R., T. ? +, V. $\frac{6}{6}$, f. slightly contracted all round, o. d. pale, with well-marked glaucoma cup, p. n. L. T. ? +, V. $\frac{6}{6}$, yet f. contracted to within 5° of the centre in the lower, inner, and upper gradients, elsewhere 10—40° (Fig. 3), o. d. paler than R., with well-marked cup, p. n. Patient has advanced
aortic dilatation, and has had rheumatic fever twice. In July, a satisfactory sclerotomy was performed in each. In June, 1887, three years later, each eye was in the same state as on admission, seeing $\frac{6}{6}$ partly; f. in L. practically unaltered (Fig. 4), but in R. seemed to have become a little smaller at the nasal side.

The result of operation in this lady’s left eye shows that glaucoma can sometimes be arrested with apparent finality by operation, even when the field is encroached upon almost up to the centre; and, as we shall see, the case does not stand alone in this respect.

**Case 19.**—Mr. A., æt. 50 (P. 13, 198). A keen sportsman, had found for a year or two, perhaps more, that he was not shooting as well with the rifle as formerly, but he did not suspect till shortly before I saw him that this was due to a defect in the right eye, though on afterwards thinking it over he had little doubt that that was the true explanation. He never recognised any variations or fogginess, but simply found that on looking straight forward he could not see either print or distant objects so sharply as heretofore. When seen (November, 1886) R. showed T. + $\frac{1}{2}$, V. $\frac{6}{12}$, f. contracted at nasal side to 15° from centre, o. d. pale and cupped in the first degree, no pulsation, p. of same size as L. and acting well, a. c. rather shallow. L. V. $\frac{6}{6}$, normal in every way. R., large
iridectomy up; T. remained slightly more than considerable time. July, 1887, R. with -4 D. c., and f. perhaps a little smaller at nasal side. May, 1887, R. unchanged, T. now quite n. L. n., as before.

Cases of the class just illustrated are generally to be particularly unfavourable for operation, the two just related, I have one—James (T. 1885, No. 239)—in which the eye has held two years since operation, and another, Mary, operated on at a late stage (T. 1885, No. 172). 2½ years have passed since sclerotomy with falling lower, though some further loss of field at the last examination, and Cases 22 and 23 success.

We have next the commoner cases, in which of sight caused by attacks of fogginess form a conspicuous feature; and there neuralgic pain in the eye, or in the corresponding forehead, or side of the nose. Congestive inflammatory attacks, also occur in some patients, fact, this sub-group merges imperceptibly into genuine acute glaucoma. The note, however, the whole group is a tendency to intermissions, are relatively common; Case 15, already given, exaggerated instance, the following is better.

Case 20.—Elizabeth P. (T. 1881, No. 25.) had a foggy attack lasting some days, after an attack of 48, having been for a time, and
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centre. Though T. was much and immediately relieved by eserine, the symptoms repeatedly returned, and three weeks later, Jan. 31, a large, double upward iridectomy was done. The fs. a fortnight later were recorded as a little more at the upper inner quadrant than before—R. to about 3° from centre; this observation, however, was repeated. The o. ds., of which there is no note were somewhat pale; R. somewhat cupped, L. not cupped. July, 1835, 4½ years after operation, V. of each \( \frac{6}{12} \) without +1 D., very little As. Oph. o. ds. very pale, edges ragged, coats of veins rather thick and white, without any, cupping.

Case 21.—John R., 72. (T. 1878, p. 59.) A well-educated man. Said his sight had been definitely failing about eight months so that for a year before his sight had often become very indistinct in short time if he got excited by reading anything etc. Both eyes were alike. He had always been "short sighted" (refraction not noted). When admitted, June, 1887, barely +1 in each, V. words of 14 Jaeger slowly, o. ds. slipper excavation, fs. contracted to from 3—10° in the up-out and up-out quadrants, down-out nearly full size but scotoma in centre of the best part, 40° from fixation. Iridectomy was done on R., and six weeks later having remained stationary and L. become worse over time. He lived nine years after operation, and could the last to read large print, sight remaining just as in time of the operations.

Case 22.—Mrs. B. (daughter of the last case), whose L. has always been very defective and was as a consequence, was admitted last year to continue her education. She was admitted Feb. 15, 1887, V. of both \( \frac{6}{12} \) with +1 D. vision still rather indistinct, and with difficulty in seeing in dark.
like excavation with a narrow zone of nerve-substance and a line of atrophied choroid all round. In Dec., 1884, 6½ years, I heard that the eye was worse, but did not see her. Oct., 1885, 7½ years, she came again, saying that a sort of curtain had gradually been coming over the sight of R. from above for some time past; with +3 D. the eye saw \( \frac{6}{18} \); the upper part of f. was lost almost up to centre (Fig. 5), T. +1, o. d. gray and very deeply cupped, p. and a. c. n. (L. o. d. decidedly but not deeply cupped); a very large iridectomy was performed upwards in R. Oct., 1887 (two years after operation), R. keeps good, T. n., sub-conjunctival fistula at centre of wound. June, 1888, R. keeps good; +2 D. V. = \( \frac{6}{18} \), and nearly \( \frac{6}{12} \); wound still fistulous and T. less than L, o. d. very pale, and moderately cupped. L.—T. n., ? +, o. d. considerably cupped but not pale, veins full, f. full to hand test.

Her son has large, physiological cups. Her daughter has for some time complained of rainbows. Her father (previous Case) had chronic glaucoma, and one of her first cousins is said to have lost an eye from the same disease.

The late Mr. Critchett was, I think, accustomed to speak of certain rare cases as "acute simple glaucoma,"* which were characterised by short, frequent attacks of very severe dimness and tension without any pain or conges-

tion, and which, owing to their high liability to internal haemorrhage, were very unfavourable for operation. I mention the matter as there can be no doubt that Mr. Critchett had in his mind a definite clinical group, of which others have probably seen examples. But I am not sure that I have myself seen any cases conforming in all essentials with Mr. Critchett's description; Cases 20 and 30 are those that most nearly agree with it.

We now and then see cases which, though essentially chronic glaucoma, have some iritis, and for the present I will put such a case as the following, which is one of this kind, in a separate group.*

The cases, fortunately rare, of glaucoma occurring in eyes from which cataract has been removed should also be separately considered.

Case 23.—Mr. C., 45 (P. 8, 247), was seen in July, 1883, with rather quick but nearly quiet glaucoma, which had begun about four months before, in both eyes; the R. was, however, rather more advanced than L. When seen, July, 1883, R. T. +1, V. 6/12, some fine dots on back of lower part of cornea, o. d. rather pale, excavated in saucer form all over, p. dilated from previous use of atropine, a. e. n., f. contracted to 5—10° everywhere except up-out, where it extends to about 60° (Fig. 6).

* I do not refer to the ordinary cases of so-called serous iritis or uveitis, in which there is often slight and usually transient increase of T. with deepening of anterior chamber.
L. V. $\frac{6}{6}$, T. $\frac{6}{6}$, f. of precisely the same type and degree of contraction near centre, but the remaining part broader (Fig. 7), no keratitis punctata; no atropine had been used.

With the traditional fear of operating with fields such as these, I temporised with eserine for nearly two months.

On Sept. 24, R. had T. still rather $+$, V. $\frac{6}{6}$ partly, dots on back of cornea gone, iris healthy, f. as before, p. still rather larger than L., still has rainbows. L. $\frac{6}{6}$ well, T. $\frac{6}{6}$ + (had been $+1$ a few days before), f. certainly smaller than before. "He thinks his eyes are about the same, but as T. at almost every visit remains $+$, and L. f. is diminishing, I now advise operation."

On October 4th, sclerotomy in each, converted into iridectomy in R. on account of prolapse. Both did well, but R. never saw so well after operation as before, chiefly, I think, owing to astigmatism.

April, 1888 (4$\frac{1}{2}$ years), R. with $=+3$ c. and $-1$ s. V. $=\frac{6}{18}$ well; L. V. $\frac{6}{6}$, Fs. tested by hand exactly the same as at last note, neither of the fields having enlarged at inner part; though central vision is perfect he has to go about very carefully and often knocks up against things, just as he did when first seen. Oph. shows the same now as on several occasions since the operation; o. ds. very pale, with saucer excavation, vessels about n. in L., arteries contracted in R.

This case I take to be a splendid instance of success from operating on chronic glaucoma with very bad fields.

You, of course, will not suppose that all operated cases have done as well, or been observed for as long as the ones I have just quoted, and, before concluding this part of the subject, I must therefore make some more general statement as to the results of my operations. Bearing in mind how tardy the disease may be, we shall do well to count as successes only cases that have been observed for, say, two years or more after the operation; and of such,
as you will readily understand, one cannot produce any large number.

Of 39 cases of chronic uncomplicated glaucoma operated upon with apparent success, which I have tabulated, I exclude one-half for various reasons, viz., 10 because less than two years has as yet elapsed since the operation,* 7 that were operated upon more than once, and were, therefore at best uncertain results,† and 2 following interstitial keratitis.‡ We have 20 left, including some that have been already narrated (Cases 18, 20, 21, 22, 23), and these are very shortly as follows:—

Case 24.—Mrs. W. Both began with some inflammatory symptoms in the spring of 1879, æt. 68. R. iridectomy six months after onset for steady but varying failure, V. being \( \frac{6}{15} \) p. sluggish, F. somewhat contracted (Fig. 8). L. iridectomy 18 months after onset, V. being \( \frac{6}{10} \), and F. smaller than in R. (Fig. 9). Nine years after operation on R. (eight years after L.) each eye as at date of operation. (Case I in Tables.)

Case 25.—Mrs. B., æt. 73. L. nearly blind a year, T. +2,

* Nos. 10, 11, 18, 20, 23, 26, 27, 28, 32, and 37 in the tabulated statement above referred to. These tables I keep, but do not think it necessary to print.
† Nos. 2, 7, 8, 29, 35, 36, and 39.
‡ Nos. 31 and 33.
quiet. R. failing lately, V. $\frac{6}{18}$, F. typically contracted, T $+1\frac{1}{2}$, iridectomy; $3\frac{1}{2}$ years, condition the same. (No. 3 in tables.)

Case 26.—Mr. B., æt. 41. Duration uncertain; symptoms variable; V. in each $\frac{6}{18}$, T. +, ps. active, Fs. R.? L. typical contraction. Sclerotomy in each; R. did well and got V. $\frac{6}{9}$, L. not so good, and never afterwards got $\frac{6}{60}$. $3\frac{1}{2}$ years, R. $\frac{6}{9}$; L. F. has become much smaller; o. ds. both pale and cupped. (4 in Tables.)

Case 27.—Mr. B., senior (father of last case). Iridectomy in each for chronic glaucoma, with partial cataract at 63; seven years later condition about the same; V. 20 J. Now had one cataract removed; aged 74, reported still to see about the same. (5 in Tables.)

Case 28.—Mr. J., R. iridectomy for advanced chronic glaucoma at 65; six years later V. the same as at operation = 19 J. (6 in Tables.)

Case 29.—James B., æt. 69. R. advanced chronic glaucoma. T. +2, V. $\frac{6}{18}$, o. d. cupped and pale. Six months later V. worse, not 20 J., F. contracted at inner part. Iridectomy. $2\frac{1}{2}$ years, still sees letters of 20 J., T. quite n. L. was more advanced than R., and lens became opaque after iridectomy; ? wounded. (14 in Tables.)

Case 30.—Miss B., æt. 46. L. "acute severe glaucoma simplex" coming on in an hour or so with very high tension and great loss of V., but neither congestion nor pain, after one year's threatening; iridectomy; four years later quite well. R. shrunk after operation for intermittent glaucoma at 37. This should, perhaps, not be counted as a chronic case. (16 in Tables.)

Case 31.—Ann B., æt. 56. Very advanced chronic painless
glaucoma both; R. p. l., T. +3; L. rather better; iridectomy both; 3½ years, V. reported much the same.

Result of operations very late in glaucoma simplex. (19 in Tables.)

Case 32.—Francis E., acute attack in both, with remissions at 29, then better; at 34 failing again eight months; R. $\frac{6}{36}$, T. +1, F. n.; L. $\frac{6}{60}$, T. +3, F. much contracted at inner part. R. sclerotomy, L. iridectomy. Three years later, R. $\frac{6}{36}$, F. and T. n. L. $\frac{6}{30}$, T. n., F. as before. (21 in Tables.)

Case 33.—Mary Ann P., æt. 45. R. failing with rainbows some months; V. $\frac{6}{24}$, T. +1, commencing cup, F. no note; L. almost absolute, T. +2, only p. l., failing one year. Iridectomy both; 6½ years, R. the same; L. no p. l. (22 in Tables.)

Case 34.—Elizabeth C., æt. 49. Chronic glaucoma, with remissions and high tension two to three years. R. $\frac{6}{9}$, T. +2, deep cup, F. slightly contracted, a. c. very shallow. L. $\frac{6}{12}$ partly, T. +2—3, deep cup, F. much contracted, a. c. very shallow. T. in each considerably reduced by eserine. Iridectomy both; 3½ years, reports V. keeps fairly well. (24 in Tables.)

Case 35.—Elizabeth B., æt. 70. R. failing six months, with pains and variations, $\frac{6}{24}$, F. extreme concentric contraction, T. +2, lessened by eserine, p. active to eserine, a. c. very shallow. Sclerotomy. 2½ years, reports can still see a little with the operated eye.

This case cannot be called conclusive. (25 in Tables.)

Case 36.—Lucy D., æt. 52. R. failing some months, quietly; T. +2, much reduced by eserine, F. much contracted, no definite cupping, V., no note. Sclerotomy converted into...
small iridectomy. Some months later, V. \( \frac{6}{24} \); four years, sends a favourable report. (30 in Tables.)

**Case 37.**—Edmund H., at. 26, began to get short-sighted; at. 33, well-marked chronic glaucoma of both, about four years, L. rather worse; Fs. considerable contraction, deep cups, eserine not much action; V., R. with \(-3\, \text{D.} \frac{6}{24}\) L. with \(-3\, \text{D.} \frac{6}{60}\). Iridectomy both; L. lost by immediate hemorrhage with severe pain; R. did well, and 3\(\frac{1}{2}\) years later saw \(\frac{6}{12}\) with much contracted F., T. n. (34 in Tables.)

**Case 38.**—James P., at. 47, iridectomy in R. for early simple glaucoma with remissions; o. d. rather pale with a steep normal cup. At. 57 in same state, V. quite good. (38 in Tables.)

The following cases (in addition to Case 15 above), that were operated on more than once, have not been counted as successes, although in all of them the second operation seems to have stopped, or at least very much retarded, the disease:—

**Case 39.**—James A., at. 43. R. iridectomy up for chronic glaucoma of about one year, exact state not known, effect lasted about 15 months, when patient thought V. worse. I now found V. \(\frac{6}{60}\), F. contracted, T. ? +. Watched seven months, when F. more contracted and T. + 1 ?. Sclerotomy down two years after iridectomy. 5\(\frac{1}{2}\) years after sclerotomy, V. the same. L. n., but o. d. suspicious. (8 in Tables.)

**Case 40.**—Sarah Ann M., 63. L., recent chronic glaucoma, ? duration, V. \(\frac{6}{18}\), F. much contracted, very deep normal cup. Sclerotomy up; 10 days later, second sclerotomy down. One year after operation V. \(\frac{6}{12}\). R. had absolute glaucoma with retinal
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hemorrhages, and T. + 3; a few hours after iridectomy lens escaped; eye did badly and was excised. (27 in Tables.)

Case 41.—David E., æt. 63. L. threatenings for some time; V. $\frac{6}{6}$, T. n., F. n. o. d. suspicious; sclerotomy up. One year later $\frac{6}{12}$, two years $\frac{6}{12}$, some contraction of F., threatenings. 3½ years $\frac{6}{60}$, F. smaller; iridectomy down with wound of lens. Lens was removed some time after and eye did well, getting $\frac{6}{36}$. Two years after iridectomy, or $5\frac{1}{2}$ after sclerotomy, keeps well. R. absolutely blind from simple glaucoma eight months before first admission. (29 in Tables.)

Case 42.—Mrs. Wiggins, æt. 53. R. acute glaucoma, did well with iridectomy. L. acute, following chronic glaucoma; iridectomy for the acute attack; eight days later second iridectomy; seven months later, lateral iridectomies; 13 months from first operation, sclerotomy up. One year after sclerotomy, two years after first iridectomy, V. 20 J., barely. Ten years after sclerotomy, æt. 63, sees fingers at 3 feet by moving the eye about. (39 in Tables.)

Case 43.—John P., æt. 67. R. failing six months; V. $\frac{6}{15}$. F. much contracted, T. slightly +. Iridectomy up, six months later sclerotomy up; three months after sclerotomy, second sclerotomy down; did badly, but gave no trouble; eight years after first operation quite blind and cornea dim. L. began about the same time as R. and thought to be worse; 16 J. barely when admitted; iridectomy up same date as R., nine months later imperfect sclerotomy up; four years later 20 J.?; 6½ years can still find his way about; eight years just sees large white objects in some parts of F. (33 in Tables.)

Case 44.—(35 in Tables), Lewis Lewis. Good result three to four years after two sclerotomies for chronic glaucoma with sharply contracted F.

As the cases quoted show there are different degrees of success amongst those classed together; and if we were content with a rather lower standard than I have taken,
we could increase our series by more than a dozen,* where the disease was stopped for a time, or decidedly retarded by the operation, or was apparently cured by a second operation.

By way of brief conclusion to this part of the subject, I may say that I have been agreeably surprised at the considerable proportion of good results after iridectomy or sclerotomy, or both operations, in chronic primary glaucoma, and that my faith in iridectomy for this disease, especially when performed early, is decidedly firmer than it was before I began to look into my cases.

It must be admitted, however, that there is much uncertainty, and that we have still much to learn before we shall be able to tell with any accuracy what influence various conditions in the patient and in the eye are likely to have on the result of operation. The chief of these conditions would be:—

* The Stage of the Disease.—Though operation is no doubt much more likely to succeed if performed early in the disease than late, we have several cases where, with a late operation, the disease was permanently stopped with good result† (Cases 29, 21, 18, 24).

* The state of the field affords no constant guide (Cases 23, 24, 21, 22, 18, and others).

* Acuteness of Vision has no necessary relation to success or failure; permanent cure may follow operation on an eye with almost perfect acuteness though with very bad field (Cases 18 and 23), but may be just as marked in a case with defective acuteness but less extensive and less sharply defined loss of field (Cases 24, 21, 25, 32, 29, 34).

* The Anterior Chamber, though often somewhat shallow,

* Nearly a dozen of the tabulated cases, Nos. 1, 3, 12, 14, 19, and 30 operated on once; and Nos. 2, 8, 29, 35, and 37 operated on more than once with partial success; and Cases 39, 40, 41, 42, 43, and 44 in the text operated on more than once with good success; in all 17.

† Even when the glaucoma is acute and operated upon early the result is not always good.
may be of good depth, as in Case 15 and others, or very shallow, as in Case 34.

Even the Degree of Cupping and Pallor of the Disc afford no constant guide to the future, as the successful Cases 18, 22, 26, and 34 show, in all of which there was considerable cupping.

The Tension, though sometimes scarcely increased, as in Case 18 and others, may be quite high, provided that it be intermittent; if tension continued very high, of course the case would not be chronic.

The State of the Pupil seems to me to furnish the best prognostic guide; in almost all of the successful cases it acted well to eserine, one of the best exceptions being in Case 37, but that patient, let it be noted, had considerable myopia.

Health and Age seem to exert a decided influence on success; at any rate, only two of the successful cases are noted as being conspicuously out of health, namely, Case 18, with advanced aortic dilatation, and Case 23, much over-worked and eating irregularly. On the other hand, amongst 11 cases that, without any apparent reason, did badly after operation, at least 6 are noted as being very cachectic in one way or another. As to age, in 26 successful cases (20 operated upon once, 6 operated upon twice) the patient was aged 45 or less in 8 (about $\frac{1}{3}$), and was over 60 in 9 (about $\frac{1}{4}$). Of the 11 unsuccessful cases above referred to, not one was below 47, and only 2 below 50, whilst 6 (at least $\frac{1}{2}$) were over 60.

Thus we may say that senile cachexia in its various forms is distinctly unfavourable to operation in chronic glaucoma, and that absence of senility and an active pupil are favourable points. The conclusion seems to me to be unavoidable that it is our clear duty to operate in chronic progressive glaucoma, and the earlier the better; and that even in advanced cases an operation should be performed unless there are special reasons (age, ill-health, complete and prolonged immunity of the other eye) rendering it
undesirable. If the disease seems to be stationary, and is in an early stage, and the patient can be watched and have his field measured at intervals of a few weeks, or later on, of some months, delay is always permissible and often desirable. In such circumstances eserine or pilocarpine should be used, but must not be strongly relied upon; and in no case of chronic glaucoma should treatment by eserine take the place of operation when it once becomes clear that the disease is advancing. Such advance may be shown either by decreasing area of the field or decreasing acuteness of central vision, but as either one of these symptoms may be much more marked than the other, the periodical examinations of the eye should include both.

Failure of Operation.—Many of the cases, whether chronic or acute, that fail unexpectedly do so owing to some unfavourable process going on at or near to the wound, and such unfavourable processes are more likely to come on when the patient is old or in bad health.

Some of these come under the heading of what has been described as "Malignant Glaucoma," tension not being relieved by the operation, and the anterior chamber not being re-formed. Displacement of the lens caused, in an eye with a weak suspensory ligament, by the suddenly reduced tension at the operation, probably accounts for some of these, and if we could in such cases remove the lens in its capsule with no worse consequence than the escape of some vitreous humour, it would be the best course to adopt. But it would seem that when the suspensory ligament is unsound, the intra-ocular blood-vessels are very often unsound too; at any rate, in the few cases of advanced glaucoma that I have had in which the lens has escaped in its capsule spontaneously within a few hours of the performance of a large iridectomy, the eye has been lost afterwards by haemorrhage. Still there probably has been a case here and there in which a bold, skilful removal of the lens would have saved some sight; the
difficulty lies much more in recognising the case than in performing the manœuvre.

In other cases a chronic inflammation is set up in the wound leading, on the one hand, to slowly progressive haziness of the cornea, and, on the other, to permanent thickening and irritability at the scar—a sort of sclero-keratitis.

As I have already said, I have not myself seen much, in chronic glaucoma, of that continued contraction of the field after operation, when the field was already a good deal contracted before, about which we hear so much in the books. I do not, however, think that we need be surprised that this should sometimes occur in acute as well as in chronic cases if the blood-vessels of the optic nerve and retina are unsound, as they frequently are in advanced glaucoma. The somewhat severe and prolonged congestion of the front of the eye that we often see after iridectomy for glaucoma may be taken as some index of the degree and duration of the congestion of the central retinal and choroidal vessels following on the rapidly diminished tension. A congestive oedema of the optic nerve thus set up might readily cause rapid increase of damage to nerve-fibres, most of which are already in a state of advanced degeneration; and especially so in a nerve where, as in advanced glaucoma, there is great increase of connective tissue. The occurrence of retinal hæmorrhages after the iridectomy, asserted by V. Gräfe to be so common, is mainly a sign of diseased vessels; I shall return to this subject in the next lecture in connection with hæmorrhagic glaucoma.

The result may also be bad, of course, from faulty performance, or faulty choice of operation, or for want of operating a second time. Probably all operators of experience have occasionally spoilt an eye by wounding the lens.

* I do not refer to the state of chronic porcellaneous-, pearly-, or milky-looking oedema of the conjunctiva which is sometimes seen over the wound, and which is certainly often, probably always, an evidence that the scleral wound is leaking, and is therefore so far a good sign.
With respect to the choice of operation, I can only say that I have come back to iridectomy in chronic glaucoma after a tolerably extensive trial of sclerotomy. The sclerotomy I performed was always made sub-conjunctivally with a Graefe's knife, and always with the preservation of a narrow bridge of sclerotic. I operated on quite 50 cases, and therefore got over the initial difficulties of the proceeding. The results were for a time very pleasing, but as time went on I found that some of the cases gradually went down hill, and that others had to undergo a second operation, usually iridectomy. Although I have had a few very brilliant cases of permanent success after sclerotomy (Cases 18, 23, 26, 32, 44), I have not been able to make out why these should have succeeded, and I therefore never feel able to say on looking at a case before operation whether sclerotomy is likely to succeed or not. Sclerotomy being a more difficult operation than iridectomy will always be fraught with more risk. For these reasons and from having become gradually convinced that iridectomy often gives excellent results in chronic glaucoma, even when the field is much contracted, and that the optical inconvenience of iridectomy can in great measure be remedied by the careful correction of the astigmatism, I feel myself unlikely to revert to sub-conjunctival sclerotomy as a primary operation. But I shall still be prepared to perform it when iridectomy has failed, placing it then on the opposite side to the iridectomy. I should say, however, that I have never made use of sclerotomy as it was originally performed with the lance-keratome by Quaglino, and is still employed I believe by Snellen and others; nor have I ever systematically repeated the section in two or more opposite positions as has been advocated by some of the French surgeons. I have, however, no doubt that such multiple incisions are surgically correct, and that we sometimes fail to arrest glaucoma for want of a timely second operation. 

(To be concluded.)
ON THE NATURE OF LIGHT-PERCIPIENT ORGANS AND OF LIGHT- AND COLOUR-PERCEPTION.

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In endeavouring to determine what ocular structures are certainly to be regarded as light-percipient,* we are met by the difficulty that sensibility to light may exist without any recognisable eye or eye-spot whatever being present. Indeed, a reaction or movement determined by light is sometimes observed in animals destitute, not only of eyes, but of any nervous system; and there are also numerous instances of its effect on the movement of vegetable organs and organisms.

Stahl,† for example, found that in Closterium, a form of Desmid, light induces the cells to alter their position according to its direction. When placed in a glass vessel, illuminated only from one side, the cells attach themselves to the glass so that their long axes coincide with the direction of the incident light. On altering the direction of the light the position of the cell changes in a corresponding manner with considerable rapidity.

This property of phototaxis, by which cells come to arrange themselves with their long axes parallel to the

* It may be contended that "light-sentient" would be a more correct term to apply to the end-organs of the visual apparatus. I have avoided the use of that term, however, on account of the difficulty that would often necessarily arise in distinguishing between cells or organs that are sensitive to or acted on by light, and those that are not only sensitive to light but inseparably connected with the visual function. Thus all young vegetable and even perhaps animal cells may be spoken of broadly as light-sentient in so far as they are acted on by light, but I am limiting myself, in the case of animals, to the consideration of such light-impressions as are capable of being appreciated by a visual nervous centre.

direction of the incident light, is found to have a very wide range of influence on the growth and behaviour of plants. Thus it determines the direction of movement of the free swimming zoospores, which arrange themselves so that their long axes are parallel to the light rays, and invariably travel directly away from, or directly towards the light, never in a cross direction. The end provided with fine protoplasmic processes or cilia always goes first, so that when the zoospore ultimately comes to rest, its ciliated end becomes the base of the germinating plant.

According to the direction of movement being towards, or away from, the source of light, we have what vegetable physiologists call respectively positive or negative phototaxis.

Similarly, light has an action on the radial organs of growing and of mature plants, by reason of this same property of phototaxis, or its parallel heliotropism. One of the most striking instances of the effect of light on the position assumed by vegetable organs is afforded by the way in which the movement of the young shoots of seedling plants is influenced by illumination. These always turn directly towards or directly away from the source of light, and the effect is induced by an illumination so feeble as to be practically indistinguishable by the human eye. In the case of most plants the movement is towards the light. Darwin,* to whose careful observations we owe our chief knowledge regarding this action of light on young plants, found that the curvature of the whole shoot was determined by the direction of the illumination of its upper extremity. "It can hardly fail," he says, "to be of service to seedlings, by aiding them to find the shortest path to the light, on nearly the same principle that the eyes of most of the lower crawling animals are seated at the anterior ends of their bodies."

"We should bear in mind," he continues further on, "that the power of bending to the light is highly beneficial to

* "The Power of Movement of Plants," pp. 484 et seq.
most plants. There is therefore no improbability in this power having been specially acquired. In several respects light seems to act on the tissues of plants in nearly the same manner as it does on the nervous system of animals."

The arguments adduced by Darwin in favour of this latter statement may be summarised as follows:—

(a.) The effect is transmitted from one part to another, in seedlings as in animals.

(b.) An animal may be excited to move by a very small amount of light, and so also can certain plants.

(c.) The retina, after being stimulated by a bright light, feels the effect for some time; so in like manner a seedling continued to bend for nearly half an hour towards the side which had been illuminated.

(d.) The retina does not readily perceive a dim light after it has been exposed to a bright one; so plants which had been kept in the daylight during the previous day and morning, did not move so soon towards an obscure lateral light as did others which had been kept in complete darkness.

In all experiments of this nature, I need hardly say, the observers have been careful to discriminate between the effects of light and those of heat.

These effects of light on plants are also to be distinguished from the chemical changes produced in them by this agent, such as the green coloration of chlorophyll, the decomposition of carbon dioxide, and the formation of starch, sugar and oil. These latter are produced chiefly or solely by the rays of low refrangibility, viz., the red, orange, yellow and green. Protoplasmic movement, on the other hand, and phototaxis, are produced chiefly or solely by the rays of high refrangibility, viz., the blue, violet and ultra-violet, the less refrangible rays acting in this respect like darkness.
As further examples of the action of light on plant-movement I may mention observations of Baranetzky and Engelmaun. The former* found that the plasmodes of *Aethalium*, a fungoid growth affecting tan, creep along the surface in the dark, but withdraw into the deep parts of the bark on exposure to a bright light. They have long, thin ramifications in the dark, while in the light they only develop short, thick processes.

In a large bacterium, to which he gave the specific name of *photometricum*, Engelmann† found a decided reaction to light. It is motionless in darkness, but moves actively on exposure to light for a few minutes. On prolonged exposure, the amount of light remaining the same, the movements again cease: the length of the period of irritability varies directly with the length of time the bacterium has been previously kept in darkness. Viewed individually they appear colourless, but large collections of them appear of a reddish colour, and the movement is best excited by the part of the spectrum corresponding to the absorbed rays.

Most forms of contractile animal protoplasm seem not to be acted on by light, but Engelmann‡ observed a peculiar effect of light on a very low fresh-water amœboid organism (*Pelomyxa palustris*). On shading it with the hand, the protoplasmic movement becomes more lively, while on sudden illumination the body almost immediately contracts into a round lump as after an electric shock. No irritation is produced by a gradual increase of light, nor by darkness suddenly produced after prolonged illumination.

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Tremblay,* again, found that the hydra, although destitute of any special organ of sight, is attracted towards the light, and he satisfied himself that this attraction was not due to the heat waves.

Effects such as I have just mentioned, induced by light in very low animal organisms, cannot be considered as examples of true visual power, but rather merely as simple protoplasmic changes produced by light, or at most as instances of one protoplasmic change determining another without consciousness. The importance of these observations on the action of light on low organisms and on cell protoplasm will be apparent later, when we come to consider the nature of the changes occurring in the retina on stimulation, and a full description of the known vital phenomena accompanying the light action will be deferred till then.

Different observers have proved the existence of a light sense in higher eyeless animal forms. The lower acari and the eyeless larvae of certain dipterous insects, for example, exhibit a fondness for light; while others, which like darkness, are put to flight by light, even by that of the moon. The common earthworm, also, though destitute of eyes, has been shown by Hoffmeister to be extremely sensitive to light, and his observations have been confirmed by Darwin. The latter authority says, "sometimes . . . as soon as the light fell on them, they withdrew into their burrows with almost instantaneous rapidity. . . . When they did not withdraw instantly, they often raised the anterior tapering ends of their bodies from the ground, as if their attention was aroused, or as if surprise was felt. . . . In all cases the duration of the light, unless extremely feeble, made a great difference in the result; for worms left exposed before a paraffin lamp or candle invariably retreated into their burrows within 5—15 minutes. From the foregoing facts," he adds, "it is evident that light affects worms by its intensity and by

* "Mémoires pour servir à l'histoire d'un sens de Polypes," t. 1, p. 137.
its duration. It is only the anterior extremity of the body, where the cerebral ganglia lie, which is affected by light. . . . We must suppose,” Darwin continues, “that the light passes through their skins, and in some manner affects their cerebral ganglia.” He found, further, that they were apparently less sensitive to moderate radiant heat than to a bright light. “The light from a candle, concentrated by a lens, and passing through a sheet of glass, which would intercept most of the heat-rays, generally caused much more rapid retreat than did the heated poker.”

With exceptions such as those we have noted, however, some form of eye or eye-spot is always met with in association with sensibility to light. The amount of differentiation of the structure having this function varies very greatly, but the presence of pigment in connection with it is invariable normally. Exceptionally, it is true, we find albino individuals having eyes without retinal pigment, but in them the light-percipient organs are otherwise well developed,—notwithstanding which, their vision is never so acute as in similar animals with pigmented eyes. We may lay it down as a law that the lower the type of eye the more necessary is the presence of pigment to its function, and we are thus prepared for a further generalisation, viz.: Whenever in any low animal organism a definite pigment spot is found, constant in its occurrence and in its position, and without any other obvious function, we are justified in regarding it as light-percipient. This conclusion is rendered practically certain if the pigment-spot be situated at the anterior end of the body of a freely moving animal, in connection with its nervous system, and if it be symmetrically disposed with any other pigment spots present that are apparently similar in function.

We must not be deceived, however, by mere symmetry. Thus, for example, a peculiar exceptional development of

* “Vegetable Mould and Earthworms,” pp. 19 et seq.
pigment, in the form of two bilaterally symmetrical deposits, occurs in *Cephalodiscus*, a very singular new form brought home by H.M.S. "Challenger," described by Professor McIntosh, and placed by him provisionally among the Polyzoa. Through this gentleman's kindness, specimens were sent me for examination. At first sight, these pigment-spots suggest the presence of eyes, but further examination showed conclusively that they could not be credited with any light-percipient function. The animal is sedentary, and the pigmented areas are not in direct connection with its nervous system. I believe they have quite another function, connected with light it is true, viz., that of developing heat in the oviducts on which they are placed.

In certain *Infusoria* among the *Protozoa*, we first meet with pigment-spots that seem to serve as light-percipient organs. These spots are confined to freely moving genera, and always occur at the anterior end of the body, *i.e.*, at the end which goes in advance. As these animals are unicellular organisms, there is no specialised nervous system, and the light impression produced upon the eye-spot is probably communicated directly to the surrounding protoplasm. Though these animals are necessarily destitute of any specialisation of organs for sensation, motion, digestion, &c., the whole cell may be regarded as serving by turns all these functions, sometimes moving as a whole for prehension of its food, sometimes acting as a digestive system, and also always capable of receiving impressions from without such as we generally find associated with the presence of distinct nerve-cells. In one of the best known of these eyed Infusoria, the *Euglena*, the eye-spot consists of plasma having a net-like arrangement, in the meshes of which are situated tiny drops of an oily red substance allied to chlorophyll.* Excep-

tionally, as in *Erythropsis agilis*, there is in addition a strongly refractive, colourless, conical crystalline body lying upon the pigment, doubtless intensifying the action of light by concentration. It is probable that the principle of phototaxis determines the position of the eye-spot at the anterior end of the body in such Infusoria. The elongated form of the mature, as compared with the more rounded shape of the young individual, may well be the result of movement, in as far as the end provided with the eye-spot always goes in advance, and the tendency of mere friction will therefore be to lengthen the cell, and to make the posterior extremity fine and tail-like.

Among the *Hydrozoa* we first meet with visual organs consisting of modified epithelial cells, some of the latter being always conspicuous from the development of pigment within them.* We meet with many variations between simple pigment-spots on the marginal bodies and a highly developed eye on the *camera obscura* type, provided with a lens, such as is found in *Charybdea marsupialis*.

It is not my object in this short paper to describe at length the individual features of the sight-cells in different animals, but merely to draw broad conclusions as to the conditions common to all.

1. *In all the invertebrate groups the light-percipient cells are developed from the ectoderm*, as in the *Hydrozoa*. Sometimes this takes place by a very simple and obvious modification of the epithelium, as in the rudimentary eyes of the starfish, the lower worms, the larva of *Dytiscus* (among *Arthropods*), and in the *Patella* and *Arca Noae* (among *Molluscs*). In highly developed eyes, *e.g.*, that of

* "Das Nervensystem u. die Sinnesorgane der Medusen." O. u. R. Hertwig, 1878. Pl. viii, figs. 9, 10, 15, and Pl. ix, figs. 5 and 13.

"Die Medusen (Physiol. u. Morphol. untersucht) auf ihr Nervensystem." Eimer, 1878, pp. 163-4, and Pl. iv; figs. 1, 3, 13, 14, &c.


"Die Sehorgane der Thiere." Carrière, 1885, pp. 90-95, and fig. 73.
Alciope (among Vermes), the stemma of the Spider, and the compound eye of Insects and Crustaceans (among Arthropods), and the Cuttlefish (Mollusca) the epithelial origin is not so easily traced, and must be followed through intermediate forms.

In the case of the compound arthropodous eye, there is still some difference of opinion as to the manner in which the different parts have been developed, and as to how they are to be interpreted. I may, therefore, endeavour very shortly to trace the divergences of structure from the primitive form, as met with in the larva of Dytiscus, the eye of which has been described by Grenacher.* Here there is a single cornea-lens, produced by a thickening of the chitinous cuticle; behind this is a single layer of cells, continuous with those of the hypodermis or surface-epithelium. The cells at the periphery of the eye are long, and bend obliquely forward and inward towards the optic axis. The more median cells, on the other hand, project forward toward the lens, and become differentiated into nerve-end cells, each developing a rod anteriorly and ending posteriorly in a nerve-fibre. Pigment granules are formed throughout the whole length of the cells next the hypodermis, but only in the posterior half of the peripheral cells which reach the lens or which meet in the optic axis: the anterior part of these remains clear so as to permit the passage of light. These cells may consequently be said to have a double function, viz., to shut off lateral light by their bases, and to act as a vitreous body in their anterior transparent extremities. Pigment granules also develop to some degree throughout the whole length of the spindle-shaped, nervous or retinal cells.

* To the latter authority, and to the work of Ray Lankester and Bourne, I am chiefly indebted for my data.


This simple form of eyelet may be modified in several directions, which may be characterised as—Grouping of the eyes as a whole; Grouping of retinal cells; and Development of a distinct vitreous layer.

A. Several similarly constructed ocelli may be grouped so closely as to touch one another, so that we get a very simple form of what may be called a composite eye. This condition exists in Iulus among the Myriapoda.

B. The vitreous cells may be further developed and displaced from their lateral into an anterior position as regards the retinal cells. Here they form a complete layer of clear "vitreous" cells. As examples of this form we have the stemmata of insects and the eyes of the spiders.

B'. A further modification may result from grouping of several such eyelets, so that we get another form of composite eye, as in Lithobius and Scolopendra among the Myriapoda.

C. The rods, instead of being developed in front of the retinal cells, are often modified so as to form hard ridges on one side, in front of the nucleus. The ridges of two or more adjacent cells now adhere together to form what has been called a rhabdom. From this change we get an organ such as is found as the lateral eye of the Scorpion, according to the description given by Ray Lankester and Bourne.

C'. Several of these, again, may be grouped together, as in the lateral eye of Limulus (or King Crab), forming a simple variety of the true compound eye. Perhaps we may place here also the more closely grouped compound Pseudoconous eyes of certain insects, e.g., Musca.

D. If now we get a combination of the two chief mentioned modifications, viz., the formation of a distinct layer of vitreous, and also the formation of rhabdomes, we have the condition found in the central eye of the Scorpion and of Limulus.

D'. Close juxtaposition of such ocelli gives us the fully developed compound eye of Insects and Crustaceans.
In the typical *facetted* or *compound* eye we have, corresponding to each facet, a transparent crystalline cone or its equivalent next the cornea-lens, and behind this the retinula, or group of modified epithelial cells, with the central rhabdom. The broad end of the crystalline cone is applied to the inner surface of the cornea-lens; its narrow end is turned towards the outer extremity of the retinula. The latter invariably consists of a definite group of vertically elongated cells, having in its centre the clear rod or rhabdom. A pigmented sheath formed of several pigment-cells encloses each "element" more or less completely, separating it from its neighbours; some of these are in very close relation with and dip in between the free sides of the cells of the retinula. The inner extremity of each cell of the retinula is connected with a fine terminal nerve-filament, which immediately pierces a perforated basilar membrane. The true retina of Insects and Crustaceans, however, does not end at the basilar membrane, as was formerly described. According to Lowne, indeed, it is situated entirely behind this membrane. It would be more correct to regard the retina as consisting of the retinular cells, along with part at least of the structures known as the optic ganglia, lying between the basilar membrane and the optic nerve.

It will be out of place here to enter into the various modifications of this structure which may be met with at different stages of development of the same animal, or in different animals. We have chiefly to deal with the cells constituting the retinula, and they are always formed on the same plan. There is little doubt from their homology, as illustrated by the very brief sketch that I have given of the different forms of arthropod eyes, and from their anatomical relations, that the cells of the retinula are really the light-percipient organs. Thus they are placed so that light may penetrate to them; they are in close relation with pigment cells, and are themselves slightly pigmented; and they are in immediate connection with nerve-filaments.
The function of the central rhabdom I believe to be mainly that of affording support to the cells grouped around it, and secondarily, presumably, that of each rhabdome transmitting light to its cell.

The pigment-cells are usually found in three series:—

(1.) Ensheathing the crystalline cone, preventing the entrance of lateral light, and the escape of light once admitted.

(2.) Pigment-cells situated on the outer region of the retinulae, and sending processes between the individual sight-cells.

(3.) Similar pigment-cells resting upon the basilar membrane round each retinula. These two latter prevent light passing from one retinula to another by reflection, and probably serve a visual function in addition.

In many of the Crustacea there is a spindle-shaped thickening of the retinula, transversely banded with pigment, situated near the basilar membrane.

II. The inner end of the sight-cell in invertebrates is either continued as a nerve-fibre, or is connected immediately with a ganglion cell, and ultimately with a nerve-fibre.

III. The outer extremity of the cell is, in all the higher forms of eye, with the exception of some of those met with in arthropods, covered with a cuticular structure in the form of a so-called "rod." In the Heteropoda and Cephalopoda Grenacher* has shown the cuticular rod to be formed of two gutter-shaped half-cylinders. The adjoining half-rods are so disposed that commonly four of them, belonging to as many cells, join to form a single rhabdom. This structure I have found to be easily demonstrated in transverse sections through this region in the cuttlefish. The analogy between the peripheral rhabdom and the true central rhabdom of the arthropodous eye must not, however, be pushed too far: there is no close association of a group of cells here, as in the retinula of insects, &c.

IV. The cuticular ends of the cells in invertebrates are turned towards the light. To this rule the eyes on the edge of the mantle of Spondylus and Pecten, and on the back of Onchidium, form exceptions. The process of development of these structures has not yet been ascertained, but doubtless there is a process of invagination to account for this inversion. In the case of the Pecten, at any rate, the cuticular ends of the inverted cells may be considered as really turned towards the light, in as far as the eye is lined posteriorly by a tapetum from which the light is reflected, so that the inversion is physiologically an apparent rather than a real one.*

V. The sight-cells in all eyes on the "camera obscura" type are arranged with their long axes parallel to the incident light, either directly, or as modified by lenticular refraction. This arrangement is very probably due to the action of phototaxis, whose influence we have already considered in connection with vegetable cells.

VI. Pigment is universally present, either in the light-percipient cells themselves, or in cells situated in close relation to them.

In Vertebrates the visual cells are not formed directly from the surface ectoderm. By a growth of lateral ridges in the ectoderm or epiblast, which gradually arch over and ultimately unite, a long tube is formed, from the walls of which the central nervous system subsequently arises. In the front part of the embryo this tube is wider than posteriorly, constituting the cerebral vesicle from whose walls the brain and retinae are differentiated. The ectodermal cells which were superficial now line this primitive nerve tube and its vesicular enlargement, and persist as the cells lining the central canal of the future cord and the central ventricles of the brain. The free cuticular border of

* For this suggestion I am indebted to Bertkau, who gives this explanation of the situation of the rods in the posterior eye of the spider. ("Beiträge zur Kenntniss der Spinnen." Arch. f. Mikr. Anat., Bd. xxvii, p. 589.)
these cells is therefore directed towards the cavity of the central canal and ventricles, and on this border cuticular structures in the form of cilia are often found to be developed.

A somewhat similar though simpler process obtains in the developing Ascidian, and in this animal there is a single special development of the enclosed ectodermal cells on the dorsal wall of the cerebral vesicle, accompanied by a similarly localised formation of pigment around the inner free or cuticular ends of these modified cells. We have here the earliest formation of a retina on the vertebrate type. The visual cells, whose formation we have just indicated, are large and pyramidal in shape, arranged radially, and converge inwards towards the pigment mass. The wall of the cerebral vesicle is bulged outwards in the position of this primitive eye.

In the lowest vertebrate, the *Amphioxus*, the pigmented eye-spot is also single, and is probably similarly developed, but nothing positive has yet been determined on this point; the retinal cells are certainly not more highly differentiated than in some of the *Tunicata*.

Recently, a further proof of the primitive vertebrate eye being a single central pigmented body on the type of that found in the Ascidian and other Tunicata, has been adduced, mainly through the researches of Spencer* and de Graaff† on the pineal body in the Lacertilia. This body is part of the *epiphysis*, which consists in a hollow outgrowth of the wall at one part of the cerebral vesicle. The termination of this epiphysis is dilated into a more or less spherical sac, having its walls formed of epithelium; in the Lacertilia we may denominate this the optic vesicle. From the anterior part of the wall of this vesicle the lens is formed, while from the posterior wall come the retinal


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structures. Now it must be recollected that the cuticular ends of the cells lining the vesicles are directed inwards, consequently the rods are formed on the inner or anterior ends of the cells, i.e., facing the light, a direction similar to what we have found to be the rule among the invertebrata. It is not correct, however, to speak of this eye as being developed on the invertebrate type, as has been done; its primitive development is quite on the usual vertebrate lines, and the first divergence occurs when the lens comes to be formed of the cerebral epithelium, instead of by a process of cuticular epiblast. The first idea, therefore, is the same for this median, practically extinct eye, as for the persistent paired eyes of vertebrates. In the median eye the primary optic vesicle persists as the eye-cavity, while in the paired eye the primary optic vesicle is obliterate, and the eye-cavity is formed secondarily quite in front of the parts developed from cerebral epithelium.

The true vertebrate retina is in like manner formed from a part of the included cerebral ectoderm. In bony fishes I find that it arises as a solid outgrowth from the central nerve-mass, but in cartilaginous fish, and in all other vertebrates, it is a hollow prolongation of the wall of the cerebral vesicle. Subsequent changes, coincident with the development of the lens from the superficial ectoderm, cause the termination of this prolongation or primary optic vesicle to be bent inwards, so that we get a cup formed by its two layers, which are thus brought into apposition. From the anterior layer the retina proper is developed, while from the posterior we get the pigment epithelium. It follows from this mode of development that the cuticular surface of the anterior layer is directed backwards, and the rods formed from it are consequently directed away from the light.

The retina consists of three great divisions, viz., Pigment, visual epithelium, and nervous layer or retinal ganglion. The visual epithelium represents, as we have seen, the epithelium of the primary optic vesicle, and is homologous
with the epithelium of the central canal of the spinal cord. Each visual cell consists of rod or cone, with its nucleus, fibre, and bulb. To the retinal ganglion belongs the remainder of the retina proper, including thus the two molecular layers, the inner granules, the layer of ganglion cells, and of nerve-fibres. The visual epithelium and retinal ganglion are held in position by a supporting framework of connective tissue. Blood-vessels are present in the retinal ganglion of a large number of vertebrates, and lymphatic spaces have also been described in this position.

I shall now consider more at length the layer of visual epithelium, including under this title the rods and cones with their cells, the nuclei of the latter being commonly known as the "outer nuclei" or "outer granules."

The size of the individual cells varies much both in length and breadth in different vertebrates. They may be divided into rod- and cone-cells from the nature of their outer extremities. Each outer extremity is subdivided into an outer and inner segment. Cones are shorter and thicker than rods, especially in amphibians, and they have tapering outer segments, while the outer segments of the rods are straight and cylindrical. Forms, however, sometimes occur which are in some respects like cones, in other respects like rods.

Both outer and inner segments are to be regarded as cuticular structures; the latter, according to Krause, corresponding to the bulbs of cilia. The outer segments of both rods and cones easily break up after death into numerous transverse discs, which possibly correspond to cuticular shedding. The outer segments of the rods have a uniform reddish-purple colour during life, except in some nocturnal animals, as the goat-sucker and the bat, and in the hen and pigeon among diurnal birds. In some amphibians a few rods occur with short green outer segments.

The outer segments of the rods and cones exhibit
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a difference between their central and cortical substance, recognised by unequal refractive power. There is also a well-defined border, corresponding to an external husk of neuro-keratin. On treatment with weak chloride of sodium solution, the axial part of the rod is dissolved, and the discs fall asunder as rings, so that probably both the axial part and the intermediate substance consist of a form of globulin. The peripheral part, constituting the ring thus formed, behaves like the medullary sheath of nerves, and is called rod-myeloid by Kühne.

The inner segments of both rods and cones are thicker in the middle than at the two extremities. The outer extremity of the inner segment is always different in appearance from the remaining part, having a homogeneous aspect and a higher refractive power. The inner part, on the contrary, is faintly granular, and penetrates the external limiting membrane, there being a hole in this membrane corresponding to the size of the segment. On the outer surface of this segment may be seen a fine longitudinal striation, which, according to Max Schultze, is due to fine fibrils proceeding from the limiting membrane, and seemingly serving for stability. The parts of the rods and cones outside the membrane are surrounded during life by an albuminous fluid, and this striated appearance may possibly be due to its coagulation, or to a shrinking of the outer shell of the segment on its contraction.

In most vertebrates, with the exception of man, the highly-refractive part just mentioned is very distinctly marked off, being ellipsoidal in shape, and named in consequence the rod- or cone-ellipsoid.

The rods are relatively of large size in Amphibians, and even Birds have larger rods than mammals. In osseous Fish, however, they are exceedingly fine, and contrast strongly with the large cones. Among mammals there is considerable variety in the size of the rods, those of the rat being the finest of all.
In Amphibians, Reptiles, and Birds, there is a round fatty globule at the extreme outer end of the inner segment of the cone; it is sometimes colourless, but often coloured red, yellow, or bluish-green. In the sterlet, a ganoid fish, a colourless oil globule also occurs in this position; this was first observed by Bowman, who compared these globules with those of Birds. I have observed similar fatty globules in the cones of all the marsupials examined fresh, with the exception of the American opossum, in which rods only were found, and although the retinæ of the monotremes that I have obtained were unfavourable for exact observation on this point, I was led to believe that they also existed in the Ornithorhynchus at least. They are not found in any higher mammals.

Most vertebrates have both rods and cones, the former considerably in excess except in Birds. In the nocturnal birds of prey, however, the cones are comparatively few in number. Many rodents, as the rat, mouse and guinea-pig, have very few cones, and they are entirely absent in the hedgehog, bat, and mole. Many fish also are said to have no cones, e.g., the sharks and rays, but this is open to question. They certainly have only one form of element, but that seems to me to be intermediate between ordinary rods and cones. In some Reptiles and Amphibians, on the other hand, cones alone are present.

In many vertebrates two cones are frequently joined. In osseous fish this is the rule, and I have very rarely found a true simple cone in their retinæ. Each such double-cone is usually of large size, and consists of coalesced inner segments, with two distinct outer segments and two cone-fibres. The body of this double-cone gives only a faint indication of its true nature by a furrow traceable down its side. In ganoid and elasmobranch fish no double-cones occur. In Amphibians, Reptiles, and Birds, both simple and double-cones are found, but here the two associated halves exhibit various differences, partly expressed in inequality of size, partly also in a dissimilar
distribution of the lenticular body, and of the oil globule. These are called *twin-cones*, and the two halves are named respectively the *chief* and the *associated* cone. Transitional forms occur between the simple and twin-cone, some having only one nucleus in common, others two; some having one outer segment in common, though possessing two oil globules and two fibres. In teased preparations of the human retina I have occasionally found somewhat similar structures, viz., large single cones with two fibres; these possibly also sometimes occur in other mammals, but no true twin-cones have ever been found in this group.

In regard to the cone-ellipsoids of Birds, Dobrowolsky makes some interesting observations. The inner surface of the ellipsoid is the more convex, but in this respect they vary according to the colour of the oil globule in the cone. In those with red globules the ellipsoid is generally most convex; then come those with yellow; and, lastly, the blue show usually only a very slight convexity; often indeed a plane or even concave surface. With the greater or less convexity of the ellipsoid and colour of the globule is associated also a difference in the form and kind of cone; those with red globules are the narrowest, those with blue the broadest. Again, the outer segments vary; those with red globules are longest, those with blue shortest,—the length of the inner segment being just the opposite. These variations, if they actually exist, have very probably a relation to the difference in refrangibility of the different light-waves transmitted.

A narrow neck separates the inner segment of the cone from its nucleus, which commonly lies near the external limiting membrane. On the inner side of the nucleus the cone-cell is prolonged as a rather thin, often curved fibre, which terminates at the outer border of the outer molecular layer in a triangular enlargement, its base resting upon this latter layer. Sometimes we can see that this enlargement or cone-fibre-bulb has a hollowed-out base, so that it is more or less stirrup-shaped, the
cavity being filled by a small deposit of protoplasm. The connection between this bulb and one or more processes of the bipolar median cells has been found by Merkel in teased preparations, and was described in sections of the human retina by myself.

The inner segment of the rod ends inwards in a narrow fibre, which sooner or later swells out to enclose a nucleus. Beyond this point the rod-cell commonly presents the appearance of a delicate varicose fibre, terminating in a small rod-bulb near or on the outer molecular layer, where it is also seemingly joined by a process of a bipolar median cell.

The number of nuclei in, and the consequent thickness of, this layer of "outer granules" are in direct relation to the thickness of the inner segments of the elements. Where these are much thinner than the nuclei, the latter must be disposed in several rows, as their size is not usually much smaller in such cases. The layer reaches its greatest development in mammals, while in many Fish, as also in Amphibians and Birds, there are seldom more than two rows, corresponding to a comparatively small number of visual cells.

Salzer* computes that there are from three to four million of cones in the human retina, and, according to Krause,† there are about 400,000 large, and about as many more fine fibres in the optic nerve, say a million in all, so that if these calculations be correct, each nerve-fibre must be connected with several cones. From the number of outer processes often found coming from the ganglion cells, this preponderance of visual cells may easily be accounted for.

In many Amphibians, club-shaped bodies, first described by Landolt, are found in the layer of outer granules. They rest on the outer molecular layer, and run outwards

† Graefé's Archiv, xxvi, 2, p. 102.
between the outer granules, ending in the neighbourhood of the external limiting membrane in one or two swellings. The nature of these is doubtful, but possibly they may merely be torn off rod- or cone-fibres.

The literature of the histology of the visual epithelium is very large and confusing. I am very doubtful as to the benefit of observations on the more minute modifications in the outer and inner segments, unless made in series by the same observer, with due regard to the previous condition of the animal during life and of the preserving reagents employed.

Two of the most recent writers on the anatomy of the retina, Krause* and Borysiekiwicz, deny the connection of the rods and cones with the recognised nervous elements of the retina, and both affirm that they are in direct connection with Müller's fibres. Krause asserts that one radial supporting fibre corresponds to each cone; but this cannot be the case, as the number of Müller's fibres increases as we approach the ora serrata, while that of the cones diminishes, and there is no such increase in the number of fibres at the area centralis as his view would necessitate. Borysiekiwicz† even goes so far as to state that in the retina of a tiger that saw well during life, there were no rods and cones. Now I can quite understand that none were present when he examined it, but this was doubtless due to post-mortem changes, which very quickly affect this layer. Indeed, in the retinæ obtained from the Zoological Society’s Gardens here, I have often observed the rods and cones to be quite broken down, and sometimes almost the entire retina disorganised. Nor can we be surprised at this result when many hours must occasionally elapse before the attendant discovers that an animal is dead, and some time longer before its body is removed and examined. The curves in the

retina, too, which this observer describes seriously as "papillae" are simply due to crumpling of the retina when softened and detached.

The pigment layer consists of a single row of prismatic cells, seen to be hexagonal on a surface view, and to be separated from one another by a little clear intercellular substance. The outer border of the cell rests on the hyaline coat of the choroid, and is colourless; near this border the nucleus is placed. The remainder of the body of the cell contains much pigment, both in the form of granules, and of fine needles of pigment called fuscin. Where a tapetum lucidum exists no pigment is present in these cells. From the inner or cuticular surface of the cell arise numerous fine processes, which pass inwards for a considerable distance between the end-elements, sometimes stopping at the division between the outer and inner segments, sometimes reaching the external limiting membrane. These may be colourless or contain pigment-needles according to previous conditions as regards light and shade.

Externally each cell has a covering of neuro-keratin around the central protoplasm, which latter contains, besides the pigment, a substance called myeloidin by Kühne, very like, if not identical with, the medullary sheath of nerve-fibres. Sometimes, as in the frog, there is also a yellow oil globule. These cells have the function of restoring retinal purple, and this apparently independently of the pigment they contain.

A yellow spot is only possessed by man and monkeys, as the diffused pigment to which the colour is due is absent in other animals. A specialised area at or near the centre of the retina is found in all vertebrate classes, but it is not always in the form of a depression or fovea, so that the term area centralis is the more uniformly applicable one. The true fovea centralis is a pit-like depression in which the retinal ganglion becomes very thin and in which the rods are wanting, while the cones are much elongated
and thinned, especially so in some Fish and in Reptiles. Berger* describes a depression, which he calls the fovea centralis, as constant in occurrence in Fish at the entrance of the vessels of the vitreous. This observation is in support of Hannover's view that the fovea centralis in all animals is a rudiment of the fetal optic cleft.

In the Hippocampus† there is a slight depression on the inner aspect of the area centralis, but the retina is really thicker here than elsewhere, on account of the great length of the cones and pigment cells.

Among the Reptilia a very well-marked fovea is found in the chamaeleon. Hulke thus sums up the peculiarities of this part in the retina of the chamaeleon:—They "consist in the attenuation of the optic nerve, ganglionic granular layers and cone-fibre plexus, from its margin towards its centre, in the absence of these layers at the centre, in the great slenderness and length of the cones, in the deflection of the primitive cone-fibres, and of their continuation in the outer and inner granular layers from the centre towards the periphery; and in the maximum development of all the layers, excepting the bacillary, at successively increasing distances from the centre of the fovea in their order of superposition from the outer to the inner surface of the retina."

This description would apply almost equally well for the fovea centralis in man. Here the ganglion retinæ is quite supplanted at the deepest part of the pit. For some distance around it the layer between the outer limiting membrane and the outer molecular layer is very thick, due to the fact that the cone-fibres run obliquely to be connected with the bipolar median cells and through them with the ganglion cells, which are also bipolar in this macular region. On account of the great thickness of the layer of outer granules and ganglion cells, the retina is

† Carrière. "Die Sehorgane der Thiere," 1885, p. 57 and fig. 39.
considerably thicker around the fovea centralis than anywhere else. At the fovea the retina is not only concave on its vitreous aspect, but also outwards, and the space included between the outer and inner limiting membranes is thus rendered very narrow.

In Birds an area centralis is found at or near the middle of the fundus, and not uncommonly a second area of acute vision, known as the "red field," from the preponderance of red globule-cones, is found in the upper temporal part of the fundus. These latter serve frequently for binocular vision, as the image of an object lying in front and a little below falls at the same time on both red fields. Hence we can understand how birds avoid the extreme convergence that would be necessarily associated with near vision if they only possessed central acute areas; if we watch a hen, for example, picking up its food we recognise the absence of convergence. In the whole binocular visual field of a bird, consequently, there are three areas of distinct vision, viz., two central and one lower nasal. This accounts to some extent for their wariness, and for the side glance they often regard one with. Indeed, we can learn a great deal as to the presence or absence of an area centralis by the manner in which animals move their eyes: if they fix the object regarded, they must have a particular region of more accurate vision.

Besides the red globule-cones present in the red field of the bird, we have also orange and yellowish-green ones in the same area. The red ones are here, however, quite peculiar, in that they have not only a large red globule in the usual position, but also tiny red drops throughout the protoplasm of their inner segments, extending close up to the outer limiting membrane and principally collected in the outer part, viz., in the opticus ellipsoid.

The changes produced in the vertebrate retina by the action of light may be classified as: (1) Photo-Mechanical, (2) Photo-Chemical, and (3) Photo-Electrical.
(1.) a. The best known photo-mechanical change consists in a wandering of pigment inwards within the fine protoplasmic processes of the pigment-cells formerly mentioned. A short exposure to a bright light suffices to bring about a distinct wandering of the pigment, and the more refrangible rays seem to act most powerfully, the red rays least, and the yellow rays with an intermediate strength. There is still some doubt whether this change is purely due to the effect of light on the pigment granules, and is not induced by changes produced in the cell-protoplasm. According to Angelucci,* the processes do not change their position; but I am inclined to think they do, for the following reason. On examining the retina of a frog that had been kept in darkness, the pigment-epithelium was found loosely attached to the retina proper, and there was some difficulty in retaining it in position for examination. In a retina that had been exposed to light during life, on the other hand, the pigment epithelium adhered to the rods and cones, suggesting that their outer segments were in this instance more tightly grasped by the swollen and elongated processes. This protoplasmic movement may, however, be an indirect effect due to primary changes produced in the pigment granules. In favour of this view is an observation of Gradenigo,† that exposure to heat alone will induce the pigmentary changes. We may, therefore, readily understand that the pigment, by changing the light-energy into that of heat, may provoke protoplasmic movement, which will secondarily produce movement of the pigment particles. I find, in the frog, that it is the pigment-needles, not the granules, that wander, and they arrange themselves with their long axes parallel to the length of the processes.

* "Une Nouvelle Théorie sur la Vision" (trad.). Recueil d'Opht., 1885, p. 220.
† "Intorno all' influenza della Luce e del Calore sulla Retina della Rana," Padova. Stabilimento Prosperini, 1885. (See Ref. in Hoffmann's Jahresb. für 1885.)
As Engelmann has pointed out, this movement of the pigment can be produced by illumination of the surface of the body alone. This reminds us of the well-known alterations in the form of the contractile pigment cells of certain fish, amphibians, and reptiles induced by changes in illumination, though the effect is here different. Lister, to whom we are indebted for first directing attention to the contraction of these cells in the frog on exposure to bright light, regards the action as an indirect one, communicated by nerves, principally in the form of a reflex, from the eye. The reflex contraction of these cells may be regarded as similar to the reflex contraction of muscle-cells.

In this connection also may be mentioned the changes produced by light and shade on the arrangement of the chlorophyll in the cells of plants. From the experiments of Sachs, Frank, and quite recently of Moore,* this is due to the action of light on the protoplasm, and, like the changes in the retinal pigment, is induced particularly by rays of high refrangibility.

b. Recent observations of van Genderen Stort,† and Engelmann have made us acquainted with a second example of photo-mechanical action in the vertebrate retina, viz., a shortening of the inner segments of the cones under the action of light, and an elongation in darkness. On exposure to light, therefore, the outer segments are drawn towards the outer limiting membrane and away from the pigment cells, while in darkness the opposite movement takes place. This effect has been observed in the retina of all animals hitherto examined, viz., in Fish, Amphibians, Reptiles, Birds, and Mammals, including man. In frogs, fish, and pigeons the movement is particularly easily seen, and the contraction has been observed to be constant even on feeble illumination. The part which

moves actively is that which in its optical and chemical properties is like protoplasm, viz., the part of the cone between the ellipsoid and the cone-nucleus, and to this they give the name of “cone-myoid.” I would suggest that the peculiar form of the outer segments of the cones is associated with this action, in being such as will favour a rapid elongation into the pigment-cell in darkness.

All parts of the visible spectrum, on sufficient duration of exposure and strength of the illumination, can excite this reaction of the cones, as also of the pigment; like the pigment-cells, however, the cones also react most strongly to the more refrangible rays.

In the Bird, all cones are contractile, irrespective of the colour of the oil globule they contain. Since the same rays which are absorbed by the coloured globules act strongly in cones in which the globules lie at the junction of the outer and inner segments, but are nearly powerless in cones where they lie scattered throughout the inner segment (as in some of the elements of the so-called “red-field” of the bird’s retina), it follows consequently that the locality of the primary irritation lies in the inner segment itself.* In the case of all coloured globule-cones, however, I would remark that the pigment-cells will only be exposed to the transmitted rays, and I would suggest that in this way they will have an influence upon the total light-effect produced, as I shall endeavour to show later.

(2.) a. Photo-chemical action is illustrated by the bleaching of the retinal purple in the rod outer segments on exposure to light,—and by its re-secretion in the pigment-cells, especially in darkness.

In the case of some fish, e.g., the Bream, this process can be observed during life, from the fact that the fundus

is white, due to the presence in the pigment epithelium of an opaque, chalky material called guanin.* Here it is bleached very gradually during life, taking at least 20 minutes of exposure to direct sunlight, while it is regenerated after about an equal interval of time.

During the bleaching process the visual purple is first converted into a substance named by Kühne "visual-yellow," which in turn is further changed into "visual-white."

All visible light decomposes it, but, intensity remaining the same, at very different rates. "The entire beam of white light is the best transformer of visual purple—better than light of any particular wave-length." It is seemingly only acted on by the visible spectrum, and "of all the visible rays, those bleach the visual purple most freely and quickly which the visual purple in solution most effectually quenches. Thus the order of activity is yellowish-green, green, blue, greenish-yellow, yellow, violet, orange, and red."† "Rays of such wave-lengths as rapidly convert visual purple into visual yellow, act most slowly on the latter: those which most easily change the visual-yellow into visual-white, and which are most readily absorbed by the visual-yellow, have, as a rule, a weaker action on the visual purple itself."‡

It is of course not essential to vision, as it does not occur in the cones, and the more recent researches on this subject have rendered exceedingly doubtful its having any real connection with either ordinary vision or colour perception. I would suggest that its function is probably to protect the pigment epithelium from too rapid exhaustion where great activity is unnecessary, i.e., away from the visual axis.

It is important to remark that it is absent or feebly

† Gamgee. "Physiological Chemistry."
‡ Kühne on Retinal Purple. Transl. by Michael Foster.
developed in birds where coloured oil-globules exist in the cones, and that these globules are also bleached by exposure to light. They possibly serve in a similar manner to protect the pigment-cells from too great an action of certain rays, viz., of those absorbed by the oil-globule in question.

b. Another photo-chemical effect on the retina that is as yet very imperfectly known, will I think ultimately prove to be of much importance, viz., the alteration in the reaction of the contents of the pigment-cells due to light-exposure. This seems to be an oxidising process, accompanied by the substitution of an acid for a previously alkaline reaction.

(3.) From the investigations of Holmgren, Dewar and McKendrick,* and more recently of Kühne and Steiner† and of Chatin,‡ it has been conclusively demonstrated that the action of light upon the retina is accompanied by an increase of the normal electrical current passing inwards along the optic nerve to the brain.

This action was found by Dewar and McKendrick in many vertebrates, high and low, and also in Crustacea; Chatin has in addition proved its existence in Molluscs.

Different parts of the spectrum produce different amounts of increase, the yellow rays having the greatest power. From this part of the spectrum we have a gradually diminishing action on either side until we reach the ultra-red rays on the one hand, or the ultra-violet on the other, when it is found that no change whatever is produced in the electrical current by these non-luminous waves.

Cohn, again, in his experiments on the furthest limits

of colour-perception, finds that a yellow spot is seen to be bright at the greatest distance: the order of greatest distance of visibility in sunlight is 1, yellow; 2, orange; 3, green; then 4, red, blue, and violet with the same greatest distance. Nettleship, from his investigations conducted in daylight, came to very similar conclusions. Now this order of visibility is exactly what we would expect from the action of those different wave-lengths in influencing the electrical current: the middle of the spectrum is most powerful, and the extremities are least so.

It would appear, therefore, on comparing these series of investigations, as if the amount of the afferent electrical current were coincident with changes in the visual centre associated in our consciousness with impressions of colour.

From all the foregoing known facts regarding light-percipient organs, I would draw the following main general conclusions:

1. That all light-percipient cells are modifications of epithelial cells, or developed from the same embryonic layer which forms them.

2. That the ends of these cells corresponding to the cuticle have generally cuticular structures formed in the shape of rods.

3. That the opposite ends of these cells are either directly continued as nerve-fibres, or are connected with ganglion cells, and ultimately with nerve-fibres.

4. That pigment is practically always present, either in the light-percipient cells or in close connection with them. Exceptions exist where a tapetum is present, and in the rare albino individuals having eyes of high types, but then non-pigmented cells always exist, which are evidently capable of performing similar functions to those of the pigmented cells, though in a minor degree.

5. That all forms of vegetable and animal protoplasm sensitive to light are acted on by the shorter waves corre-
sponding to the violet end of the spectrum, and that the same holds good in a marked degree in the case of all those light-percipient cells as yet known to act to light.

6. That the property of phototaxis is universally influential in the manner in which these cells arrange themselves, and in the direction in which they contract on exposure, i.e., parallel to the incident light in both cases. When the cell is free, as in the Euglena and Zoospore, this effect exhibits itself in free phototactic motion, while in the case of attached retinal cells it shows itself in contraction towards the incident light, i.e., in positive phototactic movement. The Euglena may thus be looked upon as somewhat similar to a red globule-cone in birds as regards its action to light.

7. That the pigment-cells have evidently the property of secreting chemical fluids according to their exposure to light and shade, and that the pigment contained in them is doubtless of service as being light-absorbent, and thus aiding a rapid transformation of light-energy into protoplasmic action.

8. That the result of the action of the secretion of the pigment-cells on the segments of the light-percipient cells may be demonstrated by the electrical current produced.

9. That seemingly the strength of this current depends upon two factors, viz. :—1, the activity developed in the pigment-cell under the action of light, and 2, the depth to which the cone is embedded in it, i.e., the extent of surface exposed to its action.

10. That in the case of vertebrates at least, this resultant current is greatest on exposure to yellow light, i.e., to visible waves of medium length and refrangibility.*

11. That differences in the action thus produced, and

* Thus in the case of exposure to violet rays the action of the pigment-cell is greatest, but the contraction of the cone is also greatest, so that a relatively small portion of it is exposed to the action of the pigment-cell. In the case of red light the contraction of the cone-myoid is least, but the action in the pigment-cell is also least, so that although a large area of the cone is embedded in the pigment-cell the total effect is relatively small. In the case
consequently in the nerve-current transmitted to the visual centre, are associated in our minds with sensations of differences in colour.

12. That as regards the stationary rods, the action induced will probably depend upon the amount of destruction of retinal purple, and the consequent demand upon the pigment-cell. As this action is known to depend more on intensity or wave-height than on wave-length, it is improbable that the rods have any higher function than that of transmitting impressions which will be appreciated in our conscious centres as variations in light-intensity.

13. The function of the retinal purple is probably mainly to protect the pigment epithelium from too great exposure, and thus to modify its secretion and its action on the end-organs embedded in it. Were the peripheral area of the retina not defended in this manner, strong lateral illumination would have an unnecessarily great and confusing effect. It must be borne in mind that the retinal purple is constantly being regenerated in the living retina during exposure to diffused light at any rate. The result of its presence may therefore be compared with that of tinted glasses, viz., preventing too great a light-action on the pigment-cells.

of yellow light, the action on the pigment-cell is considerable, and the contraction of the cone-myoid not sufficient to prevent much of the cone being embedded in the pigment and acted on by it, so that the total resultant effect is great.
CONCOMITANT CONVERGENT STRABISMUS.

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This communication must be read only in conjunction with our previous article on this subject in the last Part of these Reports, since the preliminary steps in our investigation are there described.

In this essay we have tabulated a number of facts obtained from methodic clinical investigation, and have formulated some principles which may be deduced from those facts.

We may say that in every case in which a statement of the refraction is made it represents the results obtained by retinoscopy under atropine or homatropine and cocaine. Subjective methods throughout have been discarded as much as possible.

We regard strabismus cases as alternating only when the patient squints with each eye indifferently. Those cases in which, notwithstanding excellent vision and power of fixation, the patient squints with one eye habitually, we exclude from the category of alternating cases.

I. Possibility of Alteration of Vision in the Squinting Eye.

—We obtained the distant vision in the squinting eye after accurately correcting the refraction. The fully correcting glasses were then prescribed, and were worn by the patient for months or years. The distant vision was then again tested. The following table gives the results obtained:—
<table>
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<tbody>
<tr>
<td>1</td>
<td>From $\frac{6}{36}$ to $\frac{6}{24}$.</td>
<td>7 months ..........</td>
<td>Cured $3^\circ$ in. ..........</td>
<td>Uniocular.</td>
<td></td>
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<tr>
<td>2</td>
<td>Nil .................</td>
<td>3 months ..........</td>
<td>Improved from $40^\circ$ in to $12^\circ$ in.</td>
<td>Uniocular.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>From $\frac{6}{60}$ to $\frac{6}{36}$.</td>
<td>9 months ..........</td>
<td>Improved from $35^\circ$ in. to $25^\circ$ in.</td>
<td>Uniocular ..........</td>
<td>The other eye was covered and eserine was frequently applied to the squinting eye for some months.</td>
</tr>
<tr>
<td>4</td>
<td>From $\frac{6}{12}$ to $\frac{6}{6}$.</td>
<td>2 years ..........</td>
<td>Improved (alternate strabismus).</td>
<td>Uniocular.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Nil .................</td>
<td>6 months ..........</td>
<td>Cured $0^\circ$ ............</td>
<td>Binocular.</td>
<td>The healthy eye was covered up several times, but the patient fell over chairs, &amp;c.; was quite unable to see.</td>
</tr>
<tr>
<td>6</td>
<td>Nil .................</td>
<td>12 months ..........</td>
<td>Improved from $28^\circ$ to $13^\circ$.</td>
<td>Unioocular ..........</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Nil .................</td>
<td>6 months ..........</td>
<td>Cured $0^\circ$.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Nil .................</td>
<td>5 years ..........</td>
<td>Cured $0^\circ$.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Nil .................</td>
<td>9 months ..........</td>
<td>Improved by glasses and tenotomy from $35^\circ$ to $25^\circ$ to $10^\circ$.</td>
<td>Uniocular.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Nil .................</td>
<td>12 months ..........</td>
<td>Cured $0^\circ$.</td>
<td>Uniocular.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Nil .................</td>
<td>14 months ..........</td>
<td>Cured $5^\circ$.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Nil .................</td>
<td>16 months ..........</td>
<td>Cured $0^\circ$.</td>
<td>Binocular.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Nil .................</td>
<td>12 months ..........</td>
<td>Cured $0^\circ$.</td>
<td>Uniocular.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Nil .................</td>
<td>4 months ..........</td>
<td>Cured $0^\circ$.</td>
<td>Uniocular.</td>
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We have included in the foregoing table one case of alternating strabismus (4) in which the vision in one eye was less than in the other.

Of the 14 cases recorded, in 11 the constant use of glasses failed to effect any improvement whatsoever in periods varying from 3 months to 5 years, although in these 11 cases the squint was cured in 8 cases and improved in the other 3, and also although the resulting vision was binocular in 2 of the cured cases.

In the other 3 cases, including the alternating cases, some improvement in distant vision resulted.

Thus glasses which produced great improvement in vision in the other eye, and even re-established binocular vision, absolutely failed to improve the vision in the amblyopic eye. Therefore this evidence tends to show that in cases of concomitant convergent strabismus treatment is of value chiefly for cosmetic purposes.

In so far as we are aware there is no definite evidence to show that valuable improvement in the vision of the amblyopic eye ever takes place under any circumstances. At all events, as just demonstrated, the means we adopted totally failed to produce it.

It seemed to us, however, that much of the alleged faulty vision in such eyes might be due to errors of refraction, particularly as the squinting eye is so frequently astigmatic (vide "Refraction in (Concomitant) Convergent Strabismus," p. 10). We accordingly obtained the distant vision in those eyes, then worked out the refraction by retinoscopy under atropine or homatropine and cocaine, and retested the vision with the correcting glasses, with the following result:—

II. Average distant vision in 78 amblyopic eyes in cases of concomitant convergent strabismus without glasses = between $\frac{6}{60}$ and $\frac{6}{36}$.

Average vision in the same 78 eyes after full correction in the manner indicated = between $\frac{6}{36}$ and $\frac{6}{24}$. 
In 41 cases, however, the correction did not produce any appreciable alteration, so that in the remaining 37 cases the improvement in vision effected by the glasses was about two points, from \( \frac{6}{60} \) to \( \frac{6}{24} \).

In 19 cases the vision was less than \( \frac{6}{60} \) after full correction.

In 3 cases before correction the vision was more than \( \frac{6}{12} \).

In 8 cases the vision after correction was more than \( \frac{6}{12} \) — \( \frac{6}{12} \) in one case, \( \frac{6}{9} \) in two, and \( \frac{6}{6} \) in five.

In the light of subsequent investigation it became interesting to see whether there was any special cause for the retention of such excellent vision in these cases. Inquiry showed that in 6 no special cause could be assigned, but that in 2 the squint appeared late in life—in one at six and a half, and in the other at nine years of age. These cases cannot be regarded as cases of alternating strabismus, because, although the power of fixation was excellent, the individual habitually squinted with the one eye only.

The varying amount of vision in these 8 cases before and after correction with glasses reminds one that the use of the term amblyopia must be quite relative. The vision may be \( \frac{6}{9} \) and the eye yet be amblyopic.

In these 8 cases—
CONVERGENT STRABISMUS.

We endeavoured to find out whether squint is to any extent hereditary, but prior to referring to this point we must state our experience relative to its existence in more than one member of a family.

III. Of 87 cases in which we were able to make careful inquiry for the existence of strabismus in the brothers or sisters of the squinting patient.

In 62 the patient appeared to be the only member affected, the average number of persons in each family being 5.

In 25 cases more than one member was affected. In these cases the average number of persons in each family was 6. 53 individuals squinted, or rather more than 2 per family.

Thus in the great majority of cases, but a small percentage of persons squint in any one family; exceptional cases we have met with where 2 members in a family of 2, or 3 members in a family of 5, have been affected.

IV. We carefully inquired as to the existence of strabismus in the parents or parents’ families in 77 cases with the following result:—

In 55 (71 per cent.) of the 77 cases a negative reply was returned.
In 22 (29 per cent.) a definite affirmative reply was obtained.

The details of these 22 cases were as follows. In 8 the parents themselves squinted; in 3 the father alone; in 2 the mother alone; in 3 the father, and 2 members of his family.

In the remaining 14 cases, other relatives than the parents squinted: viz., in case (1) the grandmother; in case (2) an uncle; in case (3) a paternal uncle; in case (4) 16 members of the father's family stated to have squinted, but the father himself did not; in case (5) 1 member of father's family (8 in number); in case (6) 2 members of father's family (9 in number); in case (7) 1 member of father's family (6 in number); in case (8) 2 maternal aunts (family 8 in number); in case (9) 1 member of father's family (7 in number); in case (10) 2 maternal uncles; in case (11) 2 maternal uncles; in case (12) paternal aunt; in case (13) maternal cousin; in case (14) maternal uncle and grandfather.

In these cases, no member of the family squinted other than those specified, so that, although in most cases hereditary transmission can be negatived in a fair number of cases, the evidence seems fairly conclusive as to transmission.

But the following case furnishes absolutely convincing evidence of the possibility of transmission.
A man who squinted married woman who did not squint.

Large family of children of whom

One daughter who squinted married a man who squinted

Seven children of whom two squinted

a man who did not squint married a daughter who did not squint

Ten children of whom three squinted

One of these, a daughter, married a man who did not squint

Two children, both of whom squint.
The singular interest of this case lies in the fact that two squinting people marrying, did not produce a large percentage of squinting children. In other words, it seems as if it is not the squint which is transmitted, but the liability to develop it: that is to say, it requires a special conformation and special exciting circumstances to develop it.

We endeavoured to find whether amongst the families of those who squint, we could find persons possessing amblyopic eyes, but who did not and never had squinted. In fact, we attacked the question, Is squint a result of congenital amblyopia?

V. In 22 families in which we personally examined the vision and eyes of parents, and in which at least one child squinted, we found two in which one parent was amblyopic. In one case the mother was amblyopic, and two of her children squinted (case C). In the other case the father was amblyopic. Then we examined in the same way the members of 23 families each of which contained at least one squinting individual. In most cases we examined all the members, and estimated their refraction if necessary.

Of these, in 20 families no amblyopia existed. In two cases, just referred to, there was parental amblyopia. In one case a brother was amblyopic.

These figures therefore enable us to state that this congenital amblyopia is not frequently present in the families of those who squint.

VI. We endeavoured to ascertain the age at which the patients began to squint and obtained the following results:

In 195 cases (including alternating strabismus), the average age at which it began was 3-4 years.

In 36 cases it appeared during the first year of life. In 34 cases it appeared later than the fifth year, and in 3 cases beyond the 10th year. Of these 34 cases, no less than 10 were cases of alternating strabismus in which the
vision in each eye was excellent, and 5 were produced by corneal ulcers or inflammation. Of the remaining 19 the vision taken in 17 after correction with glasses averaged \( \frac{6}{18} \), in 4 cases being \( \frac{6}{9} \) or more.

These facts are of great importance; from them it is obvious—

(1.) That good vision in the squinting eye is retained usually in cases of strabismus in which the disease appears later in life than usual (i.e., after 5 years of age).

(2.) That many of the cases which begin late in life are cases of alternating strabismus in which excellent vision exists in each eye.

(3.) That in a fair number of these cases of late origin, the extinction of vision by nebulae seems to cause the strabismus to appear.

VII. The causes for strabismus assigned by the patients or friends were as follow:—

- Pertussis, 23.
- Teething, 19.
- Measles, 16.
- Falls, 8.
- Fits, 5.
- Fright, 4.
- Bronchitis, 2.
- Hemiplegia (infantile paralysis?) 2.
- Scarlatina, 1.
- Inflammation of the eye, 1.
- Inhalation of chloroform, 1.
- Typhoid fever, 1.
- Rötheln, 1.
- Nil, 27.

Total, 111 cases.

The usual statement was that the child was attacked by one of these diseases, and that during convalescence they observed the strabismus for the first time.
Special Cases of Strabismus.

(A.) T. L., æt. 8. Right convergent strabismus which was first noticed at 6 years of age. R. V. = $\frac{6}{6}$ Hm. 2 D. L. V. = $\frac{6}{6}$ Hm. 2 D. Here no deterioration of vision has occurred.

(B.) S., æt. 17. Right convergent strabismus which was first noticed at 3 years of age. Has never worn spectacles. R. V. = $\frac{6}{36}$ c. sph. + 2.5 D.Cyl. − 4 D. V. = $\frac{6}{6}$. L. V. $\frac{6}{9}$ Hm. 2.5 D. = $\frac{6}{6}$.

Here the squinting eye has been functionally amblyopic for 14 years. Why has no deterioration of vision occurred?

(C.) Case in which the mother was amblyopic and two of her children squinted (6 in family). Mother æt. 35. R. V. = $\frac{6}{24}$ c. sph. + 2.5 D.Cyl. + 0.5 D. V. = $\frac{6}{24}$. L. $\frac{6}{6}$ Hm. 1.5 D.

Father æt. 39. R. V. = $\frac{6}{6}$ Hm. 0.75 D. L. V. = $\frac{6}{6}$ Hm. 0.75 D.

One child æt. 10. Right convergent strabismus. R. V. = $\frac{6}{60}$ c. sph. + 2.5 D.Cyl. + 3 D. $\frac{6}{36}$ L. V. Hm. 1 D. = $\frac{6}{9}$.

Another child æt. 4. Right convergent strabismus. R. V. = $\frac{6}{36}$. L. V. = $\frac{6}{9}$. By retinoscopy both eyes were hyperopic and astigmatic, but could not be worked out.

This case is extremely suggestive. The transmission of errors of refraction and amblyopia on the right side being especially worthy of note.

Our next endeavour was to obtain information relative to strabismus caused by or co-existent with corneal nebulae.
Cases of Concomitant Convergent Strabismus in which Central Corneal Nebula existed in the Squinting Eye.

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<tr>
<td>1</td>
<td>Convergent right.</td>
<td>R. H. 3·5 D.</td>
<td>20° in.</td>
<td>Central ulcer at four years of age.</td>
<td>In eight months' constant use of glasses reduced to 8° in.</td>
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<tr>
<td></td>
<td></td>
<td>L. H. 3·5 D.</td>
<td></td>
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| 2   | Convergent left.  | R. V. = \[
\frac{6}{6}
\] Hm. 2 D.       |                      | Ophthalmia in childhood. | Cured by tenotomy of left internal rectus. |
|     |                   | L. V. = < \[
\frac{6}{60}
\]             |                      |                 |                     |
| 3   | Convergent right. | R. V. = < \[
\frac{6}{60}
\]   | 20° in.              | Ophthalmia in childhood. | Glasses failed to improve. Tenotomy of right internal rectus reduced to 7°. |
|     |                   | L. V. = \[
\frac{6}{6}
\]                 |                      |                 |                     |
| 4   | Convergent right. | R. V. = \[
\frac{6}{60}
\] Hm. 2·5 D. = \[
\frac{6}{60}
\] | 50° in.              |                   | Glasses reduced to 5° when worn, 12° when not worn, in 12 months. |
|     |                   | L. V. = \[
\frac{6}{18}
\] Hm. 2·5 D. = \[
\frac{6}{12}
\] |                      |                 |                     |
<p>| 5   | Convergent left.  | R. sph. + 4           | 10° in.              | Ophthalmia after measles. | Reduced to 8° by glasses in 12 months. |
|     |                   | cyl. + 2 D.           |                      |                 |                     |</p>
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<tr>
<th></th>
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<th>L. sph. + 4 D.</th>
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<tbody>
<tr>
<td>6</td>
<td>Convergent left.</td>
<td>R. + 7·5 D.</td>
<td>20° in.</td>
<td></td>
<td>In five months reduced by glasses to 0°.</td>
</tr>
<tr>
<td>7</td>
<td>Convergent left.</td>
<td>R. V. = ( \frac{6}{12} ) Hm. 0·5 D. ( \frac{6}{6} ) L. V. = ( \frac{6}{60} ) - 5 D. = ( \frac{6}{60} ).</td>
<td>10° in.</td>
<td>Ophthalmia after measles at four years of age.</td>
<td>In 12 months reduced by glasses to 5°.</td>
</tr>
<tr>
<td>8</td>
<td>Convergent right.</td>
<td>R. V. = ( \frac{6}{60} ) sph. + 3·5 D. = ( \frac{6}{6} ) L. V. = ( \frac{6}{60} ) sph. + 4 D. = ( \frac{6}{9} ).</td>
<td></td>
<td>Ophthalmia after measles at four years of age.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Convergent left.</td>
<td>R. V. = ( \frac{6}{6} ) Hm. 5 D. L. V. = ( \frac{6}{60} ) not improved.</td>
<td>30°.</td>
<td>Phlyctenules.</td>
<td>Reduced by glasses to 18° in one day.</td>
</tr>
<tr>
<td>10</td>
<td>Convergent left.</td>
<td>R. sph. + 2 D. ( \frac{6}{6} ) cyl. + 1.5 D. L. sph. + 3 D. ( \frac{6}{6} ) cyl. + 3 D.</td>
<td></td>
<td>Uleers.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Convergent left.</td>
<td>R. V. = ( \frac{6}{6} ) Hm. 4·5 D. L. V. = ( \frac{6}{60} ) Hm. 4 D. = ( \frac{6}{60} ).</td>
<td></td>
<td>Interstitial keratitis.</td>
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The point worthy of note in connection with these cases is simply that binocular vision without squint in highly hyperopic eyes was presumably procured by an effort until disease blotted out vision in one eye. Convergent strabismus immediately occurred.

It will be observed that these cases were just as amenable to treatment as ordinary cases, perhaps more so.

The Causation of Strabismus.

The first question which requires answering is the vexed one, Is the amblyopia the consequence or the cause of the strabismus? The facts as we have elicited them are mostly these:—In the great majority of cases of concomitant strabismus (excluding alternating cases) the amblyopia is irremediable. Correction with glasses, prolonged monocular use of the amblyopic eye, cure of the squint and even the re-establishment of binocular vision, all fail to produce any valuable improvement in vision, often to produce any improvement.

In a considerable number of cases other members of the family of the squinting patient, or of the parents’ families, are also affected with strabismus.

In very few cases, however, do members of the patients’ or the parents’ families possess non-squinting amblyopic eyes. An examination of the list of cases of strabismus which began after five years of age shows that it contains:—

(1.) A large proportion of cases of alternating strabismus in which the vision in each eye is excellent.

(2.) Cases in which the vision in the squinting eye had been impaired by corneal nebulae.

(3.) Ordinary cases in which the distant vision in the amblyopic eye was much better than it usually is in the other cases.

These facts suggest strongly that it is only at a very early period of life that the amblyopia is capable of being
produced. That is to say, we must regard the amblyopia as being due not to a deterioration of vision but to a failure of development.

It becomes a question whether such a thing as deterioration of vision after its acquirement ever occurs; attempts to find such cases seem to have failed. There seems to us to be no reason why vision should deteriorate once the visual sense is educated. But it is probable that in these amblyopic cases there is failure to educate the visual sense at the only time in life when the education is possible, viz., when the sense in the other eye is being acquired.

Against this theory of the causation of the amblyopia such cases as Case B may be referred to in which functional amblyopia had existed in a squinting eye since three years of age, without real amblyopia. Practical suppression for fourteen years, beginning at such an early age had not prevented visual education taking place.

*Is the Amblyopia ever the Cause of the Strabismus?*

If this were the common mode of origin we should expect to find many more amblyopic people, i.e., people who had escaped squinting; and we should certainly expect to find such people in the families of those who squinted.

But although we found many persons who squinted in such families, in only three out of 22 families was any amblyopia discoverable.

In one case (C) the evidence is exceedingly strong; an amblyopic mother had two children who squinted. Such a case is strongly suggestive of this mode of production of strabismus, but the case is isolated.

The notes of the cases of nebulae show with what readiness squint may be produced if the vision is destroyed or materially impaired, provided that the eyes be sufficiently hyperopic, and there is no doubt that this theory would render many circumstances much more intelligible. Yet in the great majority of cases one is forced
to believe that the amblyopia is produced as a consequence of the squint. A minority of cases of amblyopia are probably congenital in origin, and the amblyopia in these cases probably determines the development of the strabismus.

It seems that the existence of hyperopia is almost essential for the development of squint; and that astigmatism, or irregularities of refraction, frequently exist in the squinting eye. These latter conditions are found so early in life that the explanation of their presence on the ground of arrested development from disuse must be rejected, and one must believe that in many cases they are causally related to the strabismus.

It further seems probable that diseases such as pertussis may determine the development of strabismus. Yet after the enumeration of every possible cause there remains something which cannot be explained—a “further something” which determines the presence of strabismus in one case and the absence of which negatives the presence of the strabismus in an exactly similar case in all other respects. That this something is transmissible seems probable from the records of our cases. We hope to say more of this in a later communication.

The Influence of Atropine on Concomitant Convergent Strabismus.

There has existed apparently a belief amongst ophthalmologists that the instillation of atropine in cases of concomitant convergent strabismus causes diminution in the amount of convergence. We had ourselves noted a fair number of cases in which it either produced the reverse, or no effect at all, and we therefore investigated the matter.

We measured the angle of convergence in a number of cases of strabismus, then administered atropine to both eyes for several days until complete mydriasis and paresis of accommodation was produced and then remeasured the angle. The following result was obtained. Of 38 such
cases the angle remained unaltered in 11, was increased in 11, and diminished in 16. Thus the strabismus was improved in only 16, or 42 per cent., and was actually worse in 11, or 29 per cent. In these 11 cases the average deterioration was 9°, the maximum being 20°. In the 16 cases the average improvement was 16°, the maximum being 30°.

Of 6 cases of alternating strabismus, in 2 no alteration took place, in 2 there was improvement, and in 2 deterioration.

We next endeavoured to ascertain whether the effect produced by atropine is of any service in prognosticating the effect of the constant use of glasses during periods of 3 to 18 months. Of 4 cases in which atropine increased the strabismus, in 3 the use of glasses failed to produce any improvement. In the fourth case the angle was reduced from 30° to 8° whilst the glasses were worn, and to 15° when they were removed. Of 6 cases in which atropine produced no alteration the use of glasses effected material improvement in only 3. In these the average improvement was 15° whilst the glasses were worn and 12° when they were removed.

Of 5 cases in which atropine improved the strabismus the use of glasses produced material improvement in every case. The average improvement was 16° whilst the glasses were worn and 16° when they were removed.

Thus it seems that the use of atropine in a fair number of cases produces a considerable diminution in the angle of convergence. In the majority of cases, however, it fails to do so and in some cases produces an increase in the angle.

It is also apparent that if the use of atropine effects much temporary improvement, the use of glasses will produce permanent improvement. On the other hand, if atropine fails to improve, one cannot say that the use of glasses will be ineffectual as a mode of treatment, but in such cases improvement does not follow so frequently and is not so great as in the other cases.
TWO CASES OF TUBERCULAR DISEASE OF THE EYE.

By J. B. Lawford,

_Late Curator of Museum._

Case 1.—Daisy J., æt. 12 months, was admitted to the Royal London Ophthalmic Hospital under Mr. Couper's care, on May 11, 1885, and underwent enucleation of the right eye on the following day.

_Family History._—Father and other members of his family are all healthy. Mother very delicate, suffers from winter cough. A maternal aunt died of phthisis. The patient is the first child; there have been no miscarriages. She has been a weakly child, and the father calls her "ricketty;" has been bottle-fed since she was a month old. She has had no acute or serious illness.

Three weeks before the date of admission, the parents noted that the child's right eye was bloodshot, but thought nothing of it for about a week, when the eyelids began to swell and the cornea looked a little hazy. The child did not seem to be in pain. There had been, so far as was known, no injury to the eye.

Unfortunately no record was kept of the appearances of the eye at the date of operation.

_Examination of the Eyeball after Removal._—Globe partially collapsed, the sclerotic having been cut during the operation. At the upper part, closely attached to the outer surface of the sclerotic, is a dirty grey ragged mass, which overlaps the upper margin of the cornea. The tissues about the insertion of the superior oblique and superior rectus muscles are matted by inflammatory exudation. On section of the eyeball, it is evident that the mass at the upper part is directly continuous through a breach in the sclerotic with the material in the interior of the eye. The gap in the sclera is 6 mm. from the corneal margin.

The cornea is clear, the iris close against its posterior surface. The lens, which is clear, is displaced forwards, pushing the iris in front of it.
The entire cavity of the eye posteriorly to the lens is occupied by a soft spongy material, of a muddy grey colour and varying in consistence, very soft in its central part, but denser towards the periphery. It forms a bed in which the crystalline lens lies. To the naked eye no trace of the retina can be distinguished, but a layer of about three times the normal thickness of the choroid lines the sclerotic, and is in the greater part of its extent fairly well differentiated from the softer material internal to it. Close to the optic nerve, however, this layer is continuous with the central mass; and at the upper part passes through the opening in the sclerotic to its outer surface. This layer, which is evidently the altered choroid, is yellowish in colour, and apparently contains very little pigment.

The iris is but little altered, being perhaps slightly thicker than normal. The ciliary body, on the other hand, is much changed, and the ciliary processes only here and there recognizable; at the upper part they are directly continuous with the mass behind the lens.

After hardening in weak and subsequently strong spirit the eye was examined microscopically, sections being made of several different parts. As a result of this examination, I came to the conclusion that the changes were of tubercular character. The choroid is everywhere greatly thickened and infiltrated with small cells; it is almost entirely devoid of pigment; in some places anteriorly, portions of the hexagonal pigment epithelium remain adherent to its inner surface, but in general this layer is entirely destroyed.

Close to the ora serrata, portions of the retina are distinguishable; elsewhere this tunic has entirely disappeared. The portions referred to are greatly infiltrated with small cells, and the vessels are dilated and full of blood. This part of the retina is very closely adherent to the mass in the vitreous chamber.

This mass which represents vitreous and retina contains in its peripheral part large numbers of small round cells, many of which are possibly the remains of the retinal granules; in its central part there are fewer cells, the structure being indistinctly fibrous.

The iris is thickened and infiltrated, and firmly united to the
anterior lens capsule by a thin layer of new tissue full of lymphoid cells. The cornea shows no changes. The portion of optic nerve removed is inflamed; close to its temporal side, and outside its sheath, is a little nodule composed of small cells and connective tissue. The optic nerve sheath is not dilated.

Throughout all the affected tissues of the eyeball there are numerous very typical giant cells, from many of which processes can be traced, and round which a fine network containing small cells exists. There are also many areas of degeneration in which nothing but a granular structure can be made out, and some of which are scarcely at all coloured by the stains employed, while others stain darkly but diffusely. These appearances are so characteristic, that I felt sanguine that I should be able to detect the Bacillus tuberculosis in the tissues, either in the eyeball or in the mass attached to the sclerotic above. In my notes of the case made in 1885, I find a statement that bacilli were detected in the grey mass from the interior of the eyeball, and I remember being satisfied in my mind that I had obtained this additional proof of the nature of the disease. However, being unable to find the slides I then made, I have again at this date (June, 1888) examined portions of the choroid, the vitreous, and the nodule on the outer surface of the sclerotic for Koch's bacillus, with an entirely negative result. Mr. E. T. Collins, the present Curator of the Museum, has also kindly stained and examined several sections for me, but could find no bacilli. Thus it seems doubtful if my previous observation was correct. The specimen has been in alcohol during the interval, and the other microscopic appearances are as characteristic now as they were in 1885.

The after-history of this case is important, and I have been able to hear of the child's condition at intervals since the operation. Her health improved decidedly soon after the removal of the eye, and the child has been since, and is now (June, 1888, three years after the operation), in perfect health.

The mother died of acute phthisis in October, 1885.

Case 2.—Rosa W., æt. 8 months, was admitted to the Royal London Ophthalmic Hospital, under Mr. Gunn's care, on
March 2, 1887, and an iridectomy was performed upon the right eye, for the purpose of removing two small nodules, thought to be tubercular. These nodules were about the size of a pin's head, one rather larger than the other. Microscopic examination of the larger nodule stained and teased, revealed a small celled growth with occasional fine strands of connective tissue. No giant cells were found.

No positive opinion as to the nature of the growth could be given.

On May 4 the swelling of iris and cornea was noted to have increased since last examination.

Two weeks later, on May 17, the child was admitted to the Hospital for Sick Children, Great Ormond Street, under the care of Mr. Gunn, to whom I am indebted for the following notes of the case, and for the specimen.

History.—The patient's father died of acute phthisis seven months ago. The mother is in good health. Patient is the fourth child, and was born at full term. She has been weakly and ailing since she was a month old. Has been bottle-fed.

It is not certain for how long the mother had noticed anything the matter with the child's right eye. There has been discharge from both ears for some months, and a "breaking out" on scalp and ears.

On Admission the child was badly nourished; but presented no good evidence of hereditary syphilis. Protruding through the inner part of the right cornea was a fungating mass springing apparently from the iris.

Although the child had had for some time antisypilitic and tonic treatment, her condition had steadily deteriorated, and the growth in the right eye had increased.

May 31. Right eye enucleated.

The patient improved after the operation, was less restless, and took food well.

She left the Hospital on June 11, and efforts to ascertain the subsequent history of the case have proved unsuccessful.

The eyeball was carefully hardened whole in Muller's fluid, and then divided into two lateral halves for examination.

Naked Eye Examination.—The eyeball is somewhat shrunken, measuring 17 mm., transversely and vertically. The cornea is thickened; at its inner and upper part near
the periphery is a large perforation, probably the site of the incision for iridectomy, through which protrudes a greyish irregular mass, continuous with the iris and ciliary body (vide Pl. II, Fig. 2). The iris is enormously but unequally thickened in its whole extent. The thickening is greatest in the lower part, and here the A.C. is almost entirely obliterated. The new growth to which this thickening is due involves the ciliary processes, so that at the lower part they are quite unrecognisable; at the upper part, however, though swollen and altered in shape, they are still distinguishable. The lens has disappeared, but traces of the capsule are visible.

The vitreous is rather too firm, and unusually adherent to the retina, otherwise there are no changes observable in the posterior part of the eyeball.

*Microscopical Examination.*—The new growth which involves, and to a great extent replaces, the iris, exhibits the usual histological characters of tubercle, very well marked. The giant cells are numerous and large, and are visible in sections of the iris, ciliary body, and the prolapse through the cornea. The small cells which form the larger part of the growth extend posteriorly as far as the hinder limit of the ciliary processes.

There are several areas of necrosis to be seen in the sections.

The pigment layer of the iris and ciliary processes is to a large extent destroyed, though traces of it remain, and are in some places included in and surrounded by the new growth.

The choroid coat, posterior to the ciliary processes, shows scattered islands of small cell accumulation, but there is no general thickening or infiltration. The optic nerve close to the eyeball shows a slight increase of staining nuclei; the papilla is a little swollen, and close to one of the large branches of the central artery is some small cell accumulation in the nerve fibre layer. The retina generally appears healthy, but anteriorly, close to the ora serrata, has undergone some alteration, the innermost layers, down to and including the inner granules, being irregularly thickened and infiltrated with lymphoid cells. From this portion of the retina small new vessels pass inwards into the anterior part of the vitreous, which here shows a moderate amount of cell infiltration; this, however, is confined to the anterior part. The lens capsule is adherent to the iris; the lens itself has entirely disappeared.
The cornea close to the site of perforation is much thickened; the new growth continuous with that of iris and ciliary body extends completely through it, but the cells are also invading the cornea at the margins of the perforation, passing in between the lamellæ for a short distance, and to a greater extent between the posterior layer of the cornea and Descemet's membrane.

Careful staining and examination of sections of the iris and prolapsed mass, both by Mr. E. T. Collins and myself, failed to discover the tubercle bacillus. Several different methods of staining were employed.

Remarks.—There seems little room for doubt that the above are instances of primary tuberculosis of the eye; still it must be remembered that neither case has passed those tests which by some writers are considered necessary to entitle a growth to be called tubercle, I mean (1) inoculation of animals and production of tuberculosis in them, and (2) the discovery in the affected tissues of Koch's bacillus. The first test could not be employed, for obvious reasons.

It is possible that in Case 2 tubercle pre-existed elsewhere, and unfortunately we are without the after-history.

Both patients were young children, with a strongly tubercular inheritance; improvement began almost immediately after the removal of the eye, though only in Case 1 are we able to say that the improvement continued.

Case 1 seems to indicate that by the timely removal of an eyeball, affected by tubercular disease, we may hope to avert general tuberculosis.

Deutschmann* has published a very similar case in which six years after the operation the child was in perfect health.

Case 2 exemplifies the rule laid down by some writers, that if in cases of tubercle of the iris, operative treatment be decided upon, nothing short of enucleation should be

* Arch. f. Ophthal., xxviii, 1, p. 317.
performed. In many cases, however, in an early stage, iridectomy and the removal of nodules upon the iris may be advisable and useful for diagnostic purposes.

A not inconsiderable number of cases of primary tuberculosis of the eye have been published during the last few years. Nearly all have been in children, and a noticeable feature in the cases has been the frequency with which a history of tubercular disease in one or other parent has been obtained. Some cases occurring in adults were published by Haab in Graefe's Archives, 1879, and more recently one by Neese in a man æt. 33.
SYPHILITIC DISEASE OF THE EYELIDS.

By J. Hutchinson, Junr.,
Ophthalmic Surgeon to the Great Northern Hospital, and Clinical Assistant at Moorfields.

Primary Chancre.—The occasional occurrence of indurated sores of the palpebral conjunctiva is thoroughly well recognised, their proportional rarity being indicated by Boeck and Sturgis's figures (7 to 4000 cases of syphilis). There is as a rule but little difficulty about the diagnosis, and the few cases I have seen presented no unusual features. It is, however, interesting to note, that in the cases of infection through a sore of the eyelids or conjunctiva, the chancre usually presents a fairly typical induration, and a bubo which conforms to rule in being indolent, non-inflammatory, and practically painless. As is well known, infecting chancre on other parts of the face, e.g., the chin, lips, or cheeks, are liable to present abnormal signs, that is to say, the induration may be very ill defined, the amount of pus-crust considerable, and the bubo quite atypical. In two or three cases of these chancre I have seen a large, painful, and tender bubo in the sub-maxillary region, differing markedly from the common indolent glandular enlargement met with in the groin. The glands which are first affected in the case of chancre of the eyelids are the pre-auricular and sub-maxillary, thus proving that the lymphatics from this region run towards the parotid in at any rate a number of cases. Here pathology comes to the aid of anatomy, since neither in Mascagni's plate of the lymphatics of the face nor in Quain's description is this course indicated. Sappey, however, has pointed out that whilst the deep lymphatics of the eyelids accompany the facial vein and end in the sub-maxillary glands, the superficial ones pass with the temporal vein to the parotid or pre-auricular lymphatic glands.
Mackenzie, Hirschler, Desmarres, and others, have recorded examples of soft or non-infecting chancres of the eyelids, and this is interesting, since hardly anywhere else on the face has their occurrence been noted. Galezowski's case is a clear one of contagion conveyed by the finger of the patient, who had at the time a soft sore on the penis. Probably this is the usual origin of both hard and soft sores in this region, and one can only explain the preference shown by the latter for the conjunctiva, by the delicacy of the latter compared with the skin of the rest of the face. In the case quoted by Hirschler, infection was conveyed to the eye of a surgeon whilst syringing a chancre on his patient's penis. The sore was situated at one commissure, and healed under purely local treatment.

Case of Ulceration of the Margin of the Eyelids during the Secondary Stage.

A woman, æt. 55, came under my care at the London Hospital for a severe general syphilide. The history was clear as to her having contracted the disease through a chancre of the tongue (the source of infection could not be discovered), and in the third month after the development of the primary sore both upper eyelids became ulcerated. The sores were multiple, superficial, and situated just above the row of eyelashes, so that it was not a true ciliary blepharitis. Under treatment they healed fairly quickly, leaving distinct scars, and for some time the eyelids remained somewhat swollen. There was also some dusky pigmentation of the lids, the eruption on the body being a strongly pigmented one. Previous to the syphilis she had never had any affection of the eyes or lids, and at the time the latter became ulcerated typical sores developed at the angles of the mouth.

Hirschler and others have recorded cases in which the secondary ulceration involved the hair-bulbs, and resulted in linear scars along the margin of the lid with complete loss of eyelashes in the affected region. This, of course, is quite distinct from the shedding of eyelashes which often
accompanies syphilitic alopæcia, and which is nearly always followed by their perfect restoration.

*Case of Relapsing Chemosis occurring during the Secondary Stage.*

The following case seems worthy of being noted, although its connection with the syphilis from which the patient was undoubtedly suffering at the time may be disputed.

William M., a fairly healthy looking man æt. 26, contracted syphilis, and was treated for a short time for various secondary phenomena with mercury. About seven months later he became liable for the first time to acute attacks of chemosis in the right eye, without other lesion. The conjunctiva would rapidly swell, the chemosis attaining its maximum in the course of 24 hours or less, and then gradual subsidence would follow in the next few days. There was nothing in his occupation to cause irritation of the eye, nor was there anything erysipelatous in its nature, for the rest of the face was never affected. He had never had erysipelas. He attended at Moorfields during the third attack, and scarification was tried on one occasion, though looking at the fact that complete subsidence had previously occurred in the other attacks, it seemed hardly necessary. It should be mentioned that he was still suffering from secondary ulceration of the tongue. The course of the affection, rapid onset, complete subsidence, and tendency to relapse after a few months' interval, somewhat resembled that of herpes of the penis, which is well known occurs not infrequently in syphilitic subjects, although it is not confined to them.

*Relapsing Ulceration and Infiltration of the Upper Lid due to Tertiary Syphilis.*

Elizabeth A., æt. 36, came under my care at the Great Northern Hospital on August the 9th, 1887, with general thickening of the upper eyelid on the right side. There was some conjunctivitis, but the universal thickening of the lid was the chief feature, and although there was then no isolated gumma and no ulcer the suspicion at once arose of tertiary syphilis. I found that she had suffered from secondary syphilis some three or four years previously, and had for many months been under
specific treatment for one or other tertiary symptoms. She was in fact, one of those patients who may be described as being "saturated with syphilis," and in whom treatment with mercury and iodide only serves to relieve the symptoms and not to prevent the occurrence of fresh ones. She was a florid and rather stout woman, who had previously been rather intemperate.

She was put under 5-grain doses of iodide of potassium and an ointment containing mercury and extract of belladonna. These measures were only partially successful, and by the beginning of November a small ulcer had developed along the ciliary margin of the lid. The liq. hydrargyri perchloridi was added to the iodide in the usual 1-drachm dose, and iodoform applied daily to the ulcer. By November 24th, a typical gumma in the tarsal cartilage ulcerated through on the conjunctival side. I was very anxious to promote rapid healing, fearing the occurrence of severe entropion, but was at a loss what addition to make to the treatment (I have not mentioned all the different remedies which had been tried). Fortunately the process now took a turn for the better, the daily application of iodoform (1 part to 4 of starch) to the bottom of the ulcers appearing to have the best effect. By January 13th, the ulcers were quite healed on the lid. A gummatous node had been for some time present on the top of the head, and an ulcer of the palate which threatened to perforate, but which at last healed under treatment with iodoform and a weak solution of chromic acid. At the beginning of February the upper lid again became greatly thickened, and a fresh gumma formed which ultimately broke and healed with destruction of several of the eyelash-follicles. All this time the patient was steadily taking iodide of potassium or mercury. By May 1888 (nearly eight months after the first affection of the eyelid), the healing appeared to be permanent, but one would not be surprised if a further relapse occurred. An obstinate form of syphilitic lupus of the upper lip has lately developed, but has yielded to some extent to mercurial inunction. It should be mentioned that there had never been any ocular symptom of syphilis, and that the conjunctiva, although not infrequently inflamed, had shown nothing of a specific nature, the disease being practically confined to the upper lid.
The extreme obstinacy of tertiary disease of the eyelids, which is illustrated by this case, has been commented on by most writers on the subject. De Wecker ("Traité d'Ophtalmologie," vol. i, p. 72) relates the case of a lady who came under treatment for a slightly inflamed swelling in the upper lid, which he at first supposed to be a chalazion, but whose nature was made clear by the fact that she had previously suffered from tertiary syphilitic sores of one thigh, and at the same time from a similar swelling of the same eyelid.

An erroneous diagnosis had then been formed, and the gumma freely incised, and it was only after energetic internal treatment with mercury and chloride of gold had been employed that healing took place. De Wecker advised the same treatment, but it was irregularly carried out, and the swelling continued to increase. The use of bichloride of mercury and Zittmann's decoction for two months was successful in reducing its size, but a third relapse occurred, and a large gummatous ulcer resulted. Finally this healed, and a small fistula through the lid which was left by it was cured by the application of nitrate of silver. Besides the tendency to relapse this case agreed with the one I have narrated in other particulars. The final result was much more favourable as regards the scar, &c., than the size of the gummatous ulcer had made one fear it would be, and the disease was accompanied by much more pain and irritation than are usually present in cases of simple tertiary syphilitic sores.

The mistake between a syphilitic gumma of the eyelid and a chalazion appears to have been made so frequently, that one must admit the diagnosis to be sometimes difficult. Usually, however, the chalazion is much more rounded and defined than the gumma, and the oedema and infiltration of the lid are much more pronounced in the latter. Sometimes in the late secondary stage a superficial infiltration of the conjunctiva occurs, which may go on to ulceration if not treated, but which rapidly clears off under mercury.
This "syphilitic tubercle," of which Mr. Vose Solomon records two cases, is usually easy to diagnose, on account of its brownish-red pigmentation, and the occurrence of other tubercles on the face at the same time.

Prof. Taylor, in the "American Journal of Medical Science" for 1875, p. 370, narrates two interesting cases of syphilitic infiltration of the caruncles. Both were in adult men, in one case two years, in the other three years after the primary attack of syphilis. The caruncles became symmetrically enlarged, but this gummatous infiltration (for such there is no doubt it was) was unaccompanied by pain, such as is almost always met with in the similar affection of the eyelids. In one case specific treatment led to absorption, but unfortunately this went on to complete atrophy of the caruncles with resulting epiphora. The result of the other case was somewhat singular; the patient's friends persuaded him that only a "specialist" could treat an affection of the eyes properly, and he went to an ophthalmologist, who diagnosed cancerous growth, and freely excised both caruncles and the surrounding conjunctiva. A plastic operation only increased the deformity, and complete epiphora persisted. He was at the time suffering from rupia of the forehead, so that the mistaken diagnosis was hardly to be excused.

An interesting case is recorded by Mr. Charles Lee, in the "Lancet" of October 31, 1885. The patient was a labourer, aged 44, who had gone through the secondary stage of syphilis some twenty years previously, but who had been since free from symptoms until Christmas, 1884, when his throat became ulcerated, and this progressed until a large part of the soft palate and uvula were destroyed.

In July, 1885, his right eye became inflamed, and when he came under care the lower lid was thickened; on everting this a somewhat extensive ulcer was exposed, involving the caruncles and adjacent conjunctiva. Its edge was thickened but not very hard, and the surface
was covered by scanty thick yellow pus. Pre-auricular glands not enlarged.

It was thought at first that the lesion was a "chancroid of the conjunctiva," and hence only local treatment (nitric acid, followed by iodoform and glycerine) was prescribed. Subsequently, however, the tertiary nature of the ulcer was recognised, and mercury (one-sixteenth of a grain of the bichloride with 5 grains increasing to 20 of iodide of potassium) ordered to be taken three times a day. Under this treatment the ulcers both of conjunctiva and palate rapidly improved, and were quite healed in six weeks' time. In reading the records of similar cases one is struck with the large proportion in which the palate was ulcerated about the same time as the eyelids. Acquired syphilis is much more often the cause than the inherited disease, although a few examples from the latter are to be found. Hirschler narrates one case in a girl aged 13, in whom both lids were swollen and infiltrated, the affection yielding to specific treatment. The diagnosis of inherited syphilis was made almost certain, from the fact that a few weeks previously both her knees had become spontaneously affected with chronic indolent synovitis.

The following conclusions may be derived from the study of recorded cases and those which I have seen:

1. Late secondary and tertiary affections of the eyelids are met with most commonly in those who have suffered severely from their syphilis, especially those who have had rupial or tubercular skin eruptions or ulcers of the palate. This fact of course helps materially in the diagnosis.

2. The upper lid is more liable than the lower one to be affected, though both are not infrequently involved.

3. The tertiary ulceration (gummatous) of the lids is more often met with in women than in men.

4. Not only do many cases of the latter resist specific treatment in a marked degree, but they show a strong tendency to relapse after being apparently cured.

5. As a rule syphilitic ulcers and gummata of the eye-
lids are more painful than those met with on other parts of the skin.

I suppose this feature must be ascribed partly to the very free innervation of the eyelids, and partly to their constant motion, although gummatous ulceration of the tongue (which is at least as mobile) is not as a rule so painful.

REFERENCES.

Zeissl. Wiener medicinische Zeitung, 1877. In a series of short articles most of the recorded cases are quoted, and in the same author's work on Syphilis, p. 288, the subject is also treated.

Hirschler. Wiener medicinische Wochenschrift, 1866, pp. 1145, 1161, and 1177. (A series of cases with references.)


J. Vose Solomon. British Medical Journal, April 18, 1883. (Three cases of secondary and tertiary ulceration of the lids.)

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Charles Lee. Lancet, October 31, 1885. (Case of tertiary ulcer of the lower eyelid.)

Windsor. British Medical Journal, June 3, 1865. (Seven cases, chiefly of late secondary ulceration.)

Hock. Wiener Klinik, 1876, p. 65.

Streatfeild. British Medical Journal, September 30, 1882. (One case of chancre of the inner canthus and one of tertiary disease of the lacrymal gland.)

ATROPINE IRRITATION.

By E. Treacher Collins,
Curator of the Museum.

I will first give the details of 18 cases of irritation caused by the use of atropine to the eye, collected while I was house surgeon at the Moorfields Hospital, and for the use of which I have to thank the members of the staff. I will then proceed to summarize and discuss them.

Case I.—John W., æt. 59.
August 26, 1881. Extraction of cataract from right eye; slight atropine irritation from drops used some days after the operation.

July 17, 1885. Extraction of cataract from left eye; duboisine used as a mydriatic during after-treatment; no irritation.

Jan. 8, 1886. Opaque membrane removed from left eye with a Tyrrell’s hook. Gut. Atrop., gr. iv to the ounce, ordered three times a day.

Jan. 25. Lids of left eye swollen, stiff and red; atropine irritation. Father and grandfather both gouty; has never had an attack himself.

Case II.—Stephen C., æt. 60.
Came first as an out-patient on March 16, 1886, with an abscess of his left cornea; the edges of his lids were everted.

March 20. L. hypopyon formed; lower canaliculi slit on both sides. Ung. Atrop., gr. iv to the ounce, ordered twice a day to the left eye.

March 29. Redness and dryness of the skin of both lids on the left side this morning, extending downwards to the cheek, and inwards towards the bridge of the nose.

Ung. Atrop. omitted. Says his father suffered from gout; has never had it himself.

March 30. Skin brushed with solution of nitrate of silver, 3 gr. to the ounce.

April 3. Injection of skin much less.
Case III.—Sarah M., æt. 79.

Jan. 20, 1886. Extraction of cataract from right eye; subsequently Gut. Atrop., gr. iv to the ounce, used once a day for a week. No irritation produced.

March 27. Some spasmodic entropion of right lower lid; membrane in right eye cut with a Knapp's knife; Gut. Atrop., gr. iv to the ounce, one drop at the time of operation, and one 2 hours later. Six hours after operation, redness, swelling, and stiffness of lids, and injection of conjunctiva, evidently atropine irritation.

April 3. Atropine has not been used since, and irritation has subsided. Entropion still continues. Patient has had slight attacks of rheumatism.

Case IV.—Mary S., æt. 59.

Dec. 30, 1885. Cataract extracted from left eye. Gut. Atrop., gr. iv, c Cocaina gr. x to the ounce, used after operation; no irritation produced.

March 30, 1886. Lids of both eyes became inflamed about three or four days ago. Has been using Ung. Atrop., gr. iv to the ounce, and Futos Belladonnae; lids are now swollen and red; conjunctiva is injected, and there is slight muco-purulent discharge. Atropine and belladonna stopped.

April 17. Swelling of lids and injection much less. Has never had any rheumatism or gout; father has had rheumatic fever.

Case V.—Archibald M., æt. 71.

Jan. 30, 1875. Cataract extracted from left eye; atropine made up with boric acid, ordered the next day, and followed by considerable swelling of the lids; eye ultimately suppurated.

Jan. 24, 1879. Cataract extracted from right eye; atropine ordered the following day to be used night and morning; no swelling of lids noted, but conjunctiva remained irritable and injected for some time; remained in the hospital for a month.

July 22, 1879. Membrane in right eye needleed, and atropine applied twice, followed by redness and swelling of eyelids and cheek.

May 25, 1886. Right eye needled a second time; after two drops of Gut. Atrop., gr. iv to the ounce, both eyelids were
swollen and oedematous, and the whole face flushed, swelling extending across nose to lids of the other eye, and to both cheeks.

He has had several attacks of gout in both great toes, the last attack 15 months ago. No history of gout in his family.

May 30. Face and eyelids desquamating.

June 3. Has an acute attack of gout in his right great toe.

Case VI.—George G., æt. 56.

Nov. 20, 1884. Cataract extracted from right eye.

Nov. 21. Gut. Atrop., gr. ii to the ounce, ordered once a day to right eye.


Nov. 27. Great toe inflamed with gout; has had an attack before.

Nov. 28. Atropine irritation, lid a little thickened and eczematous; conjunctiva red.

Dec. 1. Ung. Atrop., gr. iv to the ounce, three times a day to right eye.

Dec. 3. Lids puffy and eczematous; considerable injection and chemosis of conjunctiva.

Feb. 10, 1887. Cataract extracted from left eye.

Feb. 19. One drop of Gut. Atrop., gr. ii to the ounce, dropped into eye yesterday; atropine irritation this morning; swelling of lids, and conjunctival injection.

March 5. Duboisine also caused irritation. Swelling has now quite subsided.

Case VII.—Sarah R., æt. 64.

Jan. 11, 1887. Cataract extracted from her right eye.


Jan. 29. Slight spasmodic entropion of lower lid.

Feb. 12. Swelling of lids has subsided, patient using hyoscine all the time; pupil dilated, some posterior synechiae. Entropion cured by application of a piece of bent sheet-lead. No history of rheumatism or gout, acquired or hereditary.
CASE VIII.—Catherine P., æt. 69.
Jan. 7, 1887. Cataract extracted from her right eye.
Jan. 12. After one drop of Gut. Atrop., gr. ii to the ounce, yesterday, there was some swelling of the lids and redness, also conjunctival injection, which has increased to-day after a second drop.
Jan. 16. The swelling of lids, and other symptoms of irritation caused by atropine, have quite subsided while patient has been using hyoscine.
Jan. 19. Gut. Atrop., gr. ii to the ounce, ordered twice a day to the left eye.
Jan. 28. Has been using the atropine as ordered to the left eye, without any symptoms of irritation until to-day; now a little redness and puffiness of the lids.
The right, to which hyoscine is being used, is quite quiet. No history of gout or rheumatism, acquired or hereditary. Gut. Duboisiae, gr. ii to the ounce, ordered three times a day to right eye.
Jan. 31. Considerable irritation, with swelling and redness of lids of right eye.

CASE IX.—Jane J., æt. 65.
Was admitted Jan. 17, 1887. Patient has had several attacks of gout; father and brothers were all gouty.
On Jan. 18 cataract extracted from right eye, after which patient used Gut. Atrop., gr. iv to the ounce, for more than a week without its producing any irritation. She was readmitted on March 24, 1887, and a membrane in her right eye was needled, and atropine again used without any ill effects.
On May 3, 1887, she was readmitted with some iritis. Gut. Atrop., gr. ii to the ounce, was put into both eyes three times, and the next morning the lids were very much swollen, more on the right side than the left; the swelling and redness extended to the cheeks and neck; the atropine was omitted and the symptoms subsided; on June 5 she had an acute attack of gout in the great toe.
Case X.—Georgina I., æt. 23.
Feb. 24, 1888. Left eye aphakia after the absorption of a lamellar cataract; one drop of Gut. Atrop., gr. ii to the ounce, put in.
Feb. 25. Atropine irritation chiefly conjunctival; membrane in left eye needled.
Feb. 26. Hypodermic injection of the Nitrate of Pilocarpine, one-sixth of a grain to left temple.
Feb. 27. Left eye quiet; patient says that half an hour after the injection she went to sleep, and when she woke up the eye was quite easy, and she was perspiring very much. Ordered R. Pilocarpiae Nitratis, gr. ii; Atropiae Sulphatis, gr. i; Aq. Destillatæ, 1 oz., to be used as drops three times a day to left eye.
Feb. 28. The above drops have now been used three times without causing irritation; pupil is semi-dilated. Ung. Atrop., gr. iv to the ounce, to be rubbed into left forearm three times a day.
March 1. There is some puffiness of the lids of the right eye this morning; on the left forearm where the ointment has been rubbed in is a red papular rash, which patient says itches slightly. Hypodermic injection of Pilocarpine, as before, to the left forearm.
March 2. After injection yesterday, irritation of arm subsided considerably, but is not so well again this morning. Hypodermic injection repeated.
March 3. Irritation of arm much less.

Case XI.—Maria B., æt. 36.
Feb. 8, 1887. Catarrhal ophthalmia and keratitis in both eyes. Gut. Atrop., gr. ii to the ounce, ordered twice a day to both.
Feb. 17. Lids of both eyes swollen and red; atropine irritation. Patient says she has had several attacks of pain and swelling with redness of skin in her left great toe. Atropine stopped, and Gut. Hyoscinae, gr. ii to the ounce, ordered twice a day.
Feb. 24. The irritation, which was chiefly of the skin, not of the conjunctiva, has quite subsided since patient has been using Hyoscine.
Case XII.—John H., æt. 81.
Nov. 1885. Right eye. Cataract extracted, after which atropine was used, and caused irritation.
March 4. Has some swelling of lids and redness of left eye this morning; atropine irritation; has only had two drops of Gut. Atrop., gr. ii to the ounce, one yesterday and one the day before.
March 7. Has had Ung. Atrop., gr. iv to the ounce, rubbed into his right forearm twice a day since March 5. Now a red papular rash of the skin, which patient says itches considerably, and which was faintly present yesterday. Hypodermic injection of one-sixth of a grain of Nitrate of Pilocarpine to right forearm.
March 8. Arm less red; still large papules; patient complains of its itching at night.
March 10. There are some little pustules on arm now. Says he has never had any rheumatism or gout. Hypodermic injection repeated.
March 11. After injection, rash on arm considerably less red and irritable.

Case XIII.—Mary T., æt. 24.
Dec. 1, 1886. Interstitial keratitis of right eye three weeks. Ordered Ung. Atrop., gr. iv to the ounce, four times a day, and Fotus Belladonnae to be used frequently.
Jan. 22. Edema of lids of right side.
Feb. 2. Edema of lids and infiltration have increased; atropine irritation. Ung. Atropiae and Fotus Belladonnae omitted.
Feb. 5. Irritation of the lids still considerable; has been keeping the eye bandaged up.
Feb. 23. Irritation has subsided. Gut. Hyoscinae, gr. ii to the ounce, ordered twice a day.
Feb. 26. The day after using the Hyoscine drops, lids became swollen and inflamed as before. She has never had rheumatism; has had a stiff elbow all her life; her father has rheumatism; the swelling of lids is more oedematous than usual in atropine irritation; the conjunctiva is not affected.
April 6. Gut. Duboisiae, gr. ii to the ounce, ordered. After one drop face and lids commenced to swell.
Case XIV.—Charles B., æt. 23. Lamellar cataracts in both eyes.

July 23, 1885. Left eye needled, after which Gut. Atrop., gr. iv to the ounce, ordered three times a day.

July 27. Left eye, curette evacuation; some swelling of lids and redness, also conjunctival irritation due to atropine.

Jan. 21, 1886. Left eye, membrane needled; after the application of Gut. Atrop., gr. ii to the ounce, three times irritation commenced.

July 29, 1887. Ung. Atrop., gr. iv to the ounce, to be rubbed into right forearm three times a day.

July 31. A papular rash has appeared this morning on the forearm where the ointment was rubbed in; ointment omitted.

Aug. 1. Rash more marked; patient says "it itches." Patient has never had rheumatism or gout; mother suffers from gout, grandmother from rheumatism.

Aug. 4. Hypodermic injection of atropine administered to posterior surface of forearm.

Aug. 5. A crop of papules has appeared similar to those produced by the ointment around the seat of the injection.

Aug. 10. Rash on arm is fading and becoming scaly.

Case XV.—Harry C., æt. 27.

May 21, 1885. A stout pale flabby man. Left eye; iritis nine days; gonorrhœa 12 months ago, followed by rheumatism in the knees and inflammation in the left eye; Ung. Atrop., gr. viii to the ounce, ordered every two hours at first, and afterwards gr. iv to the ounce three times a day.

June 11. Slight atropine irritation of left eye.

June 13, 1887. A fresh attack of iritis in left eye; Ung. Atrop., gr. iv, ē Cocaina gr. x to the ounce, ordered three times a day.

June 16. Lids of left eye swollen, red, and scaly; conjunctival and ciliary injection. Father has had rheumatism (?gout).

June 27. Gut. Hyoscinæ, gr. ii to the ounce, two drops applied yesterday; lids became swollen and inflamed. Gut. Duboisia, gr. ii to the ounce, have also been tried, but produced the same result.
CASE XVI.—George B., æt. 21.

Jan. 29, 1887. Eyes first became inflamed three years ago, and again lately. Right, corneal nebulae; left, corneal nebulae and keratitis. Maternal grandfather "died of rheumatic fever," æt. 91, was crippled with it for 12 years, his feet used to swell and become red. Mother has had rheumatic fever, and father rheumatism; has five brothers and two sisters; one brother has had rheumatic fever; has not had any rheumatism or gout himself. Ordered hot boric acid fomentations and Gut. Atrop., gr. iv to the ounce, three times a day.


Feb. 23. Eczematous condition of lids, slight swelling; conjunctiva not affected; atropine irritation.

CASE XVII.—John C., æt. 65.

July 27, 1887. Catarrhal conjunctivitis and small clear ulcers of both corneæ. Gut. Atrop., gr. ii to the ounce, ordered three times a day to both eyes.

Aug. 10. Ung. Atrop., gr. ii to the ounce, ordered three times a day to both instead of the drops.

Sept. 12. Lids swollen and red.

Sept. 21. Lids more swollen; palpebral conjunctiva injected; atropine irritation. Ung. Atrop., gr. iv to the ounce, ordered to be rubbed into forearm on right side night and morning.

Sept. 23. A slight red papular rash is seen this morning where the ointment has been rubbed into the forearm.

Sept. 25. The rash has considerably increased, and is accompanied with considerable irritation.

CASE XVIII.—Fred T., æt. 16.

Sept. 21, 1887. Left eye, traumatic cataract.

Sept. 22. Cataract needled. Gut. Atrop., gr. ii to the ounce, ordered three times a day to the left eye.


Sept. 30. Ung. Atrop., gr. iv to the ounce, to be rubbed into right forearm twice a day.

Oct. 3. A red papular rash on skin of forearm where the ointment has been used.
Oct. 24. Gut. Hyoscinae, gr. ii to the ounce, ordered to left eye three times a day.
    Oct. 26. Hyoscine causing irritation; vaseline to be rubbed into left forearm twice a day.
Nov. 2. No irritation from the vaseline. Ordered:—
    B. Pilocarpiæ Nitratis gr. ii,
    Atropiæ Sulphatis gr. ii,
    Aqua Destillatæ ʒ,
to be used as drops three times a day to left eye.
Nov. 3. Drops causing irritation. Hypodermic injection of a third of a grain of the Nitrate of Pilocarpine into arm.
Nov. 4. Irritation of lids less; injection repeated.
Nov. 7. On omitting hypodermic injection for a day, irritation increased. Gut. Atrop., gr. ii to the ounce, ordered three times a day to left eye, and hypodermic injection administered to left temple.
Nov. 8. No irritation; injection repeated.
Nov. 9. No irritation; injection omitted.
Nov. 10. Irritation on lids.

It will be seen by these cases that atropine irritation, though occurring at all ages from 16 to 81, is commonest in old people: thus of the 18 cases, 11 were over 50 and 7 under.* It will also be seen that the symptoms vary considerably, both in the length of time during which the atropine is used before they appear, and also in their intensity; thus in Case V, after only two drops of atropine, the whole of the face was swollen and oedematous; while Case XVII had been using drops for a month, and then the inflammation was confined to the skin of the lids and conjunctiva; in some cases, again, the irritation is almost entirely confined to the skin of the lids, and in others the conjunctiva suffers most, at times becoming almost granular.

The cause of this affection has been attributed to some imperfection in the drug used. At one time the presence of

* I have recently seen a case in a boy aged 5, under Mr. Gunn’s care, at Moorfields Hospital.
free acid in the solution was thought to set up the irritation, but as Mr. Lawson says in vol. vi, p. 120 of these Reports:—"What amount of free acid can there be in the one or two drops which are dropped into the eye from a solution of the sulphate of the strength of gr. i ad aquæ $\frac{1}{3}j$? and yet when thus diluted I have seen it occasion great irritation."

M. Kroemer of Basil, in the "Corr. Blätt. f. Schweiz. Aerzte," xi, 1881, says he believes the conjunctival inflammation which occasionally follows the use of atropine drops is of septic origin, and thinks there is some connection between it and the fungoid growth which takes place when an atropine solution is kept for some time, and goes on to state that he had not observed it since he had used a carbolised solution of the strength of 1 in 1000.

Mr. Simeon Snell, on p. 340 of vol. i of the "Ophthalmic Review," says he has come to the same conclusion, having used salicylic acid in his solution, but he draws a distinction between those cases that get irritation from prolonged use, and those that get it after the application of only one or two drops. In these latter cases he thinks there is some idiosyncrasy.

Without denying that it is possible to produce a conjunctival inflammation by using a solution of atropine in which there is a fungoid growth, still I have produced irritation with perfectly fresh solutions, also with solutions made up with boric acid and carbolic acid, and with ointments made with vaseline. Moreover, it certainly cannot be solely due to some imperfection in the drug, for if this were so the imperfect solution ought to produce irritation in all cases in which it is used; instead of this we find that there are certain individuals who get it with any sort of solution, and others who can use all solutions with impunity.

Is there then some idiosyncrasy on the part of the patient? Mr. Lawson, in the article already quoted, vol. XII.
says:—"I believe that when atropine acts thus as an irritant, or produces peculiar and distressing symptoms, it is due to some idiosyncrasy on the part of the patient which renders him intolerant of the alkaloid or of its salts, and in some cases of any preparation of belladonna."

If this is so, why should it occur when applied to the eye specially? Does it only irritate at the junction of mucous membrane and skin, or has its mydriatic property anything to do with it? To test this, I had rubbed into the forearms of several patients who got atropine irritation of the eye an ointment made of atropine, gr. iv, vaseline, s v, and in all the five cases in which I used it an irritable red papular rash appeared on the skin; in some cases these papules developed small vesicles on their surface, and in one case they went on to pustules. Case X, in whom I produced this rash on the forearm, had got irritation of the eye from one drop of a two grains to the ounce solution; Case XVII also got a rash on the forearm, and he did not get irritation of the eye until after a month's use of atropine.

In order to prove that this rash was actually caused by the atropine, in Case XVIII I rubbed vaseline into his other arm without producing any effect, and in Case XIV I injected some solution of the sulphate of atropine hypodermically, and around the seat of the injection a crop of papules appeared.

These facts show that atropine irritation is not a purely local affection, and also that cases in which the irritation occurs after a few drops, and those in which it occurs only after a prolonged use, are of a similar nature. We know that atropine or belladonna applied locally has the power of checking secretion; to try whether its action in this way had anything to do with the irritation produced, I, in Cases X, XIV, and XVIII, injected hypodermically a solution of the nitrate of pilocarpine which has the opposite action, that is, increases the secretion of the skin. In all these cases it seemed to have a temporary effect in
relieving the irritation both in the lids and eye, and on the arm the redness became less, and the patients said there was less irritation, but this relief was only transient. In Case XVIII by repeating the injections daily I was enabled to continue the use of atropine to the eye, and so keep the pupil dilated without any irritation. I have also tried drops made of a mixture of pilocarpine and atropine, but without any satisfactory result.

Why should the checking of secretion give rise to irritation? M. von Zehender, in the Bowman Lecture for 1886, says:—“The germs of all living microzoa floating in the air can every moment drop into the open eye, and remain on the surface of the conjunctiva. Hence it cannot be astonishing that one finds in every normal eye plenty of germs of all possible kinds of micro-organisms; of two persons with quite normal conjunctiva, it has been found one eye almost always contains pathogenic germs (Gifford, "Archiv für Augenheilk.," Bd. xvi, p. 199);” and he goes on to ask: “Why does not then the eye become inflamed every moment?” May it not be that the normal secretion of the conjunctiva (or of the skin, in the case of the lids and arm), is one of the barriers, and when this secretion is checked, as I am supposing it is in some people by the atropine, inflammation results? This theory would lead us to suppose that there are certain individuals in whom the secretion of the skin or conjunctiva is checked very rapidly by atropine; others in whom it is only stopped after a prolonged use of the alkaloid, while in the vast majority it is never entirely checked. Again, we might suppose that sometimes the necessary microbes were absent or not present in sufficient quantities to cause inflammation. By these means we could explain the extreme variability in the onset, and intensity of the symptoms at different times and in different cases.

In Case II there was slight ectropion of the lower lids, and the puncta were everted, so that there was some obstruction to the flow of tears down the lacrymal ducts.
Case III, when first in the hospital, used atropine for a week and had no irritation, the second time she came in she had spasmodic entropion, and so the drainage of the lacrymal secretion was hindered; she on this occasion after only two drops of atropine got irritation. Case VII also had spasmodic entropion.

In these three cases it would seem that the interference with the passage of the lacrymal secretion down the lacrymal canal predisposed them to atropine irritation. By the constant secretion and drainage of the tears the microbes which collect in the conjunctival sac are being washed away; if the drainage be prevented in any way, they will be increased in numbers, and so more ready to set up inflammation.

If the inflammation known as atropine irritation is due to irritation set up by microbes normally present in the conjunctiva, and which are enabled to act in this way by the checking of the normal secretion, ought not the same thing to occur sometimes when the normal secretion is arrested in other ways?

The following case is an example of this:

Jane W.*, aged 60, had a cataract extracted from her right eye on July 3, 1886; iritis set in on July 9, and Gut. Atrop., gr. ii to the ounce, were ordered twice a day; on July 14 there were considerable redness and swelling of lids with conjunctival injection. I took the case to be one of atropine irritation. Substituted duboisine for atropine and had the eye untied; the inflammation then subsided. She was readmitted Nov. 23, 1886, and iridectomy was performed on her right eye; the next day the lids were a little puffy and red, one drop of atropine was put in; the second day after the operation the swelling had increased, the eye was then untied, hyoscine was used instead of atropine, and the symptoms of irritation disappeared.

In April, 1887, she was admitted for extraction of cataract from her left eye; in the fundus of her right eye there were seen to be several small scattered punctate haemorrhages; her urine contained sugar, no albumen, sp. gr. 1025; acid.
The day after the operation on the left eye the lids of both eyes were swollen, and the conjunctivæ were injected though no atropine had been used; this swelling and redness had increased by the next day. When both eyes were untied and the symptoms subsided, atropine was afterwards used, and as long as the eye remained untied no irritation occurred; on two occasions I injected some atropine hypodermically into her arm, but no rash was produced.

Still supposing all this to be as I have suggested, it leaves unexplained why some people are very readily affected and others never; or why in some the secretion of skin or conjunctivæ is so quickly checked by atropine. What is the idiosyncrasy? It is not the same as that which renders some people abnormally liable to the toxic effects of atropine, for I have seen dryness of the mouth and even delirium supervene after the application of atropine drops to the eye, but in such cases no inflammation of the lids has occurred, and duboisine and hyoscine, which more often produce toxic symptoms, less often produce irritation of the eyes; thus hyoscine was used in 6 out of the 18 cases, and in 3 only did it produce irritation; duboisine was used in 5 cases out of the 18, and produced irritation in 4 of these.

Nor is it that it occurs only in eyes in which the vitality has been lowered by past or present inflammation, for I have produced it in eyes that were practically normal; the worst attack of atropine irritation I have ever seen was in Case V, and he was a man who had had several attacks of gout; while in the hospital about a week after the irritation in his eye he had a very severe one. This led me to enquire into the arthritic history of these cases, with the following result. The figures are not sufficiently numerous to draw any conclusions from: I will therefore simply give them without comment.

Of the 18 cases:—

4 had had acute attacks of gout.

3 had a family history of gout.
1 had had gonorrhœal rheumatism and a family history of rheumatism (? gout).
1 had had rheumatism.
3 had a family history of rheumatism; and
6 had no history of gout or rheumatism either acquired or hereditary.
ON THE TREATMENT OF SUPPURATION AFTER EXTRACTION OF CATARACT.

By E. Treacher Collins.

When suppuration of the cornea has once commenced after extraction of cataract, so rapid is its progress that in spite of treatment panophthalmitis generally follows; and even in those cases where the suppurative process has been checked, so much damage has generally resulted, that in most the eyes become disorganised and shrunken.

Von Grafe, in 1863, in some clinical remarks on a case of extraction of cataract (which have been translated by H. Derby), after deprecating the use of ice compresses, of leeches, and of venesection, recommends the application of what he terms "a constrictive bandage," in which the orbit is packed plentifully, and a flannel roller passed three times over the eye in question,—and also of warm aromatic lotions. The former of these measures he says "I cannot praise too highly." He seems to have attributed the suppuration to want of adaptation of the two edges of the wound, and it was this which he hoped to effect by the use of firm pressure.

Having tried this form of treatment in several cases, and having in all of them found that the suppurative process instead of being checked rapidly ran on to panophthalmitis, and believing the suppuration in the majority of cases to be due to infection, and not to want of adaptation of the edges of the wound, I was induced to try the very opposite plan, viz., as soon as any sign of suppuration showed itself to leave the eye untied, and have it frequently bathed with a tepid antiseptic lotion, only a piece of lint kept moist with the lotion applied as a blinker over the eye. By these means, instead of keeping the discharge pent up in contact with the wound, a free escape is permitted, and the wound kept clean by
frequent bathing with the antiseptic lotion; at the same time I endeavour to combat any marasmic tendency by extra diet, stimulants, tonics, and by allowing the patient to get up out of bed and sit about.

The first case I treated in this way was a man in whom suppuration set in after the removal of a diabetic cataract (Case No. XXXIV in the table of suppuration cases after extraction, published in Part I of vol. xii of these Reports). This case recovered, but with a closed pup.1; the tension, however, remained normal. Of six other cases I have treated in this way, in three the suppurative process has been checked, though in two of these the globes ultimately shrank; in the other three the suppurative process continued unabated.

Mr. Nettleship, on June 23, 1886 (in Case XLI), applied the galvano-cautery to a yellow line of infiltration which was commencing along the margin of the cornea, freely and deeply across the whole length, but not opening up the anterior chamber; the eye was then treated as above stated. There was a striated haze of the cornea after this, which subsequently cleared up, and on August 18 the eye was quiet, and the tension normal, but the pupil blocked with a dense membrane. On October 30, 1886, an iridectomy downwards was performed with a Tyrrell's hook, and on November 6, \( V. \bar{c} + 10 = \frac{16}{24}, \bar{c} + 14 \) J. 6.

Since that time I have applied or seen the galvano-cautery applied in eight other cases, in all of which the after treatment consisted in leaving the eye untied and using antiseptic lotions. In three of the nine cases thus treated the eye has been saved and good vision ultimately obtained; in three the suppurative process was checked, but flattening of the wound and shrinking of the globe supervened, and in the remaining three panophthalmitis set in.

I will now give in detail the particulars of the other two cases in which good vision was obtained.
Samuel W., aet. 54, was admitted under Mr. Nettleship on May 10, 1887; he had nearly complete cataracts in both eyes, somewhat more advanced in the left than in the right. V. in R. = fingers at 2 feet, projection good; in the L. V. = hand reflex, projection good; pupils normal, and tension normal in both; no lacrimal complication.

May 11. L. extraction with iridectomy, capsule opened with Förster's forceps, operation uncomplicated.

May 17. Slight injection, anterior chamber reformed, haze of cornea at upper part extending from wound.

May 20. Cornea bulged forwards more in one direction than in the other, looking very astigmatic.

May 21. Some grooving of the wound and some iritis, two posterior synechiae; at the seat of wound this morning noticed for the first time a yellowish-grey nodule, a commencing patch of suppuration. L. Galvano-cautery applied to margin of wound.

May 25. Considerable grooving of the wound and some striped keratitis; suppuration has not extended.

May 28. Injection much less, the patch at seat of wound is more of a grey colour.

June 2. Wound healing; very little injection. V. of L. \( \frac{c + 10}{60} = \frac{6}{c + 14} \) J. 16.

Aug. 10. An opaque capsule, cut with a Knapp's knife, without much result.


Aug. 18. V. of L. \( \frac{c + 12}{18} = \frac{6}{c + 16} \) J. 4.

Elizabeth E., aet. 64, admitted March 22, 1888, with incomplete cataracts, with a central, white, chalky-looking patch in both eyes. V. in both = J. 19, projection good, pupils normal, tension normal, no lacrimal complication.

March 23. R. extraction with iridectomy, capsule opened with Förster's forceps, operation uncomplicated.

March 24. No swelling, pain, or redness.

March 25. Pain in the side of face and in the eye last night; slight puffiness of the lids this morning, slight purulent discharge, conjunctival injection, purulent infiltration of wound not extending backwards. Galvano-cautery applied to infiltrated margin of wound, eye left untied with blinker soaked in
Lotio Hydrarg. Perchlor. over it, eye bathed with the same lotion every two hours. Unguentum Iodoformi c Atropia made up with Lanoline applied three times a day. Beef tea and wine extra.

March 27. No fresh infiltration of wound; striated keratitis; very slight discharge, good anterior chamber. Two leeches applied to right temple.

March 29. Pupil partly dilated, two posterior synechiae; swelling of lids and conjunctiva less; wound now looks healthy, still some striated keratitis.

March 31. No pain; injection and swelling less; wound healed. There has been no fresh purulent infiltration, the keratitis is less, aqueous is not turbid, and the pupil is black.

April 7. No injection at all, wound well healed, no keratitis.

April 17. \( V. \text{ of } R. c + 12 = \frac{6}{24} + 16 \) words of J. 4.

It will be seen that in these three cases the cautery was applied in a very early stage, that is, within a few hours of the first indication of any suppuration starting. In those cases in which the result was not so satisfactory a longer time had elapsed between the onset of symptoms and the cauterisation; and in those cases in which the suppurative process was checked, and in which the globes ultimately shrank, a large portion of the cornea had become infiltrated, and consequently more tissue had to be destroyed by the cautery, the result of which was flattening at the seat of the wound and minus tension. Case L in the table is a typical one of this sort:

Hannah B., had a cataract extracted from her right eye on November 1, operation uncomplicated.

Nov. 3. Complains of pain; eye not examined.

Nov. 4. Swelling and redness of the lids; considerable yellow infiltration of the cornea. Galvano-cautery applied to the infiltrated portion, eye left untied, and bathed every two hours with Lotio Hydrarg. Perchlor.

Nov. 5. Infiltration has not increased. Ung. Atrop. c Iodoform made up with Lanoline ordered three times a day.

Nov. 8. Part of the cornea that was infiltrated is now grey. \( V. = p. 1 \).
AFTER EXTRACTION OF CATARACT. 183

Nov. 26. Anterior chamber has reformed; cornea clear except at the upper part; coloboma filled with a dense inflammatory membrane.


If a still longer time has been allowed to elapse between the onset of symptoms and the application of the cautery, it is found that not only has a large extent of the cornea become involved, but that the suppuration has extended backwards into the pupil, and then no amount of cauterisation is of any avail; these cases end in panophthalmitis.

All this shows how attentively the early signs of suppuration should be watched for. The first symptom which is likely to attract attention in nearly all cases is pain; this, together with the infiltration of the cornea, often commences some hours before there is any swelling of the lids or discharge; there are, however, exceptional cases in which there is no pain at all. Of course pain may be due to numerous other causes, and patients' ideas with regard to pain vary considerably. Still, I believe it best, if a patient complains of pain after the day on which the operation has been performed, to make a thorough examination of the eye, and to see what the real condition of things is, and this even if the pain has passed off, for in suppuration cases patients frequently give a history of acute pain lasting some hours and then subsiding. If, then, there is seen to be no infiltration of the cornea, the appropriate treatment, whatever it may be, can be adopted with confidence, but if the margin of the wound is infiltrated, the cautery should be applied there and then without delay. I believe if this plan were adopted many eyes now lost by suppuration would be saved.

Assistance might also be gained in detecting suppuration in its early stages by the systematic use of the thermometer in cataract cases. I have not had any experience of it myself, but Mr. Simeon Snell speaks of the value of its use in vol. iii, p. 105, of the "Ophthalmic Review."
ON THE PATHOLOGICAL ANATOMY OF LAMELLAR OR ZONULAR CATARACT.

By J. B. Lawford,

Late Curator of the Museum.

Opportunities of examining crystalline lenses affected with lamellar or zonular opacity are so few, that it seems worth while to record the results of the examination of three lenses (from two patients) which have come into my hands as Curator of the Hospital Museum.

Case 1.—Thomas B., æt. 44, shoemaker, admitted to the Royal London Ophthalmic Hospital under Mr. Nettleship's care on November 5th, 1886.

His history so far as ascertained was that he had never had good sight, that he had been unable to obtain spectacles which were of any assistance to him, and that he liked to shade his eyes, as he could then see better. He thinks his sight has become rather worse in the last 10 years.

He is the fourth child of six; his brother and four sisters have no defect of sight. He is married and has eight children, all of whom are healthy and have good sight.


On November 6th the lens of the right eye was extracted through an upward section. The capsule was opened by incision near its upper edge, and the lens came out nearly complete. The wound healed well, and patient left the hospital November 24th.

After needling of some opaque capsule in the pupil, the vision of this eye was 6/18 and 1 J. Patient returned in February, 1888, for operation on the left eye, the sight of which had not altered in the intervening 14 months.

On February 4th, 1888, the lens of the left eye was extracted
in its capsule. This eye also recovered well from the operation, and its vision with correcting glasses was two months later \( \frac{6}{24} \) and J. 6.

Both lenses were treated in the same way, i.e., carefully hardened in Müller's fluid for some weeks; transferred to weak and subsequently strong alcohol; embedded in celloidin. Sections were made in an antero-posterior direction; the staining reagents used were hæmatoxylin (Ehrlich's formula), alcarmine, and cochineal; a number of sections were mounted unstained, and proved more useful than the coloured ones to exhibit the changes described below.

**Right lens** (fresh). The outline is irregular, the capsule and some of cortical layers are wanting. The anterior surface is marked by the notch cut by the cystitome, the posterior surface by its somewhat greater convexity. The transverse meridians of the lens measure 8 mm. and 8.25 mm. respectively, so that it has a slightly oval shape. The lamella of opacity is plainly visible, is very thin, and exhibits tiny spokes jutting out from it. As nearly as can be ascertained in the present condition, it measures 5.25 mm. transversely. The portion of lens outside the lamella is fairly clear and not very hard.

**Microscopical Examination.**—The most noticeable feature in the sections of the lens is the difference in appearance between the nuclear and cortical parts (Plate I). Beyond some separation of the fibres and the tearing of the outermost layers which occurred during the extraction, there is no noteworthy change in the cortical layers. The nuclear portion of the lens, however, exhibits very evident change, though as will be seen from what follows, it is doubtful to what extent these changes are pathological, and to what extent artificial, the result of the fluids employed in the preservation of the specimen.

This central area (Plate I) is very similar in shape to the whole lens, and its outlines are almost parallel with those of the lens; it is, however, rather nearer the posterior than the anterior surface; this may be the result of some of the posterior cortex of the lens remaining adherent to the capsule during the extraction. This area measures (in sections made through the middle of the lens) 2.325 mm. antero-posteriorly, 5 to 5.25 mm. transversely. It contains very numerous, irregularly shaped
spots and patches, which vary considerably in size, and are generally larger and less closely packed in the central part than towards the boundary of this area. These small spots become coloured by staining fluids to about the same degree as the lens fibres; they have an almost homogeneous appearance, and look like particles of very fine sand scattered over the lens fibres; they are not, however, at all raised above the level of the fibres. These particles exhibit a somewhat concentric arrangement as if following the layers of lens fibres. They vary in size from 0·0125 mm. to 0·025 mm., and their shape is quite irregular, some are circular, others have a dentate border. In unstained sections they are bright and highly refracting. It is very difficult to give a good representation of them in a drawing.

Although this central area is very distinct from the cortical part, there is in this specimen no continuous line separating the two parts of the lens. Here and there, however, are fragments of such a line of demarcation which can easily be supposed to be parts of a lamella in the lens, in the continuity of which there are breaks. Outside this line, especially anterior to it, there are several irregular patches of degeneration in the lens fibres, some of which project towards the cortex, and which perhaps are the representations of the spokes seen during life. They are not evident in Plate I, except on the anterior surface of the dotted area. The boundary line between the central and peripheral areas has a peculiar appearance not unlike that of a twisted rope, and its edges are slightly serrated; it varies in thickness a little, its measured diameter being from 0·0125 mm. to twice that thickness. The lens fibres have a decided tendency to split along this line, as though it formed a layer of degeneration, or of some change which reduced the adhesiveness of the adjoining layers.

In a few sections there is but little trace of this boundary to be seen, while in others it can be traced almost all round the central area, though frequently interrupted by short breaks. At the lower extremity in Plate I, there is an indication of a double line. It becomes coloured to almost exactly the same degree as the rest of the lens. The dots or granules in the central part reach generally quite up to this line, but do not extend beyond it.

*Left lens (fresh.*) Capsule entire and shape of lens about
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normal. Its diameters measure 9 mm. transversely and 5 mm. antero-posteriorly. The lamellar opacity which shows very plainly is as nearly as can be measured 4·5 mm. in width. The rest of the lens is nearly if not quite clear, with the exception of a small opacity on the capsule near the equator.

Although the reagents employed, and the time taken in preparing this lens for examination, were as nearly as possible the same as in the case of its fellow, the results were much less satisfactory. After imbedding in celloidin the lens was divided antero-posteriorly into two halves, and sections of each half were made; those nearest the cut surface were not successful, so that I have no section which passes exactly through the centre of the lens and of the opaque lamella.

Microscopical Examination.—In this, as in the right lens, there is a central area of almost the same shape as the lens, which presents appearances very different from the cortical part. It contains very numerous small spots similar in size and appearance to those described above. The cortical layers of the lens exhibit marked changes which are almost entirely if not entirely due to the action of the hardening reagents. There are in places fragments of a boundary line between the nuclear and cortical areas, resembling in appearance that described in the other lens, but there is apparently much less of it. On its outer side, but close to it are several areas in which the lens fibres appear interrupted by a small nearly homogeneous patch, which projects a little towards the capsule of the lens. These patches, which probably represent the spokes seen on the zonular opacity during life, have not the appearance of post-mortem change, but more closely resemble the rope-like line which divides the nuclear from the cortical area.

The lens capsule and the sub-capsular epithelium exhibit no changes.

Altogether, the results of the examination of this lens are not satisfactory. This is, I think, simply due to the fact that the process of hardening produced considerable change in the lens, possibly on account of the impermeability of the capsule.

Case 2.—Ann C., æt. 30, admitted to the Royal London Ophthalmic Hospital, under Mr. Tweedy's care, on April 27th, 1888, suffering from lamellar cataract.
Unfortunately no particulars were entered in the in-patient notes, as to her history or the acuteness of sight at the date of admission.

The lens of the left eye was extracted on the day of admission, through an upward sclero-corneal incision. The lens capsule was divided at the upper periphery and the lens came away nearly entire. The wound healed well, but there was some subsequent iritis and a secondary operation (needling) became necessary. This was performed on June 12th, and was also followed by iritis, as a result of which the pupil became updrawn.

At her second visit, the sight of the right eye (the unoperated one) was noted as $\frac{10}{200}$; beyond the lamellar cataract there were no changes. The extracted lens was prepared for examination precisely as were those of Case 1.

The outline of the lens is irregular, some of the outermost cortical layers are wanting. The shape of the lens is, however, sufficiently well preserved to enable one to distinguish the anterior and posterior surfaces. The lamellar opacity is very distinctly visible, and looks of large size in proportion to that of the lens. The diameters of the lens as removed are 7 mm. transversely and 3 mm. antero-posteriorly; the transverse measurement of the lamellar opacity is 4.5 mm. The outline of the latter in antero-posterior section, though not quite parallel to that of the extracted lens, would probably be so if the entire lens in its capsule had been obtained for examination. There is, as in the normal lens, a greater convexity in the posterior than in the anterior layer of the opacity. This is more noticeable in sections near the periphery, and less so in those at the centre of the lens.

Microscopical Examination.—The description of the left lens of Case 1 will in the main apply to this specimen. There is the same marked difference between the nuclear and cortical parts, and the transition from the one to the other is quite abrupt. Concerning the cortical layers there is little to be said; there is splitting of the layers in several places, and ragged broken fibres at the surface, but no evident change in the fibres themselves. The nuclear part is filled by large numbers of the particles above described, which particles are generally
most numerous and smallest towards the boundary of this area, and comparatively few in number in the centre of the lens. Their average size is 0.0142 mm.

This area, as already mentioned, is of the unequally bi-convex shape of the normal lens, as is indicated in Plate B, Fig. 1, in which the anterior surface is uppermost.

Bounding this dotted area is a line which under the microscope is very like a rope, with twisted strands (a, Fig. 1, Plate II). This line is in no section continuous all round the nuclear part. There are numerous breaks in it, as is shown in the drawing, but at these breaks there is no irregularity in the contour of the dotted area; although there is a noticeable tendency in the layers of the lens to split along this rope-like line, it is quite clear that in good sections, such as that from which Fig. 1, Plate II, was made, the appearance is due not to separation of the layers and formation of an empty space between, but to some change in the lens fibres which gives rise to this line. A somewhat similar appearance is often seen in sections of lenses at points where the laminae are just beginning to separate, or where a very tiny chink has formed between adjoining layers. The impression it gives is one of fine oblique striae in the lens fibres. The width of this boundary line varies from 0.0125 mm. to 0.0375 mm. in sections near the centre where it is cut as nearly as possible at right angles to its surface; in sections near the equator of the dotted area, in which the bounding layer is cut obliquely, the width is of course rather greater than this. In the length of this line there are several small irregularities, like small knots in a rope, but, as in the rope, the continuity is not broken at these points. There is, however, an absence of the small spurs projecting from the dotted area into the cortical layers, such as were seen in some of the sections of Case 1, nor is there any indication of a double line like that in Plate I at the lower extremity of the nuclear area.

It will be seen by the foregoing description that the three lenses examined present very similar appearances. In all there is a nuclear or central area of moderate size, the outlines of which run a nearly parallel course to those of the whole lens. In the portion of lens external to this
—the cortical layers—there are no changes of any import, a few small patches of degeneration being all there visible. The line of demarcation between the cortical and nuclear areas is abrupt; there is no gradual change from one to the other. At the boundary there are indications of a thin layer, as seen in transverse section in the specimens, (a in the drawings) which probably extends all round, and encloses the central area. This lamina compared above to a twisted rope, does not in any of the sections form a continuous line, but exhibits numerous breaks. It seems fairly certain that it represents some definite and considerable change in the lens fibres, and probably constitutes the essential part of the “lamellar cataract.” The finely dentated edges of this line suggest that it is composed of lens fibres, but its thickness exceeds that of single fibres of a healthy lens, so that the alteration in structure, whatever it be, probably involves more than one layer of fibres.

In the nuclear area in all three specimens, are large numbers of small irregular dots or particles, arranged more or less in layers which seem to run concentrically, as if following the laminae.

Whether or no these are entirely the result of the fluids employed in preserving the lenses, in other words whether they are coagulation masses, I am unable to say positively. My impression is that they do to a large extent own this origin, but it is certainly a little remarkable that they are so accurately limited to the central area. It may be, however, that there is some diffuse change in the nuclear part of lenses with lamellar cataract, so that it is affected by hardening fluids in a different way to the cortical portion. I have never found (so far as I remember) changes exactly like these, both as regards their appearance and their arrangement, in healthy lenses, of which I have examined a great many, prepared in precisely the same way. In order to help me to arrive at a decision on this point, I prepared and cut sections of several lenses from both young and aged eyes generally healthy, but in
OF LAMELLAR OR ZONULAR CATARACT.

some instances affected by senile cataract. In two of these, one (normal) from the eye of a child aged 3 years, and one from the eye of a man aged 65, the former hardened in weak to strong spirit, the latter in Müller’s fluid and then spirit, I found numerous small rather bright dots among the lens fibres. These, which were smaller and more regularly oval in shape, were in the first specimen scattered over the whole of the lens; in the second they were limited to the nuclear area. They were no doubt coagulation products such as Becker has described and figured in his work on the lens.

Regarding the pathology of lamellar cataract but little has been published, and in ordinary text-books of Ophthalmology nothing is said about it. Even in Becker’s classical work* no description of lamellar cataract is given. Ed. Jaeger† and Von Graefe‡ were the earliest to record the examination of lenses with lamellar cataract, but no microscopic description is given. These observers found in sections of a dried lens a sharp whitish line (¾ to ½ mm. in thickness) separating “a normal nucleus from an unaltered cortex.”

In Arch. f. Ophthal., xxxii, 2, 1886, Deutschmann gives a short account of the examination by him of a lamellar cataract from the eye of a person who committed suicide. He found the nucleus and cortex normal in appearance, but divided by a very definite zone of altered lens substance which ran concentrically round the nucleus, and consisted of altered lens fibres with numerous vacuoles and free droplets of myelin. In small chinks which were visible in this zone there was a finely granular detritus. A little more peripherally there was a second similar but incomplete zone. These zones were of varying thickness, their diameter being greatest at the poles (see drawing in Deutschmann’s article).

* “Zur Anatomie des gesunden und kranken Linse.”
† “Staar und Staar-Operationen.” 1854, p. 17.
‡ A. f. Ophth., 1, 2, 236.
The most recent and full description of the pathological anatomy of lamellar cataract is one by Beselin in Archiv f. Augenheilkunde, Bd. xviii, Heft 1, 1887. He had the opportunity of examining a lens extracted by Professor Schweigger from a man at 64, suffering from zonular cataract. The patient had had an artificial pupil made by iridectomy, and had been able to see sufficiently well till a few months before the extraction operation. His sight was then \( \frac{11}{12} \) to \( \frac{1}{9} \) in the left eye; the right had been lost many years previously after needling of the lens. After extraction \( L. V. = \frac{1}{2} \). Beselin's description and illustrations and mine have several points in common. I had cut and examined sections of the right lens of my Case 1 before Beselin's article was published, and had made out practically all that I have now written. These notes were not published then as I knew that probably the second eye of that patient would be operated upon. As a result of this delay I was fortunate enough to obtain a third lens, and also to have the advantage of comparing my specimens with the description given by the writer just referred to.

In Beselin's specimen the area enclosed by the lamella measured in central sections 5 mm. in its transverse and 2·1 mm. in its antero-posterior diameter. The lamella consisted of a narrow zone, or rather of two incomplete zones, that on the anterior overlapping the ends of that on the posterior surface at the equator; so that there appeared to be a double layer at the margins of the lamellar opacity. These zones the author describes as chinks filled with finely granular material, containing some rounded corpuscular elements, probably fat droplets. In the greater part of its course the borders of this chink were formed by normal lens substance; its cross measurement varied from 0·016 mm. to 0·08 mm.

The nuclear area, enclosed by the zone of degeneration,
contained large numbers of small irregularly-shaped dots closely grouped and smaller at the peripheral part of this area, and larger and more scattered in the centre. These Dr. Beselin thinks are coagulation masses, the result of hardening the lens in alcohol, and thinks that if present during life greater defect of sight would have occurred. He has found similar changes in lenses with senile cataract when preserved in alcohol, but not when kept in Müller's fluid. My experience is somewhat different to his, though in the main we are agreed as to the origin of these masses. Our description and figuring of them are almost identical.

It will thus be seen that so far as our scanty knowledge on this subject will carry us, lamellar or zonular cataract (either name seems to be strictly applicable) consists essentially in a narrow zone of degenerative change in the lens fibres situated between the nuclear and cortical areas. Of the exact nature of this change, we can as yet say but little. It is possible also that the nucleus of the lens within this zone is in some way abnormal in structure. It is to be hoped and expected that future investigations will throw more light upon both these questions. That we have not already a better knowledge is due partly to the rarity with which lamellar cataracts are obtainable for microscopic examination, and partly to the fact that the crystalline lens is one of the most difficult of all tissues to manipulate for such examination. As to the cause of the occurrence of this form of cataract, whether a developmental defect, or some nutritive change in early infantile life, these microscopical investigations do not seem to assist in the determination.
DESCRIPTION OF PLATES.

Plate I.
Drawing of a nearly central antero-posterior section of the left lens of Case 1. The outer fibres are torn and ragged, where they have separated from fibres left in the capsule. The notch in the anterior surface was cut by the cystitome. The central dotted area is shown in its entirety, and also the greater number and closer aggregation of dots near its periphery. At the points a, a, a, are fragments of the rope-like line separating the central and cortical parts; in places (as at the lower extremity), this appears double. On the anterior boundary line are several irregular patches of degeneration in the lens fibres. \( \times 25. \)

Plate II.

Fig. 1. Drawing of part of a section of the lens of Case 2. The anterior surface is uppermost. The dotted area with its rope-like boundary is well shown, this line being here present in greater lengths than in most of the sections. It has, however, come out rather too distinctly in the print: it should be softer and less evident. \( \times 85. \)

Fig. 2. Drawing of the cornea, iris, and ciliary body of the eye of Case 2, in Tuberculosis of the Eye cases (p. 152), showing the great thickening of the iris and the tubercular mass continuous with it in the cornea. Some giant-cells with surrounding reticular area are indicated in the growth. \( \times 9. \)
THE CAPSULO-PUPILLARY MEMBRANE, WITH SOME VARIETIES OF ITS PERSISTENCE.

By W. J. Collins, M.S., M.D., B.Sc. (Lond.)

In vol. xi of the Ophthalmic Hospital Reports I detailed and figured a case of persistent capsulo-pupillary membrane. Such cases are, I believe, not so rare as the statements in some text-books assert, and the absence of any reference to them in others would imply. Neither do I find in most modern English ophthalmic works any distinction made between the pupillary membrane and the capsulo-pupillary membrane; instances of persistence of the latter being described under the name of the former, whereas it would be more in accordance with embryological observation to regard the pupillary membrane as merely a specialised portion of the capsulo-pupillary envelope. Moreover, there is a very great variety in the disposition of the vestigial filaments of these membranes, which the following cases which I have myself observed will suffice to exhibit:—

Case I. Caroline De C., æt. 72, came complaining of failing sight, and had striae in both lenses; but oblique illumination revealed in each eye delicate brown radial threads, of the same hue as the iris, proceeding from the periphery of the circulus minor iridis or corona, in the lower and inner quadrant to the lens capsule a little short of the anterior pole (vide Fig. 1). She had always had good sight, was admired in her youth for her "beaux yeux," and never remembers any inflammatory attack. The symmetry, situation, colour, and disposition of these capsulo-pupillary threads, corroborated by the history, exclude their possible confusion with synechiae consecutive to iritis. This was an indubitable instance of persistent capsulo-pupillary membrane. I have notes of six cases of this variety.

Case II. John G., æt. 9, came to hospital on account of catarrhal ophthalmia. On examining his left eye there were
seen four or more fine fibrils stretching chord-like across the lower half of the pupil, entirely unconnected with the lens-capsule, and attached peripherally to projecting tufts in the corona between the circles of the iris (vide Fig. 2). The other eye was normal. This was a case of persistent pupillary membrane proper. I have notes of eight cases of this kind, and must have seen many more.

Case III. Mary R., æt. 17, a patient of Mr. Tweedy's, who kindly allowed me to see the case, applied at hospital on account of a white speck in the left pupil which she was under the impression had only appeared during the previous fortnight. The white speck under oblique illumination and magnification turned out to be a milky-white circumscribed plaque about 2 mm. by 1 mm. with the long axis vertical, whence proceeded four radial blue-grey filaments to be attached to the coronal tufts of the iris as in the preceding case (vide Fig. 3). Vision was unimpaired; there was no history of inflammatory attack; the other eye was normal. This case corresponds closely with the one I figured on page 346 in vol. xi of these Transactions in a woman æt. 21; except that in this instance the capsular opacity at the site of insertion of the filaments was larger and had attracted attention (vide Fig. 7).

Case IV. James K., æt. 12, came to the North-West London Hospital on June 27 last on account of a blow on the left eye and subsequent failure of vision; the eye exhibited compound myopic astigmatism, and with glasses he read \( \frac{6}{9} \), but on examination with oblique illumination I found a variety of persistent pupillary membrane which I had not previously encountered. Three threads attached to the corona of the iris were to be seen, one arising where another was inserted, and none of them encroaching upon the pupillary area (until the pupil was dilated with atropine), but passing tangentially to it around the lower and inner parts of its circumference (Fig. 4).

Case V. Jessie C., æt. 12, came on account of an injury to the left eye of a trivial character, but exhibited yet another variety of vestige. Proceeding from one of the coronal tufts
of the iris at the upper and inner part of it was a delicate lash about $1\frac{3}{4}$ mm. in length and 1 mm. in breadth at its iridic origin, and fining down to almost imperceptible tenuity at the other end, which floated free in the anterior chamber (vide Fig. 5). This I take to be an instance of a persistent filament of the pupillary membrane, the other insertion of which had either been ruptured by pupillary movements, or had disappeared by that process of obsolescence prior to birth which normally occurs, and which this individual filament had escaped. I have seen two other examples of this same variety, one in a well-known gentleman of 55, another in a boy aged 3.

Case VI. Joseph S., aet. 54, complained of recently noticed dimness of vision; smoked half an ounce of shag a day; had had a primary sore 30 years ago, but never had any inflammatory attack in his eyes. V. R. $\frac{6}{18}$, L. $\frac{6}{9}$, unimproved by glasses. Vitreous hazy, and some neuro-retinitis. Both his eyes exhibited yet another peculiarity, which I think is due to persistence of a portion of the vascular pupillary membrane which usually makes itself scarce. In his eyes that part of the iris which I have alluded to as the corona which marks the junction of the circulus major iridis with the circulus minor is greatly exaggerated, the tags and tufts, presumably vascular in structure, overlapping the circulus minor and forming an irregular frilled margin to the pupil (Fig. 6). On casual inspection they had the appearance of multiple synechiae amounting to exclusion of the pupil, but the motility of the iris and the complete dilatation which atropine effected negatived this suggestion. This is the only example of this variety which I have seen.

The literature upon the subject of this communication is not very abundant, is mostly modern, and is very much scattered. Ancient authors do not appear to mention it at all. Wrisberg, Wardrop, and Beer cite instances.

Cohn* of Breslau has paid considerable attention to the subject, and has figured, at any rate, three varieties,

all of which, however, he describes as persistence of the pupillary membrane, though in two of his cases there is distinct capsular attachment (vide Fig. 8).* Weber, Alfred Graefe, Horner, and Mooren have also recorded cases. I can find no mention of the condition in Mackenzie.† Stellwag‡ refers to the capsulo-pupillary membrane in the anatomical part of his work, but gives no instance of its persistence after birth. The modern English text-books of Juler, Lawson, Swanzy, and Nettleship§ do not distinctively refer to persistence of the capsulo-pupillary membrane, though the last insists on the importance of diagnosing such vestiges from synechiae. In Landolt and Wecker's Traité Completǁ there is an excellent and clear account of the capsulo-pupillary membrane and of cases of its persistence.

The explanation of the occurrences which lead up to such cases as I have noted above appears to be as follows:—The deeper portion of the vascular mesoblastic intrusion which takes place after the formation of the secondary optic vesicle and between this and the epiblastic lens, surrounds the latter with a complete tunic, and obtains its blood from the hyaloid artery, a branch of the arteria centralis retinae. When the iris, later on, sprouts from the choroid, and its anterior margin advances centripetally, leaving at first coloboma and pupil, and, lastly, pupil only, a portion of the vascular tunic of the lens or capsulo-pupillary membrane is intercepted by the iris and lies in front of it, while their vessels anastomosing effect a junction between the anterior surface of the iris at the corona and the intercepted portion which is henceforth the pupillary membrane. Posteriorly this membrane retains for a time its connection with the rest of the lens tunic, which latter when no longer vascularised by the hyaloid

Case 1 and Case 2.
‡ "Treatise on Diseases of the Eye," 1868, under Cataract.
ǁ "Traité Complet d'Ophthalmologie," 1886, tome ii, p. 381.
artery fades into the capsule of the lens. It is easy to see how by the failure in one or other of these successive steps, by which the final condition which we recognise as normal is arrived at, the different vestigial anomalies referred to above may be determined. Proceeding from behind forwards we may have (1) a persistent hyaloid artery or patent canal of Stilling; (2) some opacities occasionally seen in children in the hyaloid fossa may not improbably be due to the retention of, or opacification of, or failure to clarify of, some portion of the posterior part of the capsulo-pupillary tunic; (3) some instances of circumscribed opaque plaques on the anterior surface of the lens, as in Case III, and as figured in some of Cohn's cases (Fig. 8) either with or without connecting threads with the iris; possibly, too, some of those cases of anomalous juvenile capsular cataract, and of otherwise inexplicable anterior polar cataracts, may be referable to persistent and more or less altered portions of this temporary vascular membrane; (4) we have the condition, as in Cases I and III, in which that portion of the membrane proceeding from the lens to the iris is retained; (5) then the class of cases to which the name of persistent pupillary membrane is truly applicable (Case II), where the threads are attached to the iris only, passing diametrically or chordwise across the pupil, or as in Case IV, only touching it tangentially; (6) lastly, the vascular connections established between the anterior surface of the iris and the portion of the capsulo-pupillary membrane which is intercepted by it, may alone persist, either in part (as in Case V) or in entirety (as in Case VI).

The diagnosis of these cases is important as well as merely interesting. Capsulo-pupillary tags are frequently mistaken for synechiae due to iritis, and the patient's character is unjustly impugned, while his constitution is unnecessarily assailed with vigorous medication.

As regards treatment, it is seldom called for; sight being often but not always unimpaired; operative pro-
The procedure would in most cases be accompanied with the risk of injuring the lens. In Case I, where senile cataract has supervened, it is possible that the capsulo-pupillary adhesions which exist would not be less unfavourable impediments to successful extraction than ordinary iritic synechiae.

Fig. 1. Case of persistent capsulo-pupillary membrane.

1. Case of persistent pupillary membrane.

2. Case of persistent capsulo-pupillary membrane with white plaque on capsule.

3. Case of persistent pupillary membrane with tangential filaments.

4. Case of persistent pupillary membrane represented by a single lash.

5. Case of persistent pupillary membrane in form of excessive corona.


ON CASES OF HÆMORRHAGE INTO THE EYE OCCURRENCE IN YOUNG MEN.

By Jonathan Hutchinson, F.R.S.

I published in the first volume of the Ophthalmological Transactions, 1881, the case of a young man, Colin P., who had suffered from repeated attacks of hæmorrhages into the eyes. The notes of his case extended over five years, and one eyeball had been excised, on account of glaucomatous tension and pain following hæmorrhage into the vitreous, two years before he came under my care. He had, during the two years he had remained under my observation, repeated hæmorrhages into the vitreous of his remaining eye, which used to make him for a time all but blind. My notes included a report by Dr. Mahomed as to the condition of arterial tension, which was found below normal, and I took occasion to refer to an important paper by Mr. Eales, of Birmingham, in which five cases had been recorded, four of them very similar to my own. Mr. Eales had attached great importance to the existence of constipation as a cause of the disturbance of the balance of circulation, and a predisponent to hæmorrhage. In my own case I was inclined to attach much importance to a strong
family history of gout; my patient suffered extremely from dyspepsia, and had himself had pains which were probably of a gouty character. His case quite coincided with Mr. Eales' experience that constipation and epistaxis are usually concomitants with intra-ocular haemorrhage, and that the subjects of these cases are almost invariably young men. I revert to the subject on the present occasion because I am now able to record, after an eight years interval, a statement as to the present condition of my patient. It is very desirable indeed that we should get completed histories in such cases, for they then become invaluable for purposes of prognosis.

Additional Note of Case of Haemorrhage into Eye.

Colin Perrot, st. 27, came to me again May 1885. He has been living in Devonshire ever since I saw him, helping in a grocer's shop. He has read the paper every day. Has had no relapses whatever. The cloud has not wholly disappeared. He can see the cloud on both sides when he looks over his nose, and when he looks to his temple. He sees \( \frac{20}{20} \) with ease, and reads No. 1. He has taken neither beer nor wine since I saw him, but occasionally a little spirit. He has been comparatively free from cold feet and has had less rheumatic pain. I do not think that his pulse indicates any increase of tension. It is rather sharp, but not difficult of compression. He has had constipation as much as ever, and has found no benefit from green vegetables. No bleeding from nose. Emissions very rarely—once in two or three months. His head is clear; very seldom headache; appetite always good. Heart's sounds clear and sharp. He complains much of attacks of discomfort at his heart, and has a sense of soreness to left of nipple.

These attacks are not usually attended by palpitation. They consist rather in a sense of fulness. When very bad he breaks out suddenly into profuse perspiration.

He cannot lift with his left arm on account of the discomfort caused at his heart.

He has dieted most carefully.
He thinks that weather influences him much. When it is clear he is better.

Colin P. wrote to me again in 1888 from Devonshire, informing me that he had, since I last saw him, much improved in health, and that he had ceased to be liable to the attacks of bleeding. His eye, which had been so repeatedly and so severely affected, had of late years served him well, and he could follow his occupation and also read in moderation.

This result confirms my previous impression that the liability to intra-ocular haemorrhage of this kind is closely connected with the age of the patient, and very probably with the disturbing influence of the sexual system during the early years of manhood. It occurs at the same time and under the same conditions that the liability to severe acne of the common type is often noticed, and it would appear to cease at the same time. In saying this, I by no means ignore the influence of other causes, such as inherited gout and neglected constipation. Age and sex are, however, clearly, I think, by far the most important predisponents. It is very seldom, indeed, that we hear of cases of recurring intra-ocular haemorrhage in young women. In the female sex the occurrence of menstruation saves from risk in this direction. That it may not do so absolutely is very probable; but I believe it will be a matter of general experience that not only is intra-ocular haemorrhage almost unknown in young women, but that epistaxis is far less troublesome and less severe than it is in males. The subject is one of great interest, and has not as yet attracted much attention. I am not aware that anything has been written upon it since the papers by Mr. Eales and myself. It, therefore, seems worth while to place on record a few other cases which I have since found in my note-books. I might have recorded them at the time of my former paper, had they not been overlooked, for they were written out, and were the subject of a clinical lecture delivered at Moorfields in 1871. The fact that they were observed
prior to my former paper must be my excuse for not having noted in more detail the histories of the patients as regards gout, and in reference to arterial tension, &c. Both the patients with recurrent hæmorrhages were, according to rule, young males, but I have notes of several cases in which single attacks of hæmorrhage occurred in patients of middle age, and two in which the subjects of it were women. These latter cases, though they must not be lost sight of in connection with the subject, must probably be assigned to a somewhat different clinical category. In all the recurrent cases, both eyes were at one time or another attacked, whereas in these patients at middle age, not only was there no proof of tendency to recurrence, but, so far as my notes go, only one eye was affected. When we get to senile periods of life, and in connection with senile degeneration of arteries, &c., we again encounter attacks of hæmorrhage into the vitreous, and sometimes in association with liability to epistaxis. In these cases, however, the attacks are for the most part single, affecting only one eye, and, as it were, accidental, whereas in the group of cases to which I am now asking attention, the tendency to recurrence during several years is the most marked feature.

In close connection with these cases of recurrent hæmorrhage into the vitreous are yet more rare cases of hæmorrhagic choroiditis. A very marked example of this disease, occurring in a man named Henry Gorham, who was under my care in 1874, is recorded in the paper to which reference has been made. It occurred at the same age and under precisely similar conditions to those in which the vitreous was the seat of the disease, the patient being the subject of marked sexual disturbance and liable to epistaxis.*

The liability to retinal detachment, which is unfortunately observed in a considerable proportion of the cases of the kind referred to, is probably to be explained by the occasional occurrence of sub-retinal, and possibly of choroidal, bleeding. This is illustrated in my paper in

the case of a lad named Sullivan, aged 19, who was left quite and permanently blind by this occurrence.

*Extensive spontaneous Hæmorrhage into the Vitreous (its front part) in both Eyes in a Young Man liable to severe Epistaxis.
Recovery of excellent sight. History of several previous attacks. No cause assignable.*

(F. 406.) Thos. Rogers, a spare, healthy-looking young man of 20, was admitted at Moorfields on November 2, 1871, with large hæmorrhages into the vitreous in both eyes; the blood could easily be seen by oblique illumination, and some of it was of a very bright red colour. The optic disc could be just seen in the left eye, and below it (real position) was a vertical line, the nature of which was doubtful, but apparently depending on some change in the retina.

He was taken into the Hospital, and remained an in-patient for seven weeks. Sight improved considerably during his stay, and continued to progress after he returned home. In October, 1872, ten months after his discharge from Moorfields, he wrote that he had "quite recovered his sight." The treatment during his stay in hospital consisted of the solution of bichloride of mercury in drachm doses, three times a day, for five weeks, and iodide of potassium (5-grain doses) for the remaining time. While taking the bichloride he suffered more than once from severe frontal and temporal headache, which kept him awake. He had no more pain after the change of medicine.

The history was that during the twelve months previous to admission he had had several attacks of dimness of sight, sometimes in one eye, sometimes in the other, and seldom in both at once. The dimness came on rapidly, "it would come like a lot of black specks, as I was eating my dinner;" it usually passed off in two or three weeks, and he would again have good sight for a couple of months or so. It was for the most recent attack that he came to the Hospital, its greater severity and longer duration making him anxious, especially as both eyes were affected. His account was that he had been out in camp with the Volunteers at Aldershot in September, had returned home, seeming quite well, one Saturday evening, and that on the Sunday
morning when he awoke his sight was as bad as on admission to the Hospital on November 2.

In respect to the cause of his intra-ocular bleeding, some facts of interest were obtained. He said that for about the last four years he had been liable to repeated and severe epistaxis: his nose would begin to bleed without apparent cause, and even sometimes as he was walking; “sometimes he thought it was never going to stop.” This tendency had ceased at about the time he became liable to the attacks of dimness of sight, and for the last 12 months his nose had scarcely bled at all. He denied masturbation, and would not admit ever having had intercourse; his manner was truthful. He had on one occasion, a year and a half ago, been laid up for three months in hospital by a cough, and nearly a year after I saw him he wrote that his breath troubled him much, and that he was taking cod-liver oil under advice. It is probable therefore that he is phthisical. With regard to the effect of straining in causing haemorrhage, he said that coughing had never brought on epistaxis, and that he had no cough when the present attack of dimness began; and further that when once in hospital with cough, he was constipated for a week, but that he had no special epistaxis then nor any attacks of dimness. He was not aware that any relatives had been liable to bleed unusually, nor did he himself bleed more than other people from cuts on the fingers, &c.

Repeated large Haemorrhages into the Vitreous of both Eyes with Edema of Retina and Swelling of Optic Disc. Subsequent Detachment of Retina in one Eye. Patient, a somewhat delicate youth, subject to Epistaxis. No cause assigned for the Eye disease.

(F. 277.) Frank Trickett, æt. 17, a clerk, came to me at Moorfields in April, 1871, on account of recent failure of sight in his left eye. He said that nine months previously (July, 1870) the right failed, and that a well-known oculist whom he consulted said he had “apoplexy in the eye.” Three months after that the left became affected; it improved and remained well till three days before I saw him, when the sight rapidly failed again. The right also had almost recovered.
When admitted, he could with the right read 1 J. and \( \frac{20}{40} \) Sn. With the left he was nearly blind; the disc was swollen and hazy, the veins large and tortuous; it was noted that there were no extravasations, but the existence of thrombi was suspected. There is no note of any opacities in the vitreous. In the right, some floating webs were seen in the vitreous, and the edge of the disc was indistinct; refraction hypermetropic. Small doses of iodide of potassium were ordered.

About two months later, he appears to have had a recurrence of bleeding in both eyes, for on July 6 in the left eye "abundance of blood can be seen by oblique illumination in the lower and lateral parts of the vitreous," completely obscuring the choroid; the choroidal reflex could be obtained only from the upper part. The blood was dark-red, and some of it was in sufficiently thin layers to be translucent. In the right there were many floating opacities, while at the lower part focal light showed the vitreous to be of greyish-red colour.

October 19. "Has been away in the country for a long time, and his health has improved. Sight remained about the same till a week ago (a few days after his return to London), when the right again became much worse, and he can now only just see his way about." In the right we found a large retinal detachment at the lower and outer part, and many floating bodies in the vitreous; in the left the blood had become to a great extent decolourised, and there was a whitish reflection from all parts which might be due entirely to the condition of the vitreous, or be in part caused by detachment of the retina. He could not read the largest letters with either.

November 30. With the right he can now see 8 J.; fundus very hazy, and disc cannot be seen (atropine not used). The improvement was remarkable. I have not seen him since.

This patient was a pale lad with fair hair and tolerably well nourished; he said that he had never been considered robust, but his muscular strength was good, and he was able to walk long distances. From his earliest remembrance he had been liable to epistaxis, especially in hot weather. He believed that he had scarlet fever when about 10 years of age, but had had no dropsy nor any rheumatic affection. There seemed no reason for doubting his
assertion that he was not given to masturbation. His epistaxis, although troublesome, does not appear ever to have been excessive, and while he was under observation for his eye-symptoms it was, he stated, less frequent than it had formerly been.

In December, 1875, I again heard from him. After leaving, the hospital in November, 1871, he was under care elsewhere, and in six months "was able to see clearly." He continued to retain good sight and improved health till the present autumn, when his health again failed somewhat, and he "lost the use of his left eye again, the retina being covered with blood," to use his own expression. He was already feeling better, and the eye had again begun to improve.

Spontaneous Hæmorrhages into the Vitreous (Symmetrical but not Synchronous) in a Patient subject to various other Bleedings from slight causes or without cause. Family history of Hæmorrhagic Diathesis.

Robert Beard, 22, carpenter (formerly Mr. Hulke's patient), in-patient November, 1871; again November, 1872.

Fair hair and clear rosy complexion; grey eyes. Tall and rather thin. Skin smooth, not hairy.

In August, 1871, L. eye became gradually dim; in about three weeks could only see shadows. End of November (three to four months) it recovered, so that he could read books, &c., but only for short time at once. At end of November R. was attacked, but much more suddenly; in a few hours could only see shadows. About February, '72, this eye also recovered, as he thinks, "perfectly," "as well as ever it was." About same time L. again became dim, rapidly; between tea-time and bed-time it reached its full development, and he could only see shadows. It remained as bad as this, he believes, till beginning of October, 1872 (he often tried it separately during the summer), when it began to improve, and in two weeks got a good deal better, but not so that he could read on admission. This improvement was about coincident with the second and very rapid failure of R., which in about an hour (between dinner and tea) became as bad as ever.

Never any pain in eyes.
November 14. R. very dense vitreous opacities; fundus cannot be seen in detail; reflex very uncertain.

L. Considerable opacities floating but not much obscuring choroidal reflex. Details of fundus much obscured. Disc and retinal vessels look normal. No retinal blood spots seen anywhere.

History.—At æt. 7 had whooping cough, and bled from mouth, nose, and ears, a good deal: “enough to run down from the ears.” When he had diphtheria, at æt. 9, he once vomited a moderate clot of blood. From æt. 6—7 till about 15, was very subject to bleeding from nose without cause. Has often fainted away from it. It stopped at about 15. At about 18 he often spat up blood in the morning, a little in phlegm “from the throat;” nothing of importance. Within last 12 months he began for first time to brush his teeth; was obliged to leave it off in about a month from bleeding from the gums; they bled “as soon as I touched them with the brush,” and would go on for three-quarters of an hour. His flesh very easily bruises. Has never bled seriously from a cut finger, &c. Resembles his father in complexion. His father, when a boy, used to bleed much from the nose, “so that they had difficulty to stop it.”

He has one aunt on father’s side and one uncle; neither is liable to bleeding, but a daughter of the aunt (patient’s paternal first cousin) was very subject to bad nose-bleeding till about æt. 23, when she married. Was much reduced by bleeding. Since marriage she has not bled. She has had no children. One sister of patient (second in family) was subject to bleeding at nose till she married, but not much since; her bleedings were considerable, but nothing like patient’s. She has seven children, none of whom are known to bleed. He does not think she has ever had bad bleeding after confinements. The other sisters and brothers have not been subject to bleeding except now and then a little, “like other people.” The patient and his bleeding sister are the fairest in complexion of any, and in this respect resemble the father; patient also is said to take after father in features. Patient youngest but two of ten; 8 f. + 2 m. Has been in habit of going with women pretty regularly since about 18; at one time (early on) thinks he weakened himself by excessive indulgence, but not lately. Apparently no connection between the bleeding and the sexual indulgence (rather the reverse).
Once, however (last summer), the day afterwards, his R. eye became somewhat dim for a few days, and he fancied it was caused by the indulgence. (This attack was not mentioned above.) Scarcely ever has masturbated. Never venereal disease. Urine generally thick.


Repeated attacks of Hæmorrhage into the Vitreous of one Eye in a Man of middle age. No special cause assigned.

The following notes were written in April, 1878. I cannot give any further particulars of the case.

A man, aged 40, a butcher (Simpson), is under my observation on account of hæmorrhage into the vitreous. He was in excellent health, when in chopping bones he found that he did not see distinctly, and could not aim; he nearly cut his fingers. He then found that one eye (the left) was nearly blind. He had not had the slightest pain. He came to me at Moorfields nine days after this occurrence (May 7, 1877). He could not count fingers, and the fundus was obscured by very large opacities in the vitreous, the remains of blood. His pupil acted well. He recovered from this attack, and could see to read again, but in February, 1878, another hæmorrhage occurred, and he became so blind that he had only perception of light. In March he had a third attack, and at present, April 17, he reads only 3 Snellen. I cannot make out any special cause. He has not had syphilis. He once suffered from piles, but at present appears to be in excellent health. He has no headache, and never had any other form of hæmorrhage. His sight varies much from day to day.

A Case of Intra-ocular Hæmorrhages into one Eye. Detachment of Retina.

J. C. J., at. 25, student of chemistry, single, born in Lancashire. Admitted March 23, 1879, R. L. O. H., under care of Mr. Tweedy. Tall, stout, rather anæmic. General health has been good.
About eight days ago, while exerting himself, he noticed dimness come over right eye. He had been leading a sedentary life for some time before, but this day had walked and run for four or five hours. He is subject to bleeding from nose after any extra exertion. About five years ago he had this frequently. No family history of this. Mother died two years ago; she was hemiplegic. One brother died of "consumption."

R. E.—Pupil dilated under atropine. Numerous floating webs in vitreous. Fundus.—Large detachment of retina with well-defined upper edge (partially discoloured and opaque) in outer and lower part of fundus.

March 26.  R. V. = J. 10 at 6".
L. V. = J. 1 (6"—8")

Ordered rest in bed, and—

\[\text{R. Liq. Hydr. Perchlor., } 3i. \]
\[\text{Mist. Potass. Iodid., ad } 3i. \]
\[\text{Empl. Lytt. to R. temple.} \]

March 7.  R.—Words of J. 6 at 8".
12. Allowed to get up, but advised to keep as quiet as possible.

15.  R. V. \[\frac{20}{0} \]  Words of J. 4.  Pupil active.

21. Small ulcer of conjunctiva of upper lid near outer canthus.

23.  R. V. \[\frac{6}{200} \]  Words of J. 2.

26.  R. pupil well dilated under atropine. V. \[\frac{20}{200} \] barely, not improved by spherical glasses.


30.  R. V. \[\frac{20}{100} \] and \[\frac{20}{70} \] nearly. Pupil dilated. Ophth. Exam.—Still considerable detachment at outer periphery, and large dark patches in vitreous, but site and outline of disc more visible; the large vessels running upwards and downwards over the disc can be made out.

April 2.  Ordered a slight mercurial again.

May 3. Yesterday and the day before he had slight epistaxis in evening—checked by cold application. R. V. \( \frac{20}{70} \) and \( \frac{20}{50} \) partly. J. 1 slowly at 6″.


15. R. V. = \( \frac{20}{30} \) correctly. J. 1 well at 9″.

26. R. V. \( \frac{20}{20} \) almost perfectly. J. 1 well (R. = 13″). The field has improved except inwards. There is a large floating web well formed in vitreous. The detachment is much less—now almost linear down and out. Discharged May 27, 1879.

Hæmorrhage into the Anterior Chamber and Vitreous of one Eye without apparent cause. This Eye probably Myopic, the other Emmetropic.

(G. 362.) Robert K., æt. 34, came to Moorfields on April 22, 1875, with some blood in the anterior chamber of the right eye, and the history that three days before (on 19th) his wife had noticed the eye to be bloodshot, and the sight had begun to fail. It had got worse each day. When I saw him on 22nd, there was general congestion of the globe, and the anterior chamber was about one-third full of blood. The blood had sunk to the lowest part, and its upper boundary was horizontal; its lowest part was nearly black; above it gradually shaded off into the aqueous, which was everywhere more or less turbid and greenish; thus the blood was probably in great part fluid. After the use of atropine the pupil dilated partially, but there was no positive sign of iritis. The deeper parts of the eye could not be seen. There had been no pain worth mentioning. Ten-minim doses of tincture ofaconite were ordered. On 26th “less blood, less congestion.” 29th.—“No red blood, only slight staining of aqueous.” May 6th.—Only the slightest discolouration of aqueous remained, but (after atropine) light red and white opacities could be seen by oblique illumination in the front part of the vitreous, and the fundus could not be lighted in the least; V. only shadows. During the next three months the eye did not improve; the vitreous remained full of
floating films, and the pupil covered by a thin whitish membrane; the details of the fundus could not be satisfactorily seen.

I could find no satisfactory clue to the cause of the bleeding. He believed that this eye had for two or three years been somewhat defective, for he could with it see small objects only when held close (? myopia). There was no myopia in the other eye, and with it he saw $\frac{20}{20}$. There was no history of injury nor of previous inflammation, and he was not subject to bleeding elsewhere. If it be a case of bleeding in a degenerating myopic eye, the case is still quite unusual in the occurrence of haemorrhage into the anterior chamber.

*Abundant Haemorrhage into the Vitreous of one Eye, possibly vicarious of Menstruation. Both pupils motionless.*

(G. 202.) Rachel R., a married woman of 37, was under care for nine months in 1872-73 for failure of the left eye, consequent on profuse haemorrhage into the vitreous; the opacity produced by the bleeding was so great that no reflex whatever could be obtained from the fundus; by oblique light white and reddish flakes could be seen in the vitreous many months after the symptoms began.

The history was that the eye had begun to fail about a fortnight before admission, and that it continued to get worse until shortly after I first saw her. For a short time before and after the dimness began she had severe pain in the left temple and forehead, and sometimes in the left side of the face; there was no pain in the eyeball or side of nose. She had had no toothache. She stated that her last menstruation, which, contrary to her custom, was very profuse, had occurred four months before the eye failed. With this exception, there was no clue to the cause of her eye disease. She denied ever having been subject to epistaxis, and there was no history of bleeding from either the lungs or stomach.

The sight of the right eye was good throughout, although not quite perfect; that of the left improved only slightly while under care, on admission it was only equal to distinguishing shadows, when discharged she could count fingers at 12 inches.
The pupil of the defective eye was motionless when she first came; at the last visit, nine months later, it is noted that both pupils were rather larger than usual, slightly oval, and quite motionless even when tested in a dark room with and without a bright gas light.

This last case is an exception to the statement that haemorrhages into the vitreous occur almost exclusively in males. It will be observed, however, that it is not an example of recurring haemorrhages, and that only one eye was affected. It is not by any means a parallel to the cases recorded in the first part of my paper. Nor, although we may assert that as a rule menstruation saves women from the risk of haemorrhages elsewhere, can we expect to meet with no exceptions. In this instance it will be seen that menstruation had (after a very profuse flow) been arrested for three months. I find a very important case of acute and recurring retinal haemorrhages in a girl recorded by Mr. Power. In this instance also, menstruation had for some time been absent. Only one eye was affected, and the vitreous was not involved. Liebreich has in his Atlas published an almost parallel case. I may repeat, however, that I do not know of any case similar to that of Colin P. which has occurred in a woman.
ON THE PROGNOSIS IN CHRONIC GLAUCOMA.

(Three Clinical Lectures delivered at the Hospital in June, 1888.)

By E. Nettleship.

(Continued from page 100.)

LECTURE 3.

If chronic glaucoma have been allowed to go untreated to blindness the eye will generally remain quiet. But now and then, after a longer or shorter time, the eye becomes gradually congested and more and more painful (Case 1). The question then arises whether to try palliative measures, leeching, &c., or a conservative operation (iridectomy, sclerotomy, or optico-ciliary neurotomy), or to excise the globe. If the symptoms do not soon yield to palliatives we shall do best to enucleate if the blindness be of long standing; but if the eye have been blind only a few months a large iridectomy (or a sclerotomy) may be tried; though the symptoms will sometimes be aggravated for a time, they will often subside completely if we have patience.

There is very rarely any difficulty in deciding between a case of chronic absolute glaucoma in which the eye has become congested and painful and the secondary glaucoma set up by a tumour in the eyeball. In the earliest stages of tumour the question of glaucoma hardly ever occurs; and later, when the tumour has destroyed the sight, the eye seldom remains perfectly quiet for very long, as eyes blinded by chronic primary glaucoma so often do. Glaucoma complicating tumour has to be distinguished rather from the more rapid than from the quiet forms of the primary disease; this distinction is usually, as already stated, easy to make, but in rare cases much difficulty may arise.
I will conclude with some remarks on other, not necessarily connected, points.

First, of what is called "Hæmorrhagic Glaucoma." It is a matter of common knowledge that the prognosis is bad if retinal hæmorrhages be present before operation in a case of glaucoma. Again, if after an unsuccessful operation for glaucoma we excise the eye and find hæmorrhage, we often speak of the case as hæmorrhagic, and are satisfied. And the same term is sometimes used when the development of glaucoma has been watched in an eye previously known to have retinal hæmorrhages, hæmorrhagic retinitis, or even renal retinitis,* or embolic or thrombotic plugging of the retinal artery. Indeed, we owe several specimens showing the plug or changes consecutive to it, in the central retinal artery, to an attack of painful glaucoma coming on some weeks or months after the symptoms of embolism.† It is not likely that the relation of retinal hæmorrhage to increased tension is the same in all these sub-groups, except in so far as the onset of the congestion which may excite glaucoma is favoured by a diseased and inelastic state of the intra-ocular blood-vessels. Sudden copious bleeding into the vitreous appears sometimes to determine the onset of glaucomatous symptoms. The onset of intra-ocular hæmorrhage some time after iridectomy, as in the following case, is to be looked upon as accidental; and such a case cannot properly be called hæmorrhagic glaucoma.

Case 45.—Mrs. Chapman, about 65 (T. I. P., 1878, p. 139). Chronic varying glaucoma of both with attacks of redness and pain; L. about three years, R. some months. L. has only p. 1., T. ? + , o. d. atrophic and ? cupped.

R. $\frac{6}{12}$, F. seems full, o. d. as R., but less pale.

* For a case of glaucoma in complicated renal retinitis, see Gowers's "Medical Ophthalmoscopy," 2nd Ed., p. 326 (Case 42).
Double iridectomy. Four months later sudden failure of R. from two immense sausage-shaped haemorrhages near y. s. Later other similar ones occurred at periphery, and small ones in the other (L.) eye.

In respect to the sub-groups just indicated (of which examples are given below), it may be remarked that when glaucoma follows haemorrhage into the retina or vitreous, or retinitis, the eye was in all probability already disposed to glaucoma; whilst when haemorrhage accompanies or follows glaucoma it indicates diseased vessels ruptured by passive distension. Operation may easily in either case do harm by leading to fresh extravasations at the moment when the tension is reduced. Further, the congestion and oedema which follow iridectomy for glaucoma are likely to be greater and to last longer when the intra-ocular vessels are much diseased; and on this ground we can understand how in such eyes not only retinal and neural degeneration may be increased, but the glaucomatous state itself be rather aggravated than relieved by operation. A case is given further on (Case 52) showing extreme alterations in the calibre of the retinal vessels with acute oedema, both these changes having followed immediately on rapid reduction of tension from +2 to −2, by eserine.

**Cases of “Haemorrhagic Glaucoma.”**

(a.) Retinal Haemorrhages accompanying or following the Glaucoma.

**Case 46.**—Amelia W., 58 (M., I.P., 1883, No. 91). In June, 1883, both eyes far advanced in chronic glaucoma of several months’ standing. L., which had failed longest, had only p. 1., T. + 1, a deep cup, and numerous retinal haemorrhages. R. counted fingers, T. n., deep cup, F. contracted to from 5° to 10° from centre, no haemorrhages. In view of the extravasations in R., I preferred sclerotomy to iridectomy, and performed it on both eyes on June 6.

R. did well, and six weeks later could see 19 J.
In L. iris prolapsed, and when its removal was attempted vitreous escaped; a month later, pain and + T. having returned, the eye was excised.

On opening the globe the haemorrhages were found to be limited to the lower half of the retina, where the vessels were extremely small and diseased. The escape of vitreous at the sclerotomy pointed to a weak suspensory ligament, and the failure of the operation may perhaps be attributed rather to this complication than to the retinal disease.*

**Case 47.**—John M., 69 (T., I.P., 1884, No. 312). Good health, no gout, surface arteries not hard. Advanced chronic glaucoma of at least six months' standing in both eyes, numerous retinal haemorrhages, dilated anterior ciliary arteries, deep cups, ps. sluggish but acting well to eserine, a. cs. shallow. T. +1. V. = \(\frac{3}{60}\), fs. contracted to 10° from centre. Changes all rather more in R. February, 1884, double upward sclerotomy; all went well. In two weeks T. still +1 in R., but n. in L. Not seen again, but wrote in December, 1887, that he had had to have one eye out, but could still see a very little with the other.

Probably in both these cases the haemorrhages were a consequence of venous engorgement caused by increased tension in eyes with unsound veins. The result of the sclerotomy in the second case must be taken as relatively good. William B., 64 (T. 1879, p. 173), is a similar case in which iridectomy was done with, at any rate, no harmful result.

(b.) *Hæmorrhage found, though not previously diagnosed, in an Eye excised after unsuccessful Iridectomy or Sclerotomy.*

**Case 48.**—Ellen H. (T., I.P., 1878). Here an eye, blind for two years from glaucoma, became painful, and underwent first iridectomy with very free bleeding into a. c., followed in three months by an opposite sclerotomy and a fortnight later by excision. Many hæmorrhages were found in retina between

* This case is published, with a coloured plate of the excised eye showing the localisation of the hæmorrhages, in Trans. of Ophth. Soc., vol. iv, p. 108.
equator and o. d. It is to be noted that the iridectomy byphaema had undergone but little absorption in three months.

(c.) Glaucoma Developing in an Eye previously known to have Retinal Hæmorrhages.

Case 49.—John J., 52 (T., I.P., 1886, No. 59). In March, 1885, he had hæmorrhagic retinitis in R., and just a year later the eye was glaucomatous with T. +2, and was excised for pain. In L. there was neither hæmorrhage nor glaucoma; V. $\frac{6}{6}$.

Case 50.—Samuel B., 71 (M., I.P., 1883, No. 1916), had complained that R. had been failing for three weeks; the veins were tortuous and there were many hæmorrhages; T. ? + V. 20 J. 11 days later, November 28, 1883, T. +2, V. shadows only, subacute glaucoma. L., T. ? +, partial cataract, fundus invisible, fingers at 6''. Shortly after, December 8, R. sclerotomy, L. iridectomy. December 29, R. T. +2, but no pain since operation, L. T. ? +. June, 1886, R. no p. l. T. n, L. bad p. l. T. n. It is probable that the hæmorrhages in this case preceded the glaucoma.

The next Case (51) shows that hæmorrhage without glaucoma may occur in one eye and glaucoma without hæmorrhage in the other eye of the same patient and nearly at the same time. Case 7 may also be referred to.

Case 51.—Walter T., 45 (P. 13, 209), October, 1886. L. quiet chronic glaucoma of at least a year’s duration; V. $\frac{6}{18}$, F. contracted up, up-out and in, at one place lost up to 10° from fixation point. T. rather +, o. d. pale, moderately cupped all over, no hæmorrhages, veins n. R. failing for a few weeks, V. $\frac{6}{36}$, examination not completed. Iridectomy on L. Two weeks later L. had large opacities in vitreous (probably hæmorrhagic) and engorged veins but no retinal hæmorrhages. R. now examined fully and found to have severe hæmorrhagic retinitis, V. $\frac{6}{24}$ partly, T. n. No albumen or sugar. 6 to 8
weeks after operation, L. $\frac{6}{18}$, corrected by glasses; R. $\frac{6}{24}$, haemorrhages much fewer and smaller, but veins still very tortuous.

I should add that I have not seen much of the haemorrhages immediately following operation in ordinary acute glaucoma said by Von Graefe to be so common. But perhaps I have not looked for them often enough.

*Glaucoma occurring Early in Life.*

Of this we may distinguish buphthalmos, or glaucoma of infants; glaucoma secondary to keratitis, or strictly sclero-keratitis (usually in inherited syphilis); and primary glaucoma in young adults, or even in children.

I do not propose to dwell now upon the two first varieties. In the third sub-group I have included all cases of apparently primary glaucoma in which the disease began before 30, and of these I have notes of about 15. In nearly two-thirds of these cases the glaucomatous eyes were myopic. The disease began between 20 and 30, so far as could be ascertained, in 11 of the number; below 20 in only 4. Both eyes were affected in 7, one only in 6, doubtful in 1. Of the 4 below 20, the disease affected both eyes in 1, one only in 3, and the double case was quite peculiar (Case 52). Only 5 of the series of 15 were seen early enough for treatment to be useful; and all of these underwent iridectomy with good results, notwithstanding that in two of them there was considerable myopia. In none of the very young cases was there a known family history of glaucoma, but the histories in this respect are incomplete.

**Case 52.**—E. Margaret T., aged 10 (P. 8. 136), was sent to me by Dr. Evan Jones, from Aberdare, in September, 1883, on account of her L. eye, which was absolutely blind with T. +2, general thinning of the ciliary region and enlargement of its trunk arteries and veins, very great dilatation of pupil
(9 mm.), large dark blood clots in the vitreous close to the retina, and also very large retinal hæmorrhages. Retina probably oedematous. The blood both in vitreous and retina most abundant in the lower half, where some of it was converted into a grey substance, o. d. deeply cupped. Retinal arteries and veins, where visible, were very small; in the upper half of the fundus the arteries were almost obliterated by concentric contraction, the lumen being barely visible, and the wall of the vessel, itself diminished in diameter, converted into relatively thick lines. The history was not very definite. A few months previously the pupil of this eye was observed to be getting larger; and the child said she had known for some time that she could not see with the eye.

The other, R., eye at the above date, September, 1883, had normal V., refraction and acc., P. also normal, T. ? +, anterior ciliary arteries tortuous and too large for her age; the o. d. showed a large, deep, rather shelving cup, and very marked, sharp, spontaneous pulsation in all the arteries. The pulsation did not amount to emptying, and it extended for a long distance into the retina,—the characters of pulsation due to aortic insufficiency rather than to increase of tension. Unfortunately, I did not measure the F. At this stage I thought it not unlikely that the order of events in L. had been (1) tendency to glaucoma, (2) faulty cardiac circulation, (3) thrombosis of retinal vessels, determined by a combination of the two above conditions, (4) rupture of vessels degenerated in consequence of the blocking.

She was an undergrown child, rather pale, shy and backward; she had had slight bronchitis 18 months before, and had never been considered strong, but had had no other illness. No history of rheumatism or ague. The eyes had not been injured. A month ago she had had some bleeding from the nose. There was no family history of blindness, but it was said that her mother's male relatives, farmers, all had an inveterate habit of going to sleep when they read. Dr. Barlow was kind enough to examine the child carefully; he found the radial pulse collapsing and the heart's impulse too strong, but there was no evidence of valvular disease, and no albumen in the urine.

In view of the peculiar changes in the L. (blind eye), and
the perfect sight and absence of symptoms in R., I did not think operation on R. advisable, but directed that the child should rest altogether from use of the eyes for three months, and see me if worse.

She was brought up again in six months (March 14, 1884), because she had been noticed for the last two or three weeks (on her return home from staying with friends) to knock against things in walking, and I was astonished to find R. now in a state of advanced glaucoma:—V. \( \frac{6}{24} \), T. +3 nearly, P. 8 mm., a. c. and cornea n.; much enlargement of anterior ciliary veins, and less so of arteries, in upper part only, also slight blueness of upper part of ciliary region, but no fine congestion; o. d. deeply cupped all over, but of fair colour, arteries of normal size, pulsating as before, but pulsation now much more marked on o. d. than on retina, veins much enlarged, no haemorrhages; F. very much contracted inwards, downwards and upwards, outwards nearly full. There had been no pain and the child had made no complaint. At this time T. of L. (blind eye) had become n. or very slightly +; a large yellowish vascular membrane was to be seen at inner half of fundus; outer half dark.

Observations on the Action of Eserine upon R. Eye.—At the visit at mid-day on Friday, March 14, I put eserine (gr. ii to \( \frac{3}{i} \)) into R. eye twice in five minutes; in half an hour P. had contracted to 2·5 mm., T. was somewhat lessened and the child could read 1 J. (I had not tried hand reading before the eserine, but she said “the drops had cleared the reading.”) During the next 27 hours the father used the same eserine twice.

When I saw her at 3 p.m. on Saturday the 15th, the eye had changed in the most astonishing manner:—T. was now considerably less than in L., indeed I thought it —2; general pink congestion, P. 5·5 mm., iris discoloured (congested), V. much worse, spells 16 J., not 14 J., and cannot see \( \frac{6}{60} \); the whole retina slightly hazy and oedematous; even the nerve substance of the circumference of o. d. being broader and redder than yesterday, thus lessening the diameter of the cup, which would now pass for a very large normal one; extreme dilatation and tortuosity of retinal arteries which were very nearly as large as
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the veins; the veins not much larger than yesterday, but appeared lighter in colour, so that in both methods of examination there was difficulty in distinguishing some of the largest arteries from the largest veins; a small hæmorrhage at inner side of o. d.; no trace of pulsation in retinal vessels. Ordered to blister the temple, keep quiet, and omit eserine.

16th (Sunday) 3 p.m. She both felt and looked faint this morning on getting up; is liable to such attacks. R. eye; P. now 8 mm. Eye white, iris natural colour, T. considerably more than yesterday, being about = to L. (i.e., n. or ? + ); retina clear; disc quite altered, and is now exactly as on 14th. Retinal arteries also quite different from yesterday; in fact, about normal. No pulsation; veins still too large; several small, roundish hæmorrhages.

17th (Monday). Taken into St. Thomas’s Hospital. Eserine, at first gr. ½, subsequently gr. ¼, to 3 1, cautiously used several times a day until the 21st. V. varied during these days, but on the whole kept decidedly better; T., however, remained about +1, and P. dilated quickly between the applications of eserine; and I therefore thought it better on the 21st to perform upward iridectomy. At this time the heart’s impulse was too strong and diffused, but the sounds normal; urine free from albumen.

Though the child was not in the least dusky under the anaesthetic, the iris became suddenly discoloured as soon as the aqueous flowed off, indicating distension of its vessels.

27th. P. very wide; counts fingers at 1 foot. 31st. Sees letters of 16 J. T. n. Ophthal., no hæmorrhages seen (brief examination). April 7th. Sees letters of 6 J.; some hæmorrhages at y. s. T. n.—14th. V. 6\(^6\)\(^{36}\) partly, and words of 1 J., with lens and slit. F. carefully measured, and found to be much as on March 14th. After this date the eye continued to do well.

In July, T. quite n., p. still very large, a. c. too shallow; ophthal., o. d. pale all over, and cupped up to its edge, but not deeply so; artery passing down and out, represented by a shrunken white line with white branches; other arteries and veins rather too small, and coats of some of the arteries thickened. No other changes. V. 6\(^6\)\(^{18}\) partly, and spells out
1 J.; (has always been backward in reading). I have not seen her since, but have heard from her father several times, and in February, 1889 (five years after operation), her sight was reported as keeping the same, but her health not very good.

**Case 53.—Francis E., set. 34 (T., I.P. 1884, No. 21).** History of onset of acute symptoms five years ago, ceasing after a time. Fresh, probably additional, failure of V. eight months. February 1, 1884. R. eye quiet, T. +1, V. \(\frac{6}{36}\) cornea, a. e., P. and F., n.; posterior polar cataract. L. eye congested; T. +3, V. \(\frac{6}{60}\); Hm. 2D. \(\frac{6}{24}\); P. rather larger than R., cornea steamy, a. c. n., posterior polar cataract, nasal half of F. nearly all lost. R. upward sclerotomy leaving small bridge. L. upward large iridectomy.

February, 1887. R. +1 D. sph. +1.5 D. cyl. V. \(\frac{6}{18}\) F. and T. n. L. +1 D. sph. +3.5 D. cyl. V. \(\frac{6}{36}\) partly; F. absent except in down-out part. T. +1; this eye has lately again had dimness, aching, and rainbows.

**Case 54.—Edmund H., set. 33 (M., I.P. 1884, No. 408).** Getting short-sighted seven years, and V. failing four years, with rainbows and pain round eyes.

March, 1884. R. T. +1?, M. 3 D. \(\frac{6}{24}\); F. contracted everywhere in typical form, remaining largest outwards (inwards only 10°, outwards 50°); a. c. full depth; P. large and sluggish, and contracts badly to eserine; ophthal., deep cupping of o. d., no hæmorrhages. L. same condition, but more advanced; F. smaller; T. rather higher, and V. with \(-3\) D. not \(\frac{6}{60}\).

March 15. L. large very scleral iridectomy with Graefé's knife; severe pain for three days, when wound was gaping and full of clot. Excised ten days after iridectomy.

March 26. R. Iridectomy with keratome, smaller wound, and not so far back, but large piece of iris removed.

May. R. V. with \(-3.5\) D. cyl. \(-1.25\) D. sph. \(\frac{6}{6}\) partly.
October, 1887. R. T. quite n. V. with $-3.5$ D. cyl. $\frac{6}{12}$ eccentrically. F. much the same. Ophthal., steep cupping with marked pallor of o. d., narrow annular staphyloma.

It is worth noting that in one case of double glaucoma at about 20, with very high myopia, the patient, a male, was almost a dwarf, and obviously cretinous; and that in three others (all girls) the patients were stunted, feeble, and backward (Case 52, Ellen Bromley, Charlotte Griffin).

**Glaucoma in connection with Myopia.**

It is well known that glaucoma is rare in myopic eyes. When the two conditions are seen together, we find the glaucoma to have begun very early in more than half the cases (10 out of 18). Hence we must assume that in these particular instances either myopia predisposes to glaucoma, or that both are due to the same local cause; for, since youth and myopia are alike usually antagonistic to glaucoma, we should expect glaucoma to be doubly rare when these conditions co-existed; yet of the 18 cases of myopia with glaucoma only four had reached the age of 60. The lamina cribrosa of the optic disc gives way in common glaucoma because it is the most yielding part; the sclerotic in myopia yields because it is too weak; but, if a very yielding lamina cribrosa be associated with a weak sclerotic, the disc may still be the least resistant part of the capsule. In most of the cases, 10 at least, the glaucoma was double and the myopia equal in the two eyes; but there is no quantitative connection between the two conditions—as is shown by several cases. Thus, in the two cases in which the glaucoma was single, the glaucomatous eye was the more myopic in the one, and the less so in the other; in another case (Ellen Churchill, T., O.P.) the glaucomatous eye was highly myopic, the other emmetropic; whilst opposite to this we find Alice Godfrey (T., O.P.) with glaucoma in her hypermetropic R. eye, and no glaucoma in L. which has myopia of 10 D.;
again, Miss B. (P. 10, 30) has glaucoma in her R. hypermetropic eye and no glaucoma in L. which has myopia 1·5 D.

I believe the opinion is often held that when glaucoma coincides with myopia the prognosis is bad, especially in young people. That it is not so always is well shown by Cases 53 and 54 given above; but I have not had experience enough to speak at all strongly on the point. In collecting evidence on the prognosis in glaucoma with myopia, cases preceded by interstitial keratitis or "serous" iritis should be excluded.

Glaucoma following Extraction of Cataract.

I do not know much about these cases, but I believe they are generally looked upon as unfavourable. No doubt, as Mr. Treacher Collins has lately pointed out,* glaucoma, after removal of cataract, may follow exclusion of pupil by iritis, or may accompany serous iridocyclitis with deep a. c., in the ordinary way; and in the latter form the glaucomatous state is certainly sometimes only temporary, as in the case of Mrs. K. (P. 10, 153). But glaucoma may follow removal of cataract without either of these complications—perhaps as the result of attachment of the iris and capsule to the wound. It would seem also that the disease may occasionally come on so long after the cataract operation as to negative any connection between the two. Thus:

Case 55.—Richard P., æt. 64 (T., O.P.) had his left cataract extracted by the old flap operation, without iridectomy, when he was about 45; he stated that he could see fairly well with the eye till about 62, when it began to fail. I saw him when he was 64. T. was then +1, a. c. deep, cornea dim, V. fingers at 3 feet, P. clear and black, acting a little to light; F. absent in and down; o.d. gray and uniformly cupped. The other eye had been operated on for cataract at about the time when L. began to fail, and had done badly, P. being densely blocked. The

patient was lost sight of before long, and nothing was done. I have recorded another case showing the same points in these Reports, vol. xi, p. 394 (Case 72).

*Detached Observations.*

Iridectomy or sclerotomy may do (or appear to do) harm in glaucoma:—

(a.) If followed by a rapid further contraction of the field, when this is already lost nearly up to fixation point (as already stated, p. 72). In congestive and hæmorrhagic cases this result might be accounted for, as already suggested, by oedema or increase of congestion, set up by the operation and acting on tissues already degenerated.

(b.) When followed by hæmorrhages at the yellow-spot or into the vitreous.

But when the V. simply continues to fall, or after being stationary for a time again deteriorates, we can say no more than that the operation has failed to stop the glaucoma. This seems to be the explanation of the following case (56), in which similar failure has begun in the second eye since the operation on the first, and the first (operated) eye is worse than at the date of operation. Notice should be taken of the peculiar character of the defect of field in this case.

**Case 56.**—Mr. G., 50 (P. 16, 8), complained of recurrent "inflammation" of the eyes from much reading of Arabic, which he had been learning. On February 28, 1888, he saw $\frac{6}{6}$ with each eye with $-0.5$ D.S., $-0.5$ D. cyl. I did not suspect glaucoma until I saw the discs; both were pale on the outer half, and the lower-outer quadrant of each was decidedly cupped with an overhanging edge; lamina cribrosa exposed on the cupped part; P. and a. c. n. in each. In L. the disc changes were rather more marked, and T. was slightly higher, than in R., and F. showed a considerable sectional gap at upper-inner quadrant (Fig. 10). F., R. quite full.
A week later a very large iridectomy was performed on L. In three weeks V. was $\frac{6}{6}$, partly with $-4.5$ D cyl. $+0.5$ D sph.

Soon afterwards he returned to his duties in a distant country, taking eserine to be used if any symptoms occurred in either eye, and with instructions to be as careful as possible. T. was then rather less in the operated (L.) eye than in the other. In July he noticed a "brown disc" above centre of F. in R., and in August discovered a new and decided gap in F. of L. near centre. The "brown disc" in R. soon developed into one or more decided gaps, which he measured roughly on an extemporised perimeter.

He now returned to England, seeking advice in the United States on his way, where several different opinions were given and fs. carefully mapped.

I saw him again in November. L. had T. n., V. $\frac{6}{6}$ with $-3$ D cyl., $+0.5$ D sph.; o. d. as before, but F. showed a semi-circular loss attached to the former gap and many small insular scotomata, some at about 40°, others at about 20°, from centre, and varying in density; in fact a marked tendency to ring scotoma (Fig. 11). R., T. $+\frac{1}{2}$, V. $\frac{6}{6}$, with same correction as when first seen; o. d. as before; F. shows several well-marked insular scotomata, chiefly in the upper-nasal quadrant, and all situated between 10° and 30° from centre; there was also some peripheral loss at corresponding part (Fig. 12). From the ophthalmoscopical appearances and the tension I have no doubt that the disease here is glaucoma; but my opinion on this
PROGNOSIS IN CHRONIC GLAUCOMA.

point is at variance with the views of some of the American surgeons who had seen the patient, and with that of my colleague, Mr. Couper, to whom I sent Mr. G. It should be added that there were no signs or symptoms of disease of the nervous system. Though I regarded the disease as glaucoma, I did not advise operation on the second (R.) eye, in view of the further failure that took place some months after operation on the operated (L.) eye.

Fig. 11. (Case 56.)

Fig. 12.

What is the pathogenetic equivalent of progressive failure after operation when T. remains (perceptibly) normal, as in the above case, we cannot at present say. The clinical side of these cases is as yet, I think, incomplete, especially as to any peculiarities they may present in mode of onset of the disease and mode of loss of F., in the early period, and in the behaviour of the wound after operation.

The failure itself is no doubt usually accounted for by progressive atrophy of the nerve-fibres of the o. n. rather than by over pressure on the retina; and this atrophy is itself, I suppose, due to continued formation of new connective tissue (Brailey).

We may, no doubt, assume a greater natural tendency to connective-tissue formation in some persons than in others, and probably also a greater tendency to persistent progress of an inflammatory change once started in a given tissue in some persons than in others. Illustrations
are seen in the varying influence of the causes producing scar-keloid, granular kidney, and cirrhosis of liver in different subjects; and in the different degrees in which a skin disease started locally may become generalised.

As to the state of the field in the early stage of cases of glaucoma simplex which eventually do badly after operation, we want more observations. I would only say here that we meet from time to time with cases of early glaucoma simplex in which the first thing observed is nearly central defect in the form of one or more scotomata near to or partly surrounding the centre, and without any contraction of the periphery. Of this Case 56 above and Cases 57 and 58 below are illustrations.*

**Case 57.**—Rev. D. D., 52 (P. 11, 48). Myopic since boyhood; now (May, 1885) R., M. 7·5 D, L., M. 6·5 D, with 1 D of As. in each.

Complains of seeing "gaps" in lines of print and music lately, and that R. is defective. V. of R. corrected \( \frac{6}{18} \) L. \( \frac{6}{9} \).

Finding a small opacity at posterior pole of each lens and no obvious changes at y. s. or at o. d., except moderate crescents, I supposed that the defect was attributable to the polar opacity, though I was a little uncomfortable in this conclusion. A year later he thought R. worse, but I found no further changes in lens, and no alteration of V., and still did not suspect glaucoma. In two years (March, 1887) R. had become nearly blind (fingers badly at 6") ; o. d. very pale all over and cupped in moderate degree quite up to edge, no hæmorrhages; veins full and tortuous (suffers much from bronchitis), opacity of lens not increased; T. ?+ (rather higher than L.).

L. still saw \( \frac{6}{9} \) with same lens as before \(-6\ D\ S.,\ -1\ D\ cyl.\) ; T. ?+ , but less than R. ; o. d. rather pale, and two small vessels bent sharply at scleral border ; veins tortuous as in R. ; y. s. n. ; opacity in lens not increased at all. Still complaining of gaps in lines and of difficulty in passing quickly from one line

* Bunge ("Gesichtsfeld," &c., 1884) mentions such cases.
to another, especially in music. F. now measured showed no contraction, but a small oval scotoma just above fixation point (Fig. 13); it was partly absolute, partly relative. October 1887. Thinks L. rather worse, especially when going up or down steps: four or five small vessels now bend at edge of o. d. V. still \( \frac{6}{9} \); F. as before, no contraction but scotoma perhaps a little larger; T. n. R., T. still slightly +. Has been using eserine regularly since last visit.

I did not see him again, and he died of lung complications not very long afterwards.

![Fig. 13 (Case 57).](image)

I do not say that these are particularly bad cases for iridectomy or sclerotomy, but the experience of the first of them (56) is suggestive. In them it is difficult to avoid the conclusion that the optic nerve is the primary seat of disease, or that at any rate it becomes involved in a progressive manner very early. These cases are amongst those as to the nature of which there is much difference of opinion, many surgeons looking upon them as peculiar varieties of primary uncomplicated atrophy of optic nerve rather than glaucoma. No doubt the point is a difficult one to settle, and perhaps we can at present only compare their features with those of ordinary cases of "primary" atrophy (progressive or not) and note the points of agreement or difference. Now, although in some of the cases of very quiet doubtful glaucoma, like Nos. 56 and 57, tension is never decidedly raised, and variations of sight
are absent, the following one (Case 58) shows that early failure of the central part of the field is compatible with both these cardinal symptoms of glaucoma, and no one could refuse to name such a case glaucoma.

**Case 58.—** Wm. Barker, 48 (M., O.P.). Came first on January 28 last (1889), stating that L. had been defective from "something growing over it" for four or five years; there was a small pterygium on the cornea, and he probably attributed the defect to it. R., H. 3 D $\frac{6}{6}$; central guttate choroiditis at y.s.; T. full n.; marked physiological cupping, F. n.

L., H. 3 D $\frac{6}{60}$; T. $+\frac{1}{2}$; p. larger when shaded than R; central choroiditis as in R., not more abundant; o. d. more cupped and cupped area white and atrophic-looking; F. full, but shows a small broad central zone of absolute blindness, about 10° radius, with minute central island of imperfect vision (Fig. 14).

![Fig. 14 (Case 58).](image)

A month later, after continuous use of eserine to L., the scotoma seemed less dense, T. was n., and V. decidedly better (H. 2.75 D $\frac{6}{18}$ slowly). He is still under care.

Other forms of atypical loss of field are seen from time to time, but I have nothing decided to say about any such at present.

The prognosis after operation for chronic glaucoma is also influenced, as already stated (p. 98), by the patient's
state and by the behaviour of the wound; the behaviour of the wound is influenced by the condition of the patient's tissues and by the situation and size of the section. I have for some years advocated and practised a large incision, lying as much as possible in the sclerotic, and made with a Graefe's knife. Though this method is generally most satisfactory, and is theoretically correct, I do not doubt that in certain cases a wound placed further forward, and perhaps shorter, would have been followed by quicker healing, and therefore by less tendency to that form of slow inflammation which, spreading into the cornea and perhaps iris, spoils a certain number of eyes in old and feeble persons (whether the operation have been for glaucoma or for cataract). Against this must be set the risk, not so slight, of failure from removal of too small a piece of iris, or from the occurrence of anterior synechiae, if the incision be made further forward and of smaller size, as may happen if a keratome be used. The point is one on which tabulated statistics would have no value; but the following two cases in each of which one eye was operated on by a colleague, whose incision was neither far back nor long, and the other eye by myself in the other manner, are, so far as they go, instructive; for in each case the eye operated by myself did badly. Case 54 in myopic eyes may also be referred to. It will be observed, however, that in the first of the two following the eye operated on by myself was in a much worse condition than its fellow; and that the second case was rather glaucoma complicating scleritis than primary glaucoma.

Case 59.—Maria A., 69 (M., I.P., 1886, No. 934), had iridectomy on R. for subacute glaucoma with cupped disc, in May 1886; incision not far back and not very large. It did well. L. was blind from glaucoma at date of operation on R.; duration of blindness not stated, but eye said to be quiet; a month later it became painful and red with T. +3, and I now performed iridectomy, making the wound larger and further back than my colleague had made it in R. Wound remained sodden at vol. XII.
nasal end where a small fistulous opening remained in the sclerotic; T. for a time decidedly — . A year after operation, recurrence of pain and + T., with iritis and hypopyon; eye excised. Tissues about operation scar thickened. (? Infection through porous scar.)

**Case 60.**—Jane H., 67 (M., I.P., 1886, No. 1378), underwent iridectomy on L. for "Cyclitis with + T." of six months' duration, in February 1886; incision not large, and not decidedly scleral; some permanent entanglement of iris; did well for about a year though o.d. was cupped and pale; then T. seems to have been rising again and F. contracting more; no later note. She came under my care in September of the same year (1886) with sclero-keratitis of upper part of other (R.) eye; T. +1 to 2, V. $\frac{6}{18}$, o. d. slightly cupped; I made a large iridectomy with Graefe's knife, the incision far back and passing through the inflamed tissue; eye did badly from time of operation, sclero-keratitis increased, keratitis punctata appeared and V. sunk rapidly.

Whilst on the subject of the incision, let us ask what is the result when the scar is obviously a "filtering" one, *i.e.*, has to the naked eye the characters which on theoretical grounds require and justify a large and scleral incision? I assume that the deep structure of the scar allows free percolation of fluid when the conjunctiva, over and around the wound, is and remains in a state of milky or opalescent oedema, through which the lips of the scleral wound can usually be seen to be slightly separated. Sometimes a minute round fistulous opening can be easily seen somewhere in the scleral wound, and the conjunctiva over this point may be quite raised as a little vesicle. Well, some of my cases of permanently porous scar have been as favourable as possible, and others unfavourable. Of the latter, Case 59 is an instance. John N. (T. 1882, No. 367), and Maria R. (M. 1883, No. 1383), both cases of "malignant" acute glaucoma doing badly after iridectomy, had porous scars. Even in the unfavourable cases,
however, the porous scar appeared to keep the tension low, and the failure of sight was due to other and unexplained causes. I believe we may say that so much of the future as depends upon maintenance of normal tension will be distinctly favoured by a porous scar, but that, if the patient be old and his tissues degenerated, such a scar may act unfavourably by increasing the likelihood of slow inflammatory processes.*

Referring to the very inconstant relation between tension and organic damage in chronic glaucoma, we might hope to find some help in the state of the circulation: that, e.g., if the heart's action were habitually feeble, or if there were aortic regurgitation, and still more if there were also marked loss of arterial elasticity, the eye tissues (retina and choroid) would suffer more from a given degree of increased tension than if the arterial blood stream were strong and well maintained. There may be much in this, but naturally it is difficult to demonstrate: Cases 52 and 7 are, however, apparently to the point. Another factor, also already spoken of, may probably be found in the natural variations of resistance in the lamina cribrosa; the more readily it yields, the greater the stretching, bending, and consequent atrophy of the nerve fibres. A question for our curators is whether such variations can be observed in sections, and whether a weak lamina cribrosa goes especially with a large deep normal excavation? As to the latter, I think it likely that a very large "physiological" cup shows a predisposition to the further yielding that will constitute glaucoma (Cases 21 and 22, 52 and 58).

Though not strictly connected with the subject of chronic glaucoma, I would just mention the influence of exposure of the eyes to cold air as one of the many causes that, by disturbing local circulation, not infrequently

* On the possibility of acute (infective) inflammation gaining access through a thin or porous scar, see a case by Mules (Oph. Soc. Trans., vol. iii, p. 58).}
decide the onset of acute glaucoma; and probably this will operate more on persons whose peripheral circulation is easily depressed or excited by other agencies than external heat and cold.

In speaking on sclerotomy (p. 100) I should have mentioned, as a peculiarity, that sometimes extreme mydriasis comes on within a few days of the operation, lasts some days, and more or less resists eserine. This occurred in the case of Bertha W. and Alfred A. (T. 1882, No. 307). No doubt extreme shrinking of iris is sometimes seen in old cases of absolute glaucoma, as in Case 61, Jane N., 39, absolute glaucoma of L, with extensive detachment of retina and extreme mydriasis: but here atrophy of iris is the cause. The mydriasis following sclerotomy must, I suppose, have a nervo-muscular origin.

I have lately (January 1889) seen almost complete disappearance of the iris follow optico-ciliary neurotomy performed on a young man, Case 61 (Edward S., T., I.P.) for the relief of pain in an eye lost by hæmorrhage (probably in part between choroid and sclerotic) after a severe blow. The pupil had been somewhat enlarged as the direct result of the blow, and had been kept still more dilated by atropine up till the date of the neurotomy. But within less than 3 weeks of the neurotomy the iris had in all parts of the circle shrunk to a scarcely visible line, and it has now remained so for several weeks; indeed it has lately become invisible. The eyeball is quite anaesthetic.

P.S.—March 15; sensibility of eye has returned to a considerable degree.

This uniform permanent shrinking of the iris in glaucoma comes on, so far as I know, only late and in absolute glaucoma; and perhaps (as Jane N. and Case 52 show) chiefly in eyes with detached retina or intraocular hæmorrhage in which the ciliary nerve-trunks would be stretched, or, as in the neurotomy case (61), paralysed. Is there any intrinsic neural apparatus in the ciliary muscle which, when uncontrolled by higher centres, can cause extreme mydriasis? However this may be, extreme atrophic my-
driasis in glaucoma must be distinguished from the atrophic *thinning*, with little or no *shrinking*, of patches of the iris which is sometimes seen quite early in the disease (as in Elizabeth N., 38 (T. 1883, No. 231A)), and which is one of the many evidences in favour of the belief that glaucoma of all varieties of acuteness usually starts in the ciliary region rather than in the optic nerve.
ON THE OCCURRENCE OF CENTRAL CHOROIDITIS, WITH SLIGHT CEREBRAL SYMPTOMS, IN CHILDREN.

By Edgar A. Browne.

I have been struck by the fact that in a small group of cases occurring in children, a limited central choroiditis occurs, accompanied by certain general symptoms which, though capable of more than one interpretation, seem to me to be connected with cerebral disease of a definite though slight character. The common feature of this group is the occurrence of trivial cerebral symptoms in conjunction with choroidal disturbance, in the same manner as we not unfrequently see similar symptoms allied with optic neuritis. The general symptoms are slight, and easily overlooked. In the first rank may be placed night terrors. The association of nightmare in the adult with dyspeptic disturbance has led to these nocturnal terrors in children being regarded as functional, and as having a gastric origin. The prevailing characteristic of nightmare in adults is oppression, but in children it is fright. It is difficult to obtain any coherent account of these subjective sensations, but the fact that the patients have been frightened is always clear. We have a history of starting, screams, sobbing, and a terror that is often a considerable time in subsiding. A theory frequently propounded, that these attacks are due to ghost stories told by ignorant servants, generally breaks down on examination. The occurrence of vomiting still further confirms the gastric theory. But the vomiting differs rather from that which shows itself in children who are readily upset by errors in diet, as many miserable town-bred children undoubtedly are. It occurs without any obvious dietetic cause. It may sometimes be traced to over-excitement, violent games, and so forth. It occasion-
ally lasts for a period, occurring frequently perhaps during the course of three or four months, and then ceasing; to recur again at a late period, and so on. These children are often fastidious in their choice of food, and are less liable than they should be to attacks due to repletion, and so it happens that the domestic exhibition of "Gregory" has no good effects. As a matter of fact, their dietary, at all events in the wealthier classes, is most carefully superintended, yet the vomiting occurs. So with the bowels. Alternations of troublesome constipation and relaxation are noticed, and are attributed to the hot weather, fruit, or anything that comes handy. None of these symptoms are of any value taken singly, but, taken in conjunction with one another and the ocular symptoms with which they appear to me to be associated, they have a decided importance. The ocular manifestation is a choroiditis, sometimes wholly central, occasionally extending into other parts of the fundus.

It begins as a few white or buff-coloured spots in the immediate neighbourhood of or actually beneath the macula. The clots become confluent, and form small patches presenting more or less granulated or mottled surface, with some pigment disturbance. These patches may in some cases become absorbed, but in others they seem to leave small atrophic spaces with more or less well-marked central scotomata. A few spots, seldom many together, never large in area, may be seen on other parts of the fundus, never, so far as I recollect, independently of the central, though the central occurs without any peripheral disturbance.

I have always excluded the possibility of hereditary syphilis in considering these cases. The choroiditis in hereditary syphilis is more peripheral. The main stress falls on the iris, and the anterior regions of the choroid are those most frequently attacked. Exactly the reverse here. In no case have I seen any iritis. Nor in any case was there keratitis or characteristic teeth. Whether
these cases are dependent on struma or tubercle is a more difficult question. In one or two cases which I have had the best opportunity of closely observing, and have known the family history intimately, I have absolutely no clue. The parents have been without any obvious constitutional taint, and other children of the same family have not presented any marked diathesis. I have no post-mortem evidence, as only the children who recover have been seen by me on account of the ocular symptoms, and the links that connect these recoverable with the fatal cases (as I do not doubt there are) are at present not within my knowledge.

The connection of this kind of choroiditis with coarse though transient cerebral change is inferential. The association of double optic neuritis with meningitis is well established by numerous excellent clinical and microscopical observations, and can be verified by any one. But beyond the fatal cases, there are not a few in which well-marked cerebral symptoms and neuritis occur, and pass on to recovery. In these the association of the cerebral and ocular symptoms is commonly admitted. But it is also a matter of observation that neuritis occurs in cases in which the cerebral symptoms are very slight, but in which we certainly do not doubt there is encephalic implication. I have in my own mind distinguished a group of cases in which neuritis or atrophy occurs with the set of symptoms easily referable to gastric disturbance, and it was the observation of these cases that led me to the inference in these rarer cases of central choroidal change. It seems to me probable that certain cases of slight meningitis are transient in nature and recover, and that a proportion are never recognised at all. This can occasionally be inferred from the history of cases of early optic atrophy. Cases of this kind are those which are likely to be seen by the ophthalmic surgeon with either optic atrophy or more rarely with the central choroidal change I have attempted to describe. General practitioners probably would be
able to see this more frequently, for, as neuritis may run its course without notably affecting vision, and leaving no trace behind, so is it possible that choroidal changes may escape observation. I saw an overworked undeveloped pupil-teacher with intense asthenopia and severe headache referred in the first instance to refraction error. No relief afforded by correction. During the time she was under observation, spots of central choroiditis made their appearance, and formed a well-marked patch in each eye. Under treatment these disappeared, and the headaches were relieved. A year or two afterwards she had a recurrence of the headaches, with considerable mental disturbance, for which she went for a few months into an asylum. I saw her at intervals after with occasional headaches and asthenopia, but the choroiditis did not recur. This case, although not actually belonging to the class I am considering, yet indicates that central choroiditis may occur when we should a priori have expected neuritis. An illustrative case may be cited, E. H., æt. 5, a small, but fairly well-nourished, child. His sister has had ulcer of the cornea, but is chubby and well grown. He had at each macula an excavated patch, white, with faintly pigmented edges. In both eyes there are some buff-coloured fine spots, and some discrete pigment spots, of which some may be retinal. No appearance of any marked peripheral choroiditis. Between 2—3 had an attack of "irritation of the bowels," and vomited a good deal at intervals. At one time had a strange kind of fainting fit. From that time to the present has been subject to night terrors, sometimes very violent. Occasionally does not know his mother (volunteered) and seems queer, but generally a very sharp boy, active, and all functions normal. Parents have good health, are not related. Two other children healthy. This child improved in general condition under treatment, but the choroid remains unaltered.

D., æt. 11, a delicate and highly nervous girl. Both parents healthy, unrelated. One other child, very strong.
From the age of 2 subject to "bilious attacks." Bowels exceedingly troublesome, often for months constipated, then apt to be relaxed. Vomits on the slightest excitement, sometimes if fatigued. Till about the age of 8 was miserable with night terrors—used to wake up screaming and sobbing. Hysterical sobbing lasted for some time after waking. Could not give any account of her dreams or sensations. Complained of headaches, generally attributed to stomach disturbance on account of the vomiting. Has gradually grown strong; but is still nervous, and dainty about her food. Highly My. (R. č. \(-11\) \(-4.170\) \(=\frac{20}{100}\). L. č. \(-11\) \(=\frac{20}{70}\).) Both eyes ordinary myopic crescents—at the maculae granulated central disturbance, with irregular pigmentation—over the fundus discrete circular spots of black pigment—no atrophic patches—no signs of iritis. Teeth well shaped, but brittle. This child was under observation some years, and has not altered, except gradually gaining strength. The choroiditis occurred at some period before I saw her, and has remained stationary. I think the myopia is secondary to the choroiditis, and have a suspicion in my own mind that this case illustrates the generation of a certain class of extreme myopia occurring in young people who do not employ their eyes on near objects.

B., aet. 5, a small but smart boy. Parents very fine, well-grown people, not related. When aged 3 years he was taken with vomiting, and had a comatose attack for some hours. He was very feverish. Recovered in a short time from what was considered to be a bilious attack. A few months later had a convulsion, with loss of consciousness and a good deal of twitching, though it was not noticed which side or limb were affected. Vomited at intervals, but recovered well from this attack. He had (1885) in the left eye a small central patch of buff-coloured choroiditis, another small patch some distance below the macula, and the edges of the disc very ragged and pigmented.
The central patch cleared almost away, leaving not much visible trace (V. = J. 19 held very close), but the lower patch seems permanent, and the disc has remained pale. The right eye unaffected. In this case there seems to have been some papillitis, but whether descending or spreading from the fundus I have no means of telling. I had seen this child when an infant before the attacks, and feel confident there was no choroiditis then, and no attacks have taken place since. He seems quite unaffected in intellect, and is not subject to "bilious attacks." These cases taken almost at random are seen to indicate that the central region of the choroid may if carefully watched serve to aid in the diagnosis of transient meningitis (or at least encephalic mischief). Although rare in an ophthalmic practice, I suspect they are much less common in general practice than is supposed. In all the three cases gastric disorder was definitely supposed to be the primary cause.
REMARKS ON RETRO-BULBAR NEURITIS, WITH SPECIAL REFERENCE TO THE CONDITION OF THE LIGHT SENSE IN THAT AFFECTION.

By G. A. Berry, Edinburgh.

The whole subject of retro-bulbar optic neuritis, although it has undoubtedly advanced a stage or two since Von Graefe introduced the name, is still very obscure. As has been the case in so many other instances in connection with the pathology of the nervous system, there exists with respect to retro-bulbar neuritis a dangerous tendency to lay too much stress on the data afforded by anatomical investigation. An attempt to bring the clinical facts of cases of supposed retro-bulbar neuritis into accordance with the still very imperfectly understood pathological anatomy of that affection has led de Wecker, the author of the most recent exhaustive chapter on the subject, to give an altogether fanciful description of the disease. De Wecker, without apparently entertaining the least doubt on the point, discusses cases of toxic amblyopia which are characterised by a central scotoma as coming under the heading of retro-bulbar neuritis, and forming, indeed, by far the most important group of cases recognised as due to a condition of primary inflammation of the optic nerve. Fully convinced of the existence of such an inflammation in these cases, he refers, on the one hand, to the considerable differences met with in the shape and degree of the scotoma in toxic central amblyopia, and, on the other, to the possibility of diagnosing the stage at which the inflammation has arrived in any case, and thereby obtaining valuable data for the prognosis.

From a clinical point of view, however, it is just the practical constancy in the shape of the scotoma which affords so strong an argument against inflammation in the nerve being the cause of the symptoms. This view, too, is further strengthened by the fact that the point of greatest saturation in the scotoma almost always corre-
sponds to that portion of the retina which lies midway between the optic nerve and fovea centralis. Again, a still greater difficulty on the inflammation hypothesis is to account for the practical similarity, in all undoubted cases of toxic central amblyopia, in the degree of amblyopia of the two eyes at all stages of the affection. It is difficult to imagine how an inflammation in such a situation as the optic nerve could confine itself so sharply to the impairment of the function of what is, no doubt, one particular set of fibres. More especially is this difficulty apparent when we remember that there is good reason to believe that these fibres occupy different situations in the nerve at different levels between the papilla and optic foramen. But it is still more difficult to understand how an independent inflammation in either nerve should not only involve exactly corresponding fibres, but affect their functions simultaneously to the same extent.

From these considerations, then, it can hardly be expected that any one who places the clinical facts of the case in the foreground can be prepared as yet to accept the view as to the pathology of toxic central amblyopia which has been referred to. Whether any merely circulatory disturbance, for some reason or other confined to the vessels supplying the papillo-macular fibres, and occurring symmetrically in both nerves, might account for the symptoms, can only be a matter of conjecture. Such a condition, though quite different from inflammation, might possibly give rise to anatomical changes liable to be mistaken for true inflammation.* On the other hand, anatomical investigation has definitely established the existence of such a disease as an independent destructive inflammation of the optic nerve.

Are there, then, cases whose symptoms admit of an explanation on the assumption of an inflammation of this

* The inference that inflammation has existed in the optic nerve, merely from the discovery, real or imagined, of an increase in the number of white cells or nuclei, has always appeared to me a very fallacious one.
kind? Every one is familiar with a group of cases in which, while a central scotoma exists, it is irregular in shape and subject to variation. In such cases, too, there is usually, if not always, at some time or other in the course of the affection, a distinct difference in the degree of the defect in the two eyes, or one eye alone may be affected. The affection is no more common in men than in women, or, at all events, the preponderance of cases in one sex is not marked as it is in the case of typical toxic central amblyopia. The subsequent changes met with in the optic nerve are sometimes more pronounced, too, than those ever seen in the toxic form. The whole course of such cases is then evidently more suggestive of inflammation in the nerve. Some of them are accompanied by distinct pain on moving the eye or on pressing it into the orbit, another point which is not inconsistent with the presence of inflammation somewhere in the orbit, and therefore possibly in the nerve itself. In some cases, in fact, the localisation of this pain to the nerve may be aided by the ophthalmoscopic examination. There may be changes in the papilla quite sufficiently characteristic of inflammation, and taken with the other symptoms it may fairly be inferred that the inflammation is not confined to the papilla, but exists as well over a greater or less extent of the more central portion of the optic nerve.

For cases which present either subjective or objective symptoms of such a nature as have just been described, we may, I think, fairly, so far as our present knowledge goes, diagnose retro-bulbar neuritis, but that diagnosis ought to be confined to such cases. As long as the inflammation only or mainly involves one particular portion of the bundle of fibres which enter into the composition of the optic nerve, some difference in the form of the amblyopic portion of the field of vision might be expected, according to its extent and level. Yet in the great majority of cases a central scotoma exists either alone, or, although it may be associated at the same time
with some peripheral defect, it is the most prominent feature. Probably, therefore, in most cases the site of the inflammation is much the same. As soon as the changes in the nerve have given rise to a central scotoma, and the objective examination is either negative or results in the discovery of some slight indistinctness of the margin of the disc, and it may be enlargement of the veins, the diagnosis may generally be made without much hesitation.

It is not improbable, considering the extent to which improvement takes place in quite pronounced cases of retro-bulbar neuritis, that a certain number of such cases may exist in such a slight degree that the defect in the centre of the field may altogether escape detection, or practically or virtually not exist at all. In this form, too, they may either persist for some time and eventually get well, or the symptoms may in the course of time become aggravated and leave little doubt as to the diagnosis. Is there any means of diagnosing these less severe forms of retro-bulbar neuritis?

It seems possible that the condition of the light sense may in some cases be of diagnostic importance. So far as my limited experience goes at present, a very decided light sense defect appears to characterise abnormal states of the macular fibres of the optic nerve, although the particular defect is probably not confined to cases of inflammation. Bjerrum was the first to point out, some years ago, the practical significance of testing the power of distinguishing differences in the intensity of illumination of two contiguous objects, as this is subject to pathological variation. He showed that the visual acuity might be diminished in an altogether abnormal manner when the difference in the luminosity of the test object and the background was lessened. Meyer has since proposed to denote this particular and distinct element in the light sense by the letters L.D., which stand for "light difference," and this notation has been adopted by Swanzy in the second edition of his handbook on
“Diseases of the Eye.” The method of testing the L.D. in the following cases, which are particularly interesting instances of defects of the light sense in this direction, was by means of the test types introduced by Bjerrum, which consist of the ordinary Snellen types printed in grey on a grey background. Bjerrum has used several different sets of types, in which the difference between the brightness of the letters and background is more or less. In the one which I have found most practical, the difference is approximately $\frac{1}{11}$; that of the ordinary letters on a white background being taken as unity.

Case I.—In the beginning of May, 1887, a police constable, aged 42, came under my treatment at the Edinburgh Royal Infirmary, complaining of a dimness of sight in both eyes. He did not recognise people in the streets unless pretty near to them, and stated that he saw rather better in the dark. The dimness had lasted rather more than six months. On testing his vision I found that he had $\frac{20}{20}$ in both eyes, with no restriction of the fields of vision and no abnormal diminution of visual acuity in diminished light. There was no pain on moving the eyes or on pressing them back into the orbit. As the complaint of dimness of sight was so definite, I suspected that some defect must exist in his light sense. The fact that a diminution of visual acuity did not result in any abnormal manner on reducing the illumination showed that there was no defect of the nature of night-blindness, and that, therefore, although the minimum perceptible degree of illumination might possibly be somewhat greater than normal, it was not so in any marked degree. Tested with Bjerrum’s (L.D. = $\frac{1}{11}$) types and with an illumination under which my own visual acuity for them remained undiminished, the patient’s vision was reduced to $\frac{4}{70}$. This patient afterwards developed a well-marked central scotoma in both eyes ($V. = \frac{10}{70}$), from which he completely recovered on giving up tobacco.
Case II.—Towards the end of last year a lady, aged 40, came to me complaining of an uncomfortable painful sensation in or behind the right eye when the eyes were moved from side to side. The pain was altogether absent when the eyes were at rest, and in consequence of this she had, more or less involuntarily, got into the way of moving her head and not her eyes when reading. She had also observed that the sensation of pain could be started by moving the head rapidly to the right, but was not felt if a similar movement were made to the left. This was in accordance with the fact elicited on examination, that adduction of the right eye caused pain, whereas abduction did not. The vision she believed to be quite unimpaired, though she had noticed that objects seen with the right eye had a dirty, not altogether sharp look, and often appeared distinctly pink in colour. On awaking at night she experienced a sensation of very bright light. This subjective sensation was of short duration, though it appeared to last "decidedly longer than a flash of lightning," and it only occurred once after every time of waking in the dark. No subjective light sensations were noticed at any other time. The light seen was brilliant and uncoloured. The patient believed herself to be in perfect health, and knew of nothing which might account for the symptoms she had, and which she was inclined to regard as of little importance. Some years previously she had suffered for a short time from facial paralysis on the right side, which was brought on by exposure to cold. At that time there was no diplopia, nor had that symptom ever been noticed. She did not consider herself rheumatic or gouty, and had not required to have the advice of a doctor for years.

On examination I found the vision equally good in either eye, and fully $\frac{20}{20}$. Small type was read with equal facility by the two eyes, but did not look quite so black to the right eye, while at the same time the page had a distinctly pinkish colouration. There was pain on pressing the eye back into the orbit, and on moving it inwards and upwards. The ophthalmoscopic examination revealed a distinct difference between the appearance of the optic discs. The right showed a somewhat hazy surface, by which the vessels springing from it suffered slightly in the distinctness of their outline. The margin was also less
sharply defined than the left, and less so than usually characterises the normal condition. Some enlargement of the veins also undoubtedly existed. In short, the appearances were those of congestion of the papilla, although this congestion was certainly no greater than that occasionally met with when the eyes have been overstrained. It existed, however, only in the one eye, and in that in which the pain was experienced. The diagnosis, retro-bulbar neuritis, was therefore, from the description given, no doubt justified. I recommended the patient not to drive in an open carriage, as she had been in the habit of doing, but to take as much outdoor exercise walking as she cared to, to be careful as to her diet, not to read, to use dark glasses outside, and to take salicin. As she was rather opposed to counter-irritation, I did not press it. At the next visit 10 days afterwards the pain had altogether gone, but she informed me that the vision appeared to her to be less clear. On examination it was found to be as good as before, fully \( \frac{20}{20} \). The coloured wool test revealed no colour confusion at all characteristic of any form of colour blindness, but every colour appeared less saturated when seen with the right eye than with the left; blue hues mostly so, and yellow least. There was also a slight difficulty in distinguishing between certain shades of green and blue. Bjerrum’s test-types \( \text{L.D.} = \frac{1}{11} \) were altogether invisible, even when placed at a distance of only 3 feet. At the same time there appeared to be no greater difficulty experienced in reading with the right eye by the aid of a faint illumination than with the left; there was therefore no marked night blindness.

The patient eventually recovered completely. The vision tested with Bjerrum’s types was as good as my own, i.e., nearly \( \frac{20}{20} \), while all colours appeared equally saturated to both eyes. The appearance of the disc, too, became so nearly normal that it would now be difficult to detect any difference as compared with that of the other eye.

So marked a light sense defect of a nature similar to that exhibited by these two cases is, so far as my experience goes, far from common. It is certainly rare to find
full visual acuity tested in the ordinary way along with so great a difficulty in distinguishing between luminous impressions of different intensity. This kind of light sense defect is known to characterise those forms of amblyopia which are the result of some change in the peripheral nerve elements of the visual apparatus. On the other hand, alterations in the pigment cells of the retina, and possibly circulatory disturbances in the choroid, give rise to more or less pronounced difficulty in the perception of feebler intensities of illumination. This distinction appears first to have been clearly made by Bjerrum, and may no doubt be of diagnostic importance.

From the defect met with then in the two cases just recorded it might be assumed, even did the other symptoms not point in the same direction, that some disturbance existed in the respective optic nerves. I have at different times made examinations into the state of the light sense in various forms of amblyopia; but, although I have met with a very distinct diminution in the acuteness of the appreciation of differences of intensity of illumination, these two cases are so far the only cases I remember to have seen in which a defect in this respect existed in such a marked degree without any appreciable alteration in the form sense in ordinary daylight, and for black objects on a white background. With regard to toxic amblyopia in general, I have referred in a previous volume of these reports* to the test with Masson's disc. By means of this test I have satisfied myself that a similar defect in the light sense usually exists in that affection, and since using Bjerrum's types, I have been able to confirm this by that test as well. Yet the disproportion between the defect and the visual acuity was never found to be so great as in the first case here referred to. Perhaps this may be owing to one's rarely having an opportunity of seeing the very early stages of toxic amblyopia. So far as the condition of the

* Vol. x, part 1, 1880.
light sense goes, then, the presumption is that the lesion to which toxic central amblyopia is due, whatever it may be, is located in the nerves, and not more centrally, as there are, perhaps, other reasons for believing to be more probable.

It is interesting to note that the particular defect was still more marked in the second case, which was one of retro-bulbar optic neuritis, or, at all events, congestion. In other forms of neuritis, too, which are not characterised by any disproportionate impairment of the functions of the central portion of the retina, there exists the same defect in the L.D., but to an extent which, though no doubt varying considerably in different cases, probably never amounts to anything like that found in the two cases described.

To these two cases of light sense defect, the one occurring at the beginning of what turned out to be apparently a typical case of tobacco amblyopia, and the other constituting the most marked subjective symptom of a slight retro-bulbar neuritis, I am able to add another which was met with in a case of a somewhat obscure though no doubt allied form of amblyopia, from which there has been almost complete recovery.

Case III.—George C., æt. 25, a gardener, began to complain of failing sight towards the beginning of 1887. The blindness reached its full height about three weeks afterwards, and continued much the same up to the end of April, 1888, when he first came under my care at the Edinburgh Royal Infirmary. At that time his vision was about $\frac{8}{200}$ in either eye. There was no restriction of the fields of vision, and no definite central scotoma in either eye. Colour vision was very defective. The discs were markedly pale and presented altogether the appearance of post-papillitic atrophy. The patient never drank to excess, and smoked rarely more than 3 ozs. a week of "twist" tobacco. He was ordered iron and quinine, which he took for three or four weeks and then discontinued, as he did not find
that his sight improved. I next saw him in January of this year. His vision is now $\frac{18}{30}$ in either eye. The fields are not restricted, and colours appear only slightly hazy. He complains, however, of not being able to recognise people until they speak to him. On testing him with Bjerrum's types, I found his $V. = \frac{2}{100}$ (for L.D. = $\frac{1}{11}$), and $\frac{12}{200}$ (for L.D. = $\frac{1}{6}$). He has therefore a very marked light difference defect. The discs are now both extremely pale, and the vessels covered here and there by a densely white deposit. He still continues to smoke at least 2 ozs. a week of the same tobacco. He had an attack of typhoid fever in February, 1888, shortly before and after which he saw Mr. Nettleship. From the notes of the case at that time kindly supplied to me by Mr. Nettleship, I find that he could only count fingers at 18", so that when I first saw him he had begun to improve. He himself ascribes the improvement in his sight to his recovery from the typhoid fever. It seems not impossible that this recovery may have been in some way connected with the visual improvement.

The point of interest in this case in the present connection is the fact of the great defect in the light sense remaining after such a marked improvement in vision tested in the ordinary way had taken place. It explains, too, the difficulty which the patient has in recognising people, as the difference in luminosity of the different portions of the face is small compared to the contrast presented by black letters on a white background.

The cases show the importance of testing the light sense without any attempt at dissociating it from the test for visual acuity. It is evident that when the L.D. is abnormally defective it will have a great influence on the visual acuity, as tested by Bjerrum's types. Further, it is obviously only necessary for this, that the defect should exist for the central portion of the retina. We may conclude, therefore, that a very much diminished acuity when the light difference is reduced, coexisting with otherwise normal or good visual acuity, is indicative not only of some affection of the
optic nerve, but of one which involves mainly the fibres which supply the centre of the retina. The actual lesion which may produce this effect need not always be identical in nature. Possibly a similar condition of the peripheral light sense exists for those cases of neuritis which primarily lead to restriction of the field of vision, but as to this I have no experience; the practical testing of the peripheral light sense is, besides, by no means easy.
NOTE ON A CONGENITAL DEFECT (? COLOBOMA) OF THE LOWER LID.

By G. A. Berry, Edinburgh.

The accompanying drawings exhibit a variety of congenital defect in the formation of the lower lid, which appears to be of very rare occurrence. I have been unable to find any description of a similar case in ophthalmic literature.

Fig. 1 gives a very good representation of the right lower lid of Janet R., a girl of 15, whom I first saw on account of an acute catarrhal conjunctivitis. On the margin of the lower lid, at about the junction of its outer fifth with the inner four-fifths, is a depression which has all the appearance of a badly united cut in this situation, and which is continued into a cicatrix on the skin surface, about 4 mm. in length. The natural curve of the lid is somewhat altered, the outer portion passing almost vertically downwards to the notch.

On inquiring whether she had at any time received an injury to the lid, she told me that she was born with the defect, and that her mother presented exactly the same appearance in both lower lids. This statement I was able to confirm, and Fig. 2 represents the appearance in the case of Mrs. R. The defect exists in the lower lid of both eyes absolutely symmetrically, and exactly similar to that in the daughter's right lower lid. Mrs. R. had, further, a hare-lip, which was operated on when she was eight years old. Of this condition there still remain a well-marked cicatrix and a notch which is represented in the drawing. She has had three children, two of them, Janet and a brother, being twins, and an elder daughter. The elder daughter I have seen; she is entirely free from either deformity. The son was born with hare-lip. Of Mrs. R.'s
brothers and sisters, only one, a brother, has any defect of the lid. The defect is in the lower lid of one eye, and, according to Mrs. R.'s description, is quite similar to her own. She does not remember a time when it did not exist, but her daughter declares that her uncle asserts it was due to an accident. There is, therefore, some doubt as to this case; and, as I have not seen him, I am unable to say whether it is a congenital deformity or not, although the possibility of such being the case is, perhaps, worth mentioning.

There are two points of interest in connection with these cases, viz., the hereditary transmission of the deformity and the difficulty there seems to be to explain its nature. The one point, too, appears to me to have some bearing on the other. The exact similarity of the condition in both parent and child, taken together with the fact that the other twin was born with hare-lip, seems almost to exclude the possibility of its being the result of any accident occurring during intra-uterine life. These same facts are very suggestive, too, of the lid defect being caused by some arrest of development or to be, in other words, a true coloboma. This view is also strengthened by its bilateral occurrence in the one patient. On the other hand, it is totally different from other cases of supposed coloboma of the lid which have been described. It is not evident either at what time in foetal life the particular arrest in development might possibly take place, as its position does not coincide with any known fissure, or, indeed, in any way with foetal anatomy.

About 50 cases of coloboma of the lid have been recorded, all of which seem to have been to the inner side. By far the greatest number have involved only the upper lid, and about one-third of all the cases have been symmetrical on the two sides. A certain proportion, too, of the recorded cases have been accompanied by hare-lip or coloboma of the iris. Several hypotheses have been advanced to account for the so-called coloboma of the
lids; but, as these cases have probably little bearing on those here recorded, those interested in the subject may be referred to a paper by Dor, published in the Transactions of the last International Ophthalmological Congress, where the different views are clearly discussed.
AMAUSOSIS (WITHOUT OPTIC NEURITIS) DUE TO CEREBRAL TUMOUR.

By J. Hutchinson, Junr.,

Clinical Assistant at the Hospital.

The following case presents several points of special interest which justify its record in detail, especially since the eye symptoms were the first ones which attracted attention, and the diagnosis presented considerable difficulty.

The patient, a young labourer, aged 20, first attended the Hertford Infirmary; three weeks after this he came to Mr. W. Tay's clinic at Moorfields, and was then transferred to the London Hospital, where he was under the care of Dr. Warner. To the latter, and to the house physician, Mr. Debenham, I am indebted for various notes of the case, and for the opportunity of obtaining the optic nerves after the patient's death.

George A., a brickmaker by trade, living at Ware, in Hertfordshire, was said to have been quite healthy until the spring of 1888, when his sight began to deteriorate, and gradually became worse day by day. He noticed also some general weakness, he became more tired in walking than formerly, and after a time the eyes and head began to ache. At first intermittent, this headache became almost constant. He was admitted into the Hertford Infirmary on June 25th on account of his loss of sight, which affected both eyes, and at that date was so advanced that "he could not see to read large type, even when held close to the eyes." The "tops of the eyes ached," and on June 30th he vomited once. The vision in the right eye somewhat improved, so that on the 28th he could make out large letters; the defect in the left eye did not alter much.

I do not know that any diagnosis was made in the case until he came to Moorfields Hospital on the 11th of
July, when tobacco-amaurosis was at first suspected, for the following reasons:—

1. The failure had been gradual, and was wholly unaccounted for by anything seen in the fundi. It was thought that the discs were a little hazy, but, personally, I could see nothing abnormal in them, and this was later confirmed by other observers. Both eyes were emmetropic.

2. When tested by the perimeter a definite central scotoma for red and green was made out.

3. He stated that he was in the habit of smoking about half an ounce of shag daily.

But on investigating the case it seemed very improbable that it was really one of toxic amblyopia. He was of an age (only twenty) at which amaurosis from tobacco is extremely rare, his visual power (only 20 J. badly at 10" and \( \frac{1}{60} \)) was unusually impaired, and there was some evidence of mental deterioration in addition to his complaint of constant headache and loss of sleep.

It does not, perhaps, mean much in a country labourer to have a heavy and stupid expression, but besides this the patient was liable to break into causeless laughter, and answered questions in a rather slow and imperfect manner. But perhaps the most conclusive argument was the state of his pupils, which were large, and acted very slowly both to light and on accommodation.

Nevertheless, on the chance that the visual defect might be due to tobacco-amaurosis, he was ordered to abstain from smoking, and to take a mixture containing tinctures of nux vomica and perchloride of iron. He returned six weeks later, when his vision had, if anything, become rather worse, although he had entirely left off smoking.

On August 23rd I made the following note:—"Fundi normal. Sickness after taking food, occasional faintness, still much headache. Some deafness on the right side."
Knee-jerks normal, finer movements of hands perfectly executed. (?) Cerebral tumour."

There was nothing in the family history to throw light upon the case; there was no history of tumours, his father and mother were alive and healthy, and there was no evidence to point to syphilis, either acquired or inherited.

He was admitted into the London Hospital on the same day, and died suddenly on September 15th—three weeks later, and probably about four months since the first symptom developed. His temperature and urine were normal until the end, but his mental condition altered considerably. The headache became constant with exacerbations, the pain being most severe in the eyes and towards the occiput. The pupils, at first contracting to light in a sluggish manner, ultimately became fixed; his vision varied somewhat (at times he could not see the window even). Partly owing to the headache it became very difficult to examine the fundi, but when they were looked at there was not the slightest evidence of neuritis. There was only occasional vomiting, but frequent nausea. The knee-jerks continued normal or were slightly exaggerated, and the other reflexes (triceps, plantar, &c.) were increased.

Treatment consisted in the administration of mercury and iodide of potassium, the application of ice to the head, and various sedatives were tried, without effect, with the object of relieving the headache.

The post-mortem examination was as follows:—

Viscera healthy, with the exception of the brain. Heart in systole. A large soft glioma involved the apex of the right temporo-sphenoidal lobe, and reached across the middle line in the inter-peduncular space. "On trying to examine the brain more closely it was found to be too soft to allow of the exact limits of the tumour to be made out, but the growth had penetrated somewhat deeply into the right crus cerebri; at the base of the brain it extended
over an area as large as the palm of the hand, and about an inch and a half in depth" (Dr. F. J. Smith).

The optic nerves and posterior halves of the globes were removed, and I made sections involving the optic papillae as well as transverse sections of the optic nerves, both near to the eyes and towards the chiasma.

The symptoms had led me to suspect that, though the ocular expansion of the nerve might not be inflamed, we should find retro-bulbar neuritis, and possibly that the inflammatory changes would chiefly affect the band of fibres concerned in tobacco-amaurosis. The results of examination (which Mr. E. T. Collins kindly confirmed), however, proved that the nerve in transverse sections was but slightly and equally affected throughout. The peri-neural sheath was filled up with small cells and delicate connective tissue, which, there was no doubt, consisted in a prolongation of the gliomatous structure downwards from the base of the brain towards the globes. Immediately behind the lamina cribrosa was also a similar infiltration, the papilla itself being quite normal. In the interstitial bands there was but little evidence of change, nor could there be said to be any true neuritis. There was no dis-tension of the nerve-sheath, either close to the eye or further back.

Looking at the slight character of the changes present, it seems most probable that the amaurosis was due to involvement of the optic chiasma or tracts in the growth, and I am sorry that the extremely soft nature of the tumour prevented an accurate opinion being formed on this point.

The case recorded is the exact converse of those to which Dr. Hughlings Jackson has especially drawn attention—examples of optic neuritis or papillitis from cerebral tumour in which (at any rate for a time) there is little or no defect of vision. Here we have a large, soft, rapidly growing basal tumour, causing great defect of sight but no papillitis. It is of course possible that, had
the patient survived a few months more, optic neuritis would have developed. So far as one can judge from the symptoms, the tumour had started four or five months before the patient's death.

Are such cases not infrequent? According to Aunuske and Reich, papillitis is absent in only about 4 per cent. of the total number of cases of cerebral tumour. It would be of interest to know in what proportion of the 4 per cent. amaurosis was present without changes visible to the ophthalmoscope.

I do not wish to suggest that such a case has any bearing upon the theory of the causation of optic neuritis so well advocated by Messrs. Lawford and Edmunds. On the post-mortem table a soft infiltrating glioma at the base of the brain may appear to be closely similar to meningitis; in reality they may be wholly different, and one may be much more liable to produce optic neuritis than the other.
NOTES OF CASES OF EPITHELIOMA AND SARCOMA AFFECTING THE CORNEA AND CONJUNCTIVA.

By J. B. Lawford,

Clinical Assistant at the Hospital.

The following brief notes concern some pathological specimens which came into my hands while Curator of the Moorfields Hospital Museum.

Three of these were obtained from patients in the Hospital, and one from a patient under care elsewhere. As they were all cases of some rarity, and of both clinical and pathological interest, it seemed worth while to publish them in these Reports; I have considered them, however, almost entirely from their pathological side.

The history of Cases 1 and 4 have been obtained up to date; of Cases 2 and 3 unfortunately nothing is known since the operation.

Case 1.—*Epithelioma growing at Corneal Margin.*

F. G., æt. 66, a patient under the care of Mr. Nettleship, who has kindly given me the notes of the case.

In May, 1887, whilst under treatment for bronchitis by his regular medical attendant, a "spot" was noticed on the "white of the right eye." Some little time afterwards the patient consulted an ophthalmic surgeon, and was advised treatment under which the eye "got well." It soon relapsed, however, and on again consulting the surgeon he was told that the spot was "probably cancerous." A year previously the head of a burning match flew into the right eye, and caused much pain for a short time.

In November, 1887, he was seen by Mr. Nettleship. The condition at that time was as follows:—"Right eye. At the outer (temporal) part is a thickened patch encroaching slightly on the cornea. It is rather buff coloured, its texture a little translucent, and its surface decidedly rough or (?) papillary. Its
greatest thickness is just at the limbus, the scleral part is movable with the conjunctiva, the corneal part is fixed. In the vicinity the anterior ciliary and conjunctival vessel trunks are much enlarged. The eye is in all other respects sound."

The growth was removed, under cocaine, and the galvanocautery applied to the corneal margin, and to the floor of the hollow which was left. The wound healed slowly by granulation, and up to the present date (January, 1889) there has been no return of the growth, and the eye has remained quite sound.

The growth when removed consisted of a strip of greyish-looking tissue, measuring rather more than 0.5 mm. in its thickest part. Examined with the microscope, the surface of the tissue is uneven, with small papillary projections and intervening hollows. In sections (cut at right angles to the surface, see Fig. 1) a deeper fibrous part and a superficial cellular part are evident. The former has been very slightly coloured by the logwood; it contains few oval nuclei, and in its deeper layers is loose and irregular in arrangement. Adjoining the cellular part it is more like corneal tissue, which it probably represents. There is nothing which can be recognised as the anterior elastic lamina of the cornea, but the transition from the fibrous to the cellular tissue is abrupt. The epithelial part, which comprises rather more than half the thickness of the tissue removed, consists of cells which vary in shape and size much as do the cells of the normal corneal epithelium. The cells resting on the fibrous tissue are very similar to those of the deepest layer of the corneal epithelium, but are less regular in form and arrangement, and more closely packed; their nuclei stain deeply. Superficial to these are cells more circular in shape, less closely set, and the nuclei of which stain badly.

More anteriorly still the cells gradually become more degenerate looking, the surface layers being composed of long fibre-like cells, which are scarcely at all coloured by the staining fluid. The cells of these layers are not very closely adherent, and numerous small spaces are evident where they have become separated. These cornified cells in places dip into the deeper layers.

There is a considerable amount of stroma throughout the
growth; in the middle layers and towards the surface this is most evident, for here the cells have fallen out in many places, whereas in the deep layers they remain in position. The stroma has a faintly granular appearance, and does not stain with haematoxylin. Several quite characteristic "bird-nest" collections of cells can be seen in the sections (see Fig. 1, a).

The growth is apparently a-vascular. No vessels can be found in any of the sections in the cellular portion.

There seems to be but little tendency to invasion of the fibrous tissue by the epithelial elements, but here and there a small tongue dips into the subjacent tissue.

Case 2.—Epithelioma at Corneal Margin.

George L., æt. 65, sailor (Reg. No. 24560), was admitted to the Hospital under Mr. Gunn's care on May 10, 1887. For about twelve months he had noticed a small spot on his left eye, which he thought was increasing in size.

On admission, there was a pale, slightly vascular swelling at the sclero-corneal junction of the left eye, on the temporal side, to which some enlarged vessels ran from the conjunctiva. The swelling seemed to consist of two or three solid semi-translucent outgrowths. The eye was sound in other respects.

There was a small ulcerated spot on the left ala nasi, and a little nodule in the skin of the left side of the nose.

There were no enlarged glands.

Family history good.

The growth was dissected off, and after removal consisted of a narrow strip of rather hard greyish tissue; the portion removed from the cornea was somewhat thicker than the outer or episcleral portion. After hardening in Müller's fluid, vertical sections of the growth were made and stained with haematoxylin.

Microscopic Examination.—Beneath the epithelial portion is some loose connective tissue with numerous nuclei, at what is apparently the outermost or conjunctival part of the growth; to the inner side of this is tissue resembling healthy cornea, but containing more nuclei.

Between this and the epithelial cells is a sharply defined layer, which is doubtless the anterior elastic lamina of the cornea.
cornea. The cells in contact with this layer are not unlike those of the deepest layers of the cornea, but are not so columnar in shape; they are succeeded more superficially by circular and flattened cells, those on the surface being thin and fibrous looking. The deeper layers stain well, the superficial ones badly.

Among the anterior layers of cells are several areas where considerable degeneration has occurred; here many of the cells have disappeared, and others are shrunken and degenerate. Spaces are thus formed, which are crossed irregularly by strands of stroma. Except at these points the stroma is not very evident; but where seen it has a more fibrillated appearance than in the previous specimen, and is more coloured by the logwood. There are several characteristic "bird’s-nests." In the outer or conjunctival part there are in two or three places small invasions of the subjacent tissues by the epithelial cells; these processes or buds are continuous with the main growth, and have, apparently, no connection with the underlying tissues into which they merely push their way. The growth is apparently completely devoid of blood-vessels. In the subjacent connective tissue there are a few small blood-vessels and some extravasated blood.

Case 3.—Ulcerating Epithelioma of Cornea.

Joseph E., æt. 49, was admitted to Moorfields under Mr. Tweedy’s care, January 30th, 1885. His right eye had been painful and inflamed for six months. On admission (notes by Mr. E. Hudson), “the right eye was much congested; there was a spreading ulcer of cornea at nasal side covering an area from the inner edge of cornea to a point over the inner pupillary edge of iris. The border of the ulcer was infiltrated, and the ulcerated surface had a gelatinous appearance. There was no iritis; T. n. The left eye was healthy.” Mr. Tweedy suspected that the disease was epitheliomatous. The ulceration continued to spread outwards across the cornea in spite of active treatment. Scraping, cauterising, the local use of iodoform, quinine, mercury, and other remedies seemed to have no effect in arresting the ulcerative process. On April 21st, after nearly three months’ treatment in the hospital, the eyeball was
AFFECTING THE CORNEA AND CONJUNCTIVA.

The ulceration had then involved the whole superficies of the cornea, with the exception of a small irregular area near the upper and outer margin, which showed as a little island of moderately clear corneal tissue raised above the level of the surrounding structures.

The naked eye appearances of the eyeball after removal were as follows:—Size and contour normal. The cornea is uneven on the surface and semi-opaque. In nearly its whole extent the appearance is that of cicatricial tissue, but at the upper outer part is a small area with steep, slightly undermined edges which has escaped the ulcerative process. The thickness of the cornea varies; it is thinnest at its upper part. On the cicatrised part some large blood-vessels are visible.

No adhesions between iris and lens capsule, but on the latter in the pupillary area is a thin layer of lymph. Iris not appreciably thickened. Lens in situ. Cortical layers clear; nucleus slightly hazy. Vitreous clear and of normal consistence. Retina and choroid apparently healthy.

Sections of the cornea were made with a freezing microtome and stained with logwood. Microscopical examination gave the following results:—

The thickness of the cornea varies considerably; in general the true corneal tissue is reduced in depth, though the measurement of all that macroscopically represents the cornea is in places greater than that of a healthy specimen. The posterior layers of the cornea are fairly normal, exhibiting merely some increased nucleation (see Figs. 2 and 3), and in the peripheral part a few new vessels. The posterior epithelial layer is wanting in greater part, and has not improbably been removed during the manipulation of the specimens; however, in places where it remains adherent, the cells have a slightly swollen, indistinct look, and may have undergone some pathological change. At only one part, and over a comparatively small area, is the anterior elastic lamina (Bowman's layer) evident. This portion of the cornea forms a kind of plateau or flat-topped eminence, slightly raised above the surrounding surface, and probably corresponds to the area noticed before excision, over which ulceration had not spread. The anterior epithelium over this area is considerably altered, the several rows of cells being much less regular than in healthy eyes, and not so easily
differentiated, and the whole layer separates from the elastic lamina much too readily.

The anterior layers of the cornea, excepting over the area above described, are replaced by tissue consisting almost entirely of small, round cells which stain darkly with logwood—a sort of granulation tissue. In this layer and in the corneal laminae immediately subjacent are numerous small blood-vessels filled with corpuscles. Superficial to this granulation tissue, as it may be called, is a layer of very varying thickness composed almost entirely of well-formed nucleated epithelial cells resembling in size and appearance the cells of the middle layer of healthy corneal epithelium (see Figs. 2 and 3). I have said "almost entirely," because in some places, notably on one side of the plateau spoken of above, these cells appear somewhat irregular in shape and not so well defined as elsewhere. This epithelial layer is in parts of greater thickness than the corneal tissue beneath; from it numerous columns or rod-like extensions of epithelium pass into the underlying tissue and make their way along it in different directions; some, seen in transverse section, appear as cylinders of cells, others are shown in longitudinal section. A few typical "bird-nest" clusters are visible. There are no blood-vessels to be seen in the epithelial layer, but in some places small vessels with some surrounding tissue have become enclosed by epithelium. This epithelial layer is directly continuous with the conjunctival epithelium; but except over corneal tissue it shows no tendency to invade the strata beneath; over the whole area of the cornea, however, its invading properties are very evident. Its surface cells are flat, but not so flat or horny looking as the most anterior layers of the healthy epithelium.

There seems but little doubt that this case was one of an unusual form of epithelioma of the cornea in which extensive ulceration had occurred; the tendency of this ulceration having been to spread along rather than deeply into the cornea. The disease seems to have begun at the corneal limbus, as epithelioma generally does, and from this starting point to have extended steadily across the cornea, the clinical features it presented being those of ulceration rather than of new growth. Although the
superficial layers of the cornea were destroyed, the deeper layers were scarcely affected; from the microscopic characters of the disease, however, there is no reason to doubt that extension to these layers would have occurred had the eyeball not been removed.

I have been unable to find records of any cases like the above, but I have not had an opportunity of looking up all the references I obtained. The cases of epithelioma of cornea (not very numerous), which have been published by both British and foreign writers, were cases in which there has been an evident new growth, something which could be dissected off the cornea. I have never seen a specimen like that here described, and the only one which, from its naked eye appearances, I thought might exhibit microscopically a similar condition, proved when examined to be of quite a different nature.

Of the clinical features of the case I cannot speak. I have given above a few brief notes taken from the in-patient record; that the symptoms were in some respects unlike those of ordinary serpiginous ulceration of cornea is apparent from the fact that the surgeon under whose care the patient was suspected the disease to be epitheliomatous. This case suggests that it is not altogether improbable that some of the cases of very intractable serpiginous ulcer of cornea, occurring in people beyond middle age, may in reality be cases of epithelioma.


Edward R., æt. 38, labourer (Reg. No. 2354), was admitted to Moorfields Hospital, under Mr. Tay’s care, June 13, 1887.

Ten years previously he had noticed a small red spot in his right eye. Six years ago he had this spot “burnt with blue-stone,” and states that after this treatment it disappeared but returned in three years’ time. It did not, however, increase much in size till Christmas 1886. An operation was then performed and the growth partly removed; since then a rapid
increase in its size has occurred. There is no family history of importance; the patient has always had good health. On admission the following notes of his condition were made by Mr. Collins, the then Senior House-Surgeon:—"Right eye. Down and out, partly on the cornea, partly on the conjunctiva, is a reddish granular mass about the size of a small bean. It does not enter the anterior chamber, nor is the cornea infiltrated at its margins. Its surface is smooth and apparently covered by an epithelial layer. V. = $\frac{6}{6}$. T. n. No ophthalmoscopic changes."

The growth, after removal, consisted of a fairly hard nodule, somewhat kidney shaped, its concave surface slightly irregular, its convex surface smooth. It measured in its longest diameter 5 mm. After hardening in Müller's fluid, the specimen was frozen and sections made with a microtome.

Microscopic Examination.—The growth is a sarcoma, consisting of cells which vary somewhat in size and are imbedded in an almost homogeneous matrix. The cells are oval or oat-shaped, but all of small size; no large spindles are evident in the sections examined. The stroma is in moderate amount, but the closeness with which the cellular elements are packed varies a little in different parts of the tumour and also, probably, according to the way in which they are seen, whether in longitudinal or cross section. An epithelial layer is discernible over nearly the whole convex surface of the nodule, and in some parts where this is wanting it is doubtful whether the growth has made its way through this layer or whether the epithelium has become detached during preparation of the specimen. The appearance of the layer is more like that of the conjunctival than of the corneal epithelium; the cells are generally long and flat but in places they look swollen. Between the epithelium and the sarcoma cells is a layer of varying thickness containing large numbers of small round cells, considerably smaller than those of the tumour, from which they also differ in shape. In this layer towards one end of the growth (upper or lower) is some blood extravasation, and at the base of the growth, in some loose connective tissue attached to it, there is a large amount of extravasated blood.
In the growth, both in its deep and superficial parts, are blood-vessels. Some of these are of large size, and appear to be merely channels in the new tissue, without any walls of their own. The growth is entirely free from pigmentation, and no areas of degeneration are visible.

This patient was readmitted on December 5, 1888. The growth had recurred "soon after" he left the Hospital in 1887, and had been slowly increasing in size since that date. The notes on admission (taken by Mr. Walker, the House-Surgeon) say: "Right eye. There is a growth about the size of a mulberry on the outer part of the cornea. It has a constricted base, and is flattened against the surface of the globe, from which it projects fully one-eighth of an inch. The inner edge of its widest part reaches to the mid-line of the cornea. It is firm to the feel, like gristle. Slight purulent conjunctival secretion. P. active. T. n. Cannot tell the time by a watch. No ophthalmoscopic changes."

The growth was removed by scissors, and was found to be pedunculated, its base about half as large as the area shadowed by the growth. The cornea beneath was slightly infiltrated. The base was touched with the galvano-cautery after removal.

The corneal wound healed kindly, and the patient left the Hospital in a few days.

The growth after removal resembled in shape the top of a mushroom, the concave surface showing traces of the peduncle by which it had been attached to the eyeball. It measured in its longest diameter 12 mm., and was thus more than double the size of the nodule removed in June, 1887. It was hardened in Müller's fluid, and sections made with a freezing microtome.

Microscopical Examination.—In its histological characters the recurrent differs in some details from the primary growth. There is no trace of epithelium on its surface, but a thin fibrous capsule surrounds it, from which strands of fibrous tissue penetrate and ramify through the cell structure, and give it an indistinctly lobulated arrangement. The cells are more generally round, although in many places long oval cells are evident. The vascularity of the tumour is greater than that of the former nodule, but the individual vessels appear smaller and
have better formed walls. There are no evident extravasations. As in the primary growth there is an entire absence of pigment.

I am indebted to Mr. E. T. Collins, the present Curator of the Museum, for kindly handing over to me the recurrent growth.

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DESCRIPTION OF PLATE.

Fig. 1 represents a section of the growth from Case 1. The fibrous part (c) is at the upper part, the cellular part below. The narrow space between these two parts at the left-hand side of the figure is artificial. \( \times 160. \)

Fig. 2 is a drawing of a section of the cornea from Case 3. Descemet's membrane is represented at d, and to the left of this are the posterior layers of the cornea, but little altered. These are succeeded by a narrow layer containing large numbers of small stained cells, and this layer by the epithelioma. At the lower end of the figure, the new growth is shown in about its greatest depth, and from this point a long extension of it (e) passes up in the small celled tissue, a portion of which has become enclosed between two layers of epithelial cell growth. \( \times 120. \)

Fig. 3 represents another portion of the same cornea, and shows the epithelial overgrowth dipping into the small cell layer beneath. \( \times 70. \)
PRIMARY SARCOMA OF THE IRIS.

By E. Treacher Collins, Curator of the Museum.

On August 12th, 1887, William Arthur H., aged 21, consulted me concerning a little brown spot at the outer and lower part of his left iris; he first noticed it three years ago, since then it has gradually increased in size, but he does not think that lately it has progressed more rapidly. His irides used both to be blue, the left has now become more of a green colour. He has never had any inflammation in the eye, nor has he at any time received any injury to it. His sight has always been good both for distant and near objects; the last few months, however, in the sunshine, with his right eye closed, he has observed a slight dimness; yesterday, for the first time, he noticed an appearance as of a circle of rainbow colours when he looked at the gas lamps. A photograph taken in February, 1883, shows a dark spot down and out on his left iris. His father and mother are living and well; none of his family as far as he is aware have ever suffered from any eye trouble or had tumours of any sort. His general health is quite good; he has never had syphilis or any serious illness. He is tall, robust, and of a fair complexion.

In his left eye some of the anterior perforating vessels are enlarged, especially those on the inner side; the cornea is clear; the pupil is active, but shows some irregularities in its margin at the lower part, probably posterior synechiae. The iris is of a greenish colour mottled with brownish pigment; this pigmentation is most marked at the lower and outer part, and least at the upper and inner quadrant. Down and in the iris is swollen, and at the pupillary margin at this part is seen a rounded brown projection, the lens is clear, the optic disc and fundus are normal. T. full, V. = \( \frac{6}{6} \) and J. 1.
In the right eye the pupil is active, the iris of a blue colour, no pigment spots on it, lens and fundus normal, V. = 6/6 and J. 1. T. normal.

He was admitted into the Moorfields Hospital under the care of Mr. Nettleship, who has kindly permitted me to publish the case, and on August 17th, 1887, his left eye was excised.

On January 7th, 1889 (i.e., nearly 1 year and 5 months since the operation), I heard from him, he was in good health, and there was no recurrence of the growth.

Pathological Examination.—The eye was hardened for three weeks in Müller's fluid, then frozen, and an anteroposterior oblique section made through the entire globe, running downwards and inwards; the structures were found to be all in situ, and (except the iris and ciliary body) showed no naked eye changes. The iris on the inner (nasal) side, and towards the lower part, was considerably thickened, the thickening being slightly irregular, and involving the whole width of the iris; the iris angle was nowhere blocked, but the iris and cornea were in contact. Near, but not quite at, the periphery there was patchy dark pigmentation of the iris over three-fourths of its extent. The ciliary body on the same side as the thickened iris was involved and considerably thickened. The lens, retina, choroid, and optic disc appeared normal.

Microscopical examination of sections through the thickened portion of the iris and ciliary body shows on the anterior surface of the iris a layer composed of closely packed small round cells, with very little intercellular substance, and only a small amount of cellular protoplasm surrounding a large deeply staining nucleus; this layer is thicker in some parts than in others, so that the surface of the iris is irregular. At the angle of the anterior chamber some of these round cells are seen lying between the layers of the cornea, and in and around the canal of Schlemm, and also lining for a short distance the posterior surface of
Descemet's membrane. Beneath this continuous layer of round cells are seen numerous small collections of similar cells, and some spindle-shaped cells extending throughout the substance of the iris, and separated from each other by bundles of unstriped muscular fibres and connective tissue; the ciliary muscle and processes are in like manner infiltrated with groups of round and spindle-shaped cells, the former everywhere predominating. There are a few scattered patches of pigment throughout the tumour; the blood vessels are not numerous.

Sections of the iris in the lower part, below the level of the pupil, show a somewhat different structure, represented in Figs. 2 and 3; the thickness of the iris here varies considerably in different parts, but nowhere is it so thick as in the other sections; the anterior layer is the most affected, but in places the whole thickness of the iris seems composed of small round cells. There are a large number of irregular masses of brown and black pigment, most marked in the anterior layer and around the blood vessels; pigment is also seen to be deposited as little granules in some of the cells. The blood vessels are numerous, and have thick muscular walls; the ciliary body on both sides is involved, but to a much greater extent on the inner side than the outer. On both sides a few cells are seen between the layers of the cornea, and also some in the sclerotic.

The literature of sarcoma of the iris has been worked up by Kipp, Knapp, and Little, so as to leave very little to be added. Galezowski states that he has only seen one case in 65,000 patients; 17 cases have been recorded in which the iris was the primary seat of the growth. To bring out some of the points in these cases I have tabulated them as follows:—
<table>
<thead>
<tr>
<th>No.</th>
<th>By whom recorded</th>
<th>Sex</th>
<th>Age</th>
<th>Nature of growth</th>
<th>Situation of growth on iris</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Le Brun ..................</td>
<td>F.</td>
<td>36</td>
<td>Round celled, white...</td>
<td>Started from the inner side near the ciliary margin</td>
<td>Iridectomy; only a portion of tumour removed; rapidity of growth increased. Excision.</td>
</tr>
<tr>
<td>2</td>
<td>Hirschberg ..............</td>
<td>M.</td>
<td>38</td>
<td>Spindle celled, melanotic.</td>
<td>Lower part ..................</td>
<td>Excision.</td>
</tr>
<tr>
<td>3</td>
<td>A. Robertson and H. Knapp</td>
<td>F.</td>
<td>24</td>
<td>Round celled, melanotic.</td>
<td>Largest growth at the upper and outer part, and extending downwards from this a chain of three other similar tumours</td>
<td>Excision.</td>
</tr>
<tr>
<td>4</td>
<td>Kipp ....................</td>
<td>M.</td>
<td>36</td>
<td>Spindle celled, white...</td>
<td>Inner and lower quadrant...</td>
<td>Iridectomy; 18 months, and no recurrence.</td>
</tr>
<tr>
<td>5</td>
<td>Knapp ....................</td>
<td>M.</td>
<td>36</td>
<td>Spindle celled, white...</td>
<td>No note ......................</td>
<td>Iridectomy; 12 months, and no recurrence.</td>
</tr>
<tr>
<td>6</td>
<td>Knapp ....................</td>
<td>F.</td>
<td>35</td>
<td>Spindle celled, melanotic.</td>
<td>Lower part ..................</td>
<td>Iridectomy; three weeks later, eye quiet.</td>
</tr>
<tr>
<td>7</td>
<td>Knapp ....................</td>
<td>M.</td>
<td>22</td>
<td>Round celled, white...</td>
<td>Outer and lower part........</td>
<td>Iridectomy.</td>
</tr>
<tr>
<td>8</td>
<td>St. John Roosa ...........</td>
<td>F.</td>
<td>40</td>
<td>White ..................</td>
<td>Inner side, ciliary margin ...</td>
<td>Patient refused treatment.</td>
</tr>
<tr>
<td>9</td>
<td>Vose Solomon ............</td>
<td>F.</td>
<td>43</td>
<td>Spindle celled, melanotic.</td>
<td>Outer side ciliary margin; several secondary deposits</td>
<td>Excision.</td>
</tr>
<tr>
<td>No.</td>
<td>By whom recorded</td>
<td>Sex</td>
<td>Age</td>
<td>Nature of growth</td>
<td>Situation of growth on iris</td>
<td>Operation</td>
</tr>
<tr>
<td>-----</td>
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</tr>
<tr>
<td>10</td>
<td>Galezowski</td>
<td>F.</td>
<td>35</td>
<td>Melanotic</td>
<td>Lower part</td>
<td>Patient refused treatment</td>
</tr>
<tr>
<td>11</td>
<td>Dreschfield</td>
<td>F.</td>
<td>53</td>
<td>Spindle celled, white</td>
<td>Lower part</td>
<td>Excision</td>
</tr>
<tr>
<td>12</td>
<td>Romiée</td>
<td>F.</td>
<td>74</td>
<td>Round celled, melanotic</td>
<td>Outer part</td>
<td>Excision</td>
</tr>
<tr>
<td>13</td>
<td>Carter</td>
<td>M.</td>
<td>15</td>
<td>Round celled, white</td>
<td>Both eyes affected; L., lower and inner quadrant; R., two small tumours</td>
<td>L., iridectomy; growth reoccurred</td>
</tr>
<tr>
<td>14</td>
<td>Adams</td>
<td>F.</td>
<td>13</td>
<td>Round celled, melanotic</td>
<td>Lower and outer part</td>
<td>Excision</td>
</tr>
<tr>
<td>15</td>
<td>Little</td>
<td>F.</td>
<td>20</td>
<td>Round celled, melanotic</td>
<td>Outer and lower quadrant</td>
<td>Iridectomy; two years later no recurrence</td>
</tr>
<tr>
<td>16</td>
<td>Von Hasner</td>
<td>..</td>
<td>..</td>
<td>Melanotic</td>
<td>Outer and upper part</td>
<td>Patient refused operation</td>
</tr>
<tr>
<td>17</td>
<td>Hosch</td>
<td>M.</td>
<td>66</td>
<td>Spindle celled, melanotic</td>
<td>Lower part</td>
<td>Excision</td>
</tr>
</tbody>
</table>
SEX.—Out of the 18 cases (including my own) 10 were females, 7 males, 1 not stated.

AGE.—2 between the ages of 10 and 20 years.

4 " " 20 " 30 "
6 " " 30 " 40 "
2 " " .40 " .50 "
1 " " 50 " 60 "
1 " " 60 " 70 "
1 " " 70 " 80 "

In one the age is not stated; the youngest case was aged 13, and the oldest 74.

Nature of Growth.—In 11 of the cases the growth was melanotic, in 5 of which round cells predominated, and in 4 the spindle-shaped cells; in 2 no microscopical examination had been made. In the cases recorded by Little and Hosch, and in my own, the pigment lay chiefly along the line of the vessels. In several of the cases, as well as in my own, a dark spot on the iris had been noticed for some time previous to the appearance of the neoplasm. Knapp and Hosch are of opinion that these dark spots from which the sarcoma starts are simple melanomata of the iris, which the former has described as a very rare affection, and similar to warts on the skin. It is interesting to note in connection with the multiple character of the tumours in some of the cases of sarcoma of the iris, that in one of the cases of melanoma recorded by Knapp, he states there were "a few small brown tumours."

In 7 cases the growth was unpigmented; 2 of these were composed chiefly of round cells, and 4 chiefly of spindle-shaped cells; in 1 no microscopical examination was made.

Situation of Growth on Iris.—The lower part of the iris was either partly or entirely the starting point of the growth in 11 cases, while only in 2 was the upper part affected, viz., Cases Nos. 3 and 16 in the table; in the former of these there was a chain of tumours extending downwards.
Knapp, in commenting on this case, discusses the question as to whether the single isolated tumours were "the result of a common morbid tendency in the iris, or the product of dissemination from the primary (larger) tumour." "The location of the larger tumour in the upper part of the iris," he says, "and the denser accumulation of the smaller tumours on the lower part, seem to support the dissemination theory." In my case there was also a chain of tumours, the largest one was at the lower and inner part, and lower than some of the secondary (smaller) nodules.

Operation.—Iridectomy was performed in seven of the cases. In Lebrun's case only a portion of the tumour was removed, and the operation seemed to hasten the rapidity of its growth; in one other case the growth recurred.

In none of those cases in which the eye has been enucleated was any recurrence recorded.

In the case I have related such a large extent of the iris was involved, that iridectomy was not attempted, and the pathological examination shows that it would have been useless, as the ciliary body was considerably involved, some of the sarcoma cells even extending into the neighbouring parts of the cornea and sclerotic.

To sum up, then, sarcoma of the iris is an extremely rare affection, occurring rather more frequently in females than males, most commonly between the ages of 20 and 40, but occasionally earlier or later in life. The growth may be melanotic or white, more often the former, in some of which occur secondary nodules, due probably to a common morbid tendency in the iris; it is composed of round and spindle-shaped cells, either of which may predominate and characterise the tumour; the lower part of the iris is the most frequently affected; as with other intraocular tumours it may give rise to glaucomatous symptoms. Iridectomy in many cases proves successful, but unless the whole of the growth is likely to be removed it is better to enucleate, as partial removal of the tumour stimulates the rapidity of the growth.
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DESCRIPTION OF PLATE.

Fig. 1 is from a drawing of the external appearance of the eye before operation. \( \times 2 \).

Fig. 3 represents a section through the lower part of the iris; and

Fig. 2 gives a highly magnified view of the part opposite a in Fig. 2.
TWO CASES OF ORBITAL CELLULITIS, WITH NECROSIS OF THE HORIZONTAL PLATE OF THE FRONTAL BONE, ACCOMPANIED BY CEREBRAL ABSCESS.

By E. Treacher Collins, Curator of Museum; and C. H. Walker, Senior House Surgeon.

Case I.—John M., æt. 17, came to Mr. Tay as an outpatient at the Moorfields Hospital on July 14, 1887, stating that a month previously he had received a blow from a turnip on his left eye, after which the eyelids became swollen and very black. This had all passed away, but lately the upper lid had commenced to swell again. On examination it was found that there was an abscess pointing there, the skin over it being hot and discoloured. An incision was made into the centre of the lid, and some pus escaped; a drainage tube was then inserted. Two days later the swelling of the orbital tissues had considerably increased, the discharge became very foetid, and his temperature was 101°; the left cornea was clear, and the eye and vision normal; the lids on the right side were oedematous. The incision on the left upper lid was then enlarged, to facilitate the free exit of pus, and a lotion containing perchloride of mercury used to irrigate the abscess cavity from time to time.

On July 18 (that is four days after the patient first presented himself at the hospital), at six o'clock in the evening, he had a rigor, and his temperature rose to 107°, after which he sweated freely; there was still considerable swelling of the orbital structures, and the wound was again enlarged towards the outer side of the orbit, iodoform powder being dusted in, and a lotion with chloride of zinc being substituted for the one with perchloride of mercury. During the next few days he had repeated rigors, his temperature at these times reaching 104° and 105°; his tongue became red and dry; quinine in two-grain doses was administered every three hours.

On July 22 there was less swelling round the orbit, and less discharge, but on the 23rd a large fluctuating swelling appeared.
over the left parietal bone; an incision was made into this, and a quantity of foetid pus made its escape; a chloride of zinc lotion was syringed in, iodoform dusted on, and a drainage tube inserted; on the evening of the same day an abscess appeared at the inner side of the nose, which was treated in a similar manner to that over the parietal bone.

On July 24, at 5 a.m., his temperature was 107°, pulse 122. Though he had had no rigors for two days, he vomited; at 10.30 a.m. he was barely conscious, lying with his head drawn to the left side, and throwing his arms about wildly. There was no change in theoptic disc of the right eye; no ophthalmoscopic examination could be made of the left, on account of the swollen state of the lids. At 4 p.m. his temperature was 104°, and he was more comatose; he died at 6 p.m.

Post-mortem examination was made at 10 a.m., on July 25, 16 hours after death, by Mr. J. B. Lawford. Body fairly well nourished, little subcutaneous fat; no rigor mortis present; no effusion into joints. There is swelling and edema of left eye-lids, especially the upper; pus oozes from an incision beneath orbital rim at the outer angle, and through this bare bone can be felt in the roof of the orbit; there are two other incisions, one over the inner canthus in the upper lid, the other 1½'' above the rim of the orbit. On removing the scalp there is suppuration beneath it over the left frontal and parietal bones, and the bone is exposed over an area 2'' × 1½'', on adjoining portions of temporal and parietal bones.

On removing the skull-cap the membranes are very adherent to the bone (especially over the left side), and thickened, yellow, and infiltrated; there is pus on the surface of the convolutions on both sides anteriorly; the superior longitudinal sinus is completely blocked anteriorly by dirty yellow clot. There is a circular opening, 4 mm. in diameter, with dirty ragged edges, in the anterior end of the second left frontal convolution, from which a thin, dirty, foetid pus exudes; this leads into an abscess cavity in the left frontal lobe, of irregular shape, the size of a large walnut, whose walls are of a greenish colour and ragged, with rapidly breaking down tissue adherent to them; it communicates with the anterior horn of the left lateral ventricle; its anterior, outer, and lower walls are very thin. The left lateral ventricle contains purulent fluid; in the right lateral
ventricle is some thinner sero-purulent fluid, and some yellowness along the edge of the choroid plexus. There is a soft grey patch on the anterior extremity of the left corpus striatum; otherwise no changes are found in the basal ganglia or their ventricle. At the base there is fairly widespread purulent meningitis; there is no perforation of the inferior surface of the left frontal lobe.

On the superior surface of the horizontal plate of the frontal bone on the left side there is a small patch of necrosis barely the size of a sixpenny piece. On removing the roof of the left orbit, a patch of bare necrotic bone is found in its anterior part the size of a halfpenny, its edge being just behind the orbital rim; beneath this, but apparently above the periosteum, is a small abscess cavity. There is pus in the frontal and ethmoidal sinuses; the left cavernous sinus is filled with semi-solid purulent material, but there is no suppuration in the superior petrosal or lateral sinuses of the left side.

The left optic nerve and the back of the eye removed; the optic disc is hazy, and the vessels hidden at its margins. The thoracic and abdominal viscera were not examined. Microscopical examination of sections of the left optic nerve near the eyeball and at the apex of the orbit show perineuritis and some increase of nuclei in the nerve, chiefly in the trabeculae. In the anterior sections these changes are much less marked.

Case II.—Bertha B., aged 15, was brought to the outpatient department on May the 11th, 1888, and placed under the care of Mr. Tweedy. She complained of a painful swelling over the left eye, which was said to have been first noticed three weeks previously, and to be getting worse. No history of injury was given at the time, nor was any cause assigned. There was considerable swelling of the left upper eyelid extending towards the bridge of the nose and upwards on the forehead. At a point corresponding to the inner end of the upper palpebral fold fluctuation could easily be felt; in fact, it was clear that there was an abscess almost pointing.

The patient was taken to the operating theatre, and whilst under an anaesthetic, an incision three-quarters of an inch long was made parallel to the inner end of the eyebrow, and about half an inch below it. About two drachms of thick pus were let out, and then the cavity was explored with a probe, and a
large area of bare bone at the inner side of the roof of the orbit was felt. The cavity was washed out with perchloride of mercury lotion, a drainage tube inserted, and the wound dressed with iodoform and antiseptic gauze. As a matter of precaution, Mr. Tweedy directed that the patient should be taken into the hospital and kept in bed.

The following day the swelling had much diminished, and the patient had no pain. Her temperature was normal. The wound was syringed and dressed in the same way as before. For the next two days there was nothing to notice except that the patient looked rather poorly and languid; she did not care to get up, and her appetite was bad. Her temperature was slightly raised, but was never above 100° F. There was very little discharge from the wound, which was syringed out daily and dressed with sal alembroth wool.

On May 18th (a week after the abscess was opened), the patient was distinctly worse. She was very drowsy, and complained of rather severe headache chiefly on the right side. She had taken scarcely any food for two days; her tongue was furred; bowels regular; pulse 100 to the minute, small and rapid; respiration shallow, about 30 to the minute; skin hot and dry, and cheeks flushed. The edges of the wound were pale, there was no discharge, and the drainage seemed to be quite free. No disease could be detected in the chest or abdomen. Ophthalmoscopic examination was made, but no changes were seen. Mr. Tweedy saw the patient, and ordered a dose of calomel to be given, and an ice bag to be kept applied to the head.

Shortly before midnight the patient seemed to be much the same; her temperature was 100°; she had been asleep some hours, and had not complained of anything.

The following morning (May 19th), after having a fairly good night, the patient was noticed to be rather more animated and lively than usual, but at 6:30 A.M. she again became drowsy. At 8:45 she suddenly became much worse. The house surgeon was called, and found her quite unconscious, and not able to be roused, except to move her limbs slightly. Her breathing was stertorous and her face congested. Heart's action violent, no murmur audible; pulse very irregular, 60 to 80 a minute. Temperature 99°.8. Pupils unequal, right 4 mm., left 7 mm; no
changes seen in fundi. The wound was in the same condition as it had been the last three or four days. After a time, the limbs were seen to move in an irregular manner at various intervals. Excepting the dilatation of the left pupil there were no unilateral phenomena. No squinting or deviation of the eyes was observed. She continued in this state till 10 o'clock, when the breathing became much slower and more laboured, and the lips and face extremely congested. About six ounces of blood was drawn from the left arm, and this seemed to give slight relief, but it was only temporary. She died at 11:30 A.M.

The autopsy showed an irregular area of bare bone about the size of a sixpenny piece, some distance back in the roof of the orbit. On removing the upper portion of the cranium in the usual way, a quantity of pus escaped. This was found to come from an abscess situated in the left frontal lobe, about a quarter of an inch from the surface, and extending back into the left lateral sinus. The cavity, which was as large as a hen's egg, was filled with thin curdy pus of a pale muddy-red colour; there was no offensive smell. The walls of the abscess were covered with a slimy substance. There was no distinct membrane separating the abscess from the brain tissue. All round the cavity of the abscess the brain matter was soft and red, and the left corpus striatum was softer and distinctly smaller than the right. The convolutions of the brain were a little flattened and the veins distended. There was no pus or sign of inflammation in the other ventricles, and the rest of the brain substance seemed healthy. The membranes over the upper surface of the hemispheres were healthy, but at the base of the brain there were signs of meningitis, the pia mater being opaque, and the sub-arachnoid space filled with semi-purulent fluid. There were no signs of suppuration or thrombosis in the superior longitudinal or other venous sinuses. The dura mater was adherent to the left frontal lobe, and came away with the brain when the latter was removed, leaving the orbital plate of the frontal bone rough and carious. In the centre of this area, which was about an inch and a half long from before backwards, and an inch wide, there was a small hole, through which a good sized probe could be passed into the orbit and out through the external wound. In the dura mater there was a minute hole corresponding with this, but no distinct communication
with the abscess cavity in the brain could be detected. The disease had not affected the frontal or ethmoidal sinuses, nor were any other changes noticed elsewhere. The other organs were not examined.

These two very parallel cases present several points of interest. The apparently trivial nature of the injury in otherwise healthy individuals contrasts with the serious and fatal symptoms that followed. In Case II the only history of injury that could be obtained was, that the patient had a year previously run against some iron railings. This was not mentioned by the child's parents until after her death, and they were not at all certain as to the date or immediate consequences of the injury; at all events, the parents could not recollect the child being unconscious or laid up after it, nor could any scar of an external wound be found. There was no history of tubercle in the family, nor any symptom of it in the patient, and the only assignable cause of the abscess seems to be this trifling injury. In Case I the interval between the blow and the acute symptoms was not so long, being only a month; probably, also, the injury was more severe, as the patient was said to have had a "black eye" after it. Here again, however, there was no indication of there having been any external wound, nor could any other cause be discovered. In both cases the patients were young, being aged 17 and 15 years respectively, and in three similar cases recorded by J. Crawford Renton* and George S. Norton,† and quoted by Carter and Frost (from the Archiv für Ophthalmologie) in their treatise on "Ophthalmic Surgery," the ages were 12, 21, and 4 years.

The slightness of the symptoms presented when the patients first attended the hospital should, we think, engender great caution both in prognosis and treatment in all cases of abscess pointing in the eyelids. In Case II

no symptom of any disease at all was complained of until the supra-orbital swelling was noticed a month before the termination of the case. There was no interference with any motor or sensory nerve (with the exception of the left pupil a few hours before death). There was no paralysis, fit, or spasm of any kind, and no impairment of the intellect until two days before the patient succumbed; there was no optic neuritis; headache was complained of, but it was of such a character that it might easily be accounted for by the patient's feverish condition. Excepting the hebetude noticed a few days before death there was no symptom to cause apprehension or indicate cerebral complication.

With regard to the course of the disease and the primary nature of the lesion, there are two possible explanations. First, that the injury caused an abscess of the orbit which set up periostitis (or primarily caused periostitis of the roof of the orbit) followed by necrosis and perforation of the bone, and subsequently by meningitis and abscess of the brain—in Case I the meningitis spreading upwards and backwards and causing a patch of necrosis in the parietal bone and the formation of an abscess beneath the scalp; for the abscess in the orbit and that over the parietal bone were apparently quite separate. Secondly, the injury may have caused an abscess of the brain, followed by meningitis, necrosis, and perforation of the roof of the orbit and an abscess pointing in the upper eyelid.

In favour of the first theory is the fact that in both cases the symptoms of disease in the orbit preceded any cerebral symptoms; though in Case II, as has been mentioned, the cerebral symptoms were never very definite. In Case I it was not until four days after the abscess in the lid (which had been forming for some days previous to his attendance at the Hospital) was opened that he had any rigor. Also, that periostitis from slight injuries about the age of puberty is of common occurrence.

In favour of the second view: in Case II the character
of the contents of the cerebral abscess, the atrophied condition of the neighbouring brain matter (especially the corpus striatum) and the fact that the dura mater in one place was very adherent, would all lead one to suppose that the abscess must have existed a considerable time. The position, also, of the necrosed bone, namely, in the horizontal plate of the frontal bone in both cases, seems an unlikely one to have been affected by a trifling blow without any perforating wound.

With regard to treatment, there is one point of practical interest which is suggested by these cases, and that is with reference to drainage of the orbit, especially when the abscess is situated as far back as it was in both these cases. In Case I the incision was originally made in the middle line, and it was found that the boy had to be frequently turned on his face to allow of any pus escaping by the tube. Subsequently the wound was enlarged outwards, and then by turning on his left side free drainage was possible. We would suggest that in all cases where it is evident that an abscess in the orbit has to be opened the incision should, if possible, be made on the outer side.
MICROPHTHALMOS WITH CYSTS OF THE GLOBE.

By William Lang,
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Congenital cysts of the lower lid are sufficiently rare to justify a full description of such examples of them as come under the notice of the surgeon.

This is especially true when it is possible to make a further examination of them after removal.

It was not until Kundrat of Vienna accurately described* both the macroscopic and microscopic appearances of these tumours, with their surroundings, that much can be said to have been known about them. Of those cases previously recorded very few had been removed, and still fewer subjected to examination by the microscope. They were very generally thought to have no necessary connection with the eyeball. A reference to the chief points in Professor Kundrat's paper will be useful in comparing them with the description of another case to be given later on. (1.) These cysts always occur in the lower lid, and lie medially or more towards the inner side; they present a hemispherical and (usually) bluish

* Wiener Medizin. Blätter, Nr. 51, 52 (1885) und 3 (1886).
protuberance, which shows through the skin and encroaches upon the inter-palpebral aperture from below, and converts it into an arched slit with its convexity upwards. (2.) They accompany microphthalmos, and especially the so-called anophthalmos.

(3.) In one half the cases referred to they were bilateral, in the other half unilateral, and more frequently on the right side.

In previously published cases not much is said about the true character of these cysts, since most of them were observed on the living subject only, or the observer contented himself with puncturing the tumour. A good deal of stress was also laid on the character of the fluid contained in the cyst.

Talko, who made an examination after removal, denies that there is any necessary connection between the cyst and the eyeball. Manz, on the other hand, thought it to be sub scleral, and concludes, as Arlt noticed in cases of microphthalmos with coloboma, that it results from the pressing forwards of a staphyloma. These contradictory opinions probably result from the fact that no investigator had examined the anomalous structures, post mortem et in situ, so that their relation to surrounding malformations, or to other pathological alterations in the orbit and cranial cavity, had been lost sight of.

In view of the fact that it was possible to examine carefully, before and after removal, a congenital cyst of this sort, it will not only add to the interest which naturally attaches to such cases, but may help to throw some light on their pathology, if the notes of the case and the results of the microscopical and pathological examination be briefly summarised as follows:—Rose G —- aged 3 years, was brought to the Moorfields Eye Hospital on November 5th, 1888. The mother stated that when the child was born it was noticed that she had no eyeball on the left side, and that there was a swelling in the lower lid, which has not altered since, except to increase
in size. The patient is her fifth child; the other children are free from any deformity or malformation, nor does she know of any defect in either her own or her husband's family.

The child was born on September 20th, 1885. In the previous March, that is, in the third month of her pregnancy, she received a fright from a cat jumping out from a cupboard.

The child appeared in perfect health, and was well nourished; apart from the eye there was no malformation of any part of her body to be detected, even after a very careful examination. The right eye was normal. On the left side a rounded fluctuating swelling bulged forward the lower lid, which was somewhat everted. The cyst appeared bluish in colour through the freely moveable skin of the lower lid; it was the size of a pigeon's egg, and appeared fixed far back in the orbit to a very small globe whose cornea was directed upwards.

The lids and canaliculi were otherwise normal, and tears were shed when she cried.

On November 15th, whilst the child was under the influence of chloroform, an incision was made in the skin of the lower lid, about three-quarters of an inch from and parallel to the border of the lid—subsequently the lower lid was divided in the middle by a second incision at right angles to and united with this first. The cyst was then dissected out from beneath the orbicularis and the conjunctiva of the lower lid. Posteriorly the cyst was found to merge into the small globe which was freed from its surrounding muscles and connections, and the whole mass removed. During the dissection the cyst was pricked, and clear fluid escaped.

In a few weeks, when the wounds had firmly united, the general appearance of the orbit was found to be greatly improved, and the socket was now capable of retaining an artificial eye.

Mr. E. Treacher Collins' report is as follows:

Specimen consisted of a small eyeball, with a cyst (which had been cut into) attached to its inferior surface.

The eyeball measured 11 mm. laterally, 9 mm. vertically, and 13 mm. antero-posteriorly. Anteriorly there was a small narrow strip of opaque cornea measuring 3 mm. laterally and 2 mm. vertically. Posteriorly was the optic nerve surrounded by its sheath, while springing from its inferior surface and the extreme posterior part of the eyeball was a large cyst, measuring, when distended, 17 mm. vertically and 15 mm. antero-posteriorly. Springing from the lower and inner side of the optic nerve was a circular mass which had been cut across, and which consisted of an external sheath and a central grey portion like brain substance. In diameter it was about twice the size of the optic nerve.

The specimen was hardened in Müller's fluid for three weeks, the cyst was then filled with absorbent cotton-wool, dipped into water and so distended, the whole specimen was next frozen, and an antero-posterior section made through the eyeball and cyst.

The inner half contained the whole cornea and the portion of tissue mentioned as springing from the inner and lower side of the optic nerve, the outer half contained the whole of the optic nerve.

The cyst wall, which was very thin, was seen to be continuous with the sclerotic at its posterior part; this was especially well marked at the lower part of the specimen. Next to the sclerotic was a brown coloured layer, and inside this a deeply pigmented layer (the pigment layer of the retina), which ran into the isthmus which joined the cyst to the eyeball. The interior of the eyeball was filled with the lens, which in proportion to the rest of the eye was larger and more circular than usual, and of a brown colour; posterior to it there was a greenish gelatinous-looking mass. At the lower part, projecting into the cyst and closing what would have been a communication of the interior of the globe with the cavity of the cyst, was a greyish mass, the colour of the grey matter of the brain. This had on the surface turned towards the cavity of the cyst several little projections.
The interior of the cyst was very uneven, due to numerous projecting bands. The sheath of the optic nerve was continuous with the wall of the cyst at its upper part. The circular mass starting from the optic nerve had its sheath continuous with the sheath of the optic nerve, while the grey central portion was continuous with the gelatinous mass in the interior of the eyeball.

Explanation of Figure.—Diagrammatic sketch representing the eyeball, optic nerve, and cyst. Co, cornea; L, lens; I, iris; R, retina, much folded; Ch and P, choroid and pigment epithelium; S, sclerotic; O.n, optic nerve; Cy, cyst. The striated band of fibrous tissue represented as forming the sclerotic at S should have been continued round the adjacent curve as the nerve-sheath to O.n. The part marked off by straight lines is shown magnified in the accompanying plate.

Microscopical Examination.—The sections show the fibrous tissue of the sclerotic to be continuous above with that forming the sheath of the optic nerve, and below with the fibrous tissue forming the outer portion of the wall of the cyst. The fibrous tissue of the lower part of the sheath of the optic nerve joins that of the upper wall of the cyst; thus separating the nerve fibres of the optic nerve from the retinal elements in the interior of the cyst, which are described below. The fibrous tissue of the sheath of the optic nerve and sclerotic is also continuous with that forming a sheath to the grey substance mentioned as springing from the inner side of the optic nerve. The lamina cribrosa is well marked. In those sections cut above or below the neck of the cyst, the sclerotic is continuous around the posterior part of the globe. In those through the neck of the cyst, the sclerotic is broken up into isolated
bundles of fibrous tissue, in the intervals between which is a tissue continuous with, and of a similar structure to, the retina.

The ciliary processes and muscle, together with the choroid, are well developed. The latter terminates above at the entrance of the optic nerve, and below at the lower wall of the neck of the cyst; between the lower part of the optic nerve and the upper part of the cyst there is no trace of choroid. On tracing the pigment layer of the retina it is seen inferiorly to bend round and lie along the neck of the cyst, the pigment then becomes somewhat broken up, and ends where the cyst commences to expand. Above the optic nerve the pigment of this latter is more scattered; there is no pigment between the lower part of the optic nerve and the upper wall of the cyst.

The retina is thrown into numerous folds and almost entirely fills the vitreous chamber of the eye, its nuclear layers are the only ones which can be distinctly made out, and these only in places; not any rod-cone layer can be seen. Müller’s fibres are very distinct in some parts. The substance of the retina is chiefly composed of a network of fibres and fine branching cells with delicate processes supporting a number of deeply staining nuclear bodies. At the posterior part of the eyeball, tissue of this structure, continuous with that contained in the eyeball, passes between the bundles of fibrous tissue above mentioned, and projects into the cyst. It can be traced for a short distance, forming an inner lining to the wall of the cyst. Sections of the posterior part of the wall of the cyst also show scattered patches of nuclear bodies. The remainder of the wall of the cyst is made up of fibrous tissue, the fibres of which are very wavy, and have between them numerous spindle-shaped cells.

The grey mass projecting from the lower and inner side of the optic nerve, and surrounded by a sheath as above mentioned, is composed of a structure similar to that forming the retina, viz., a network of fine fibres, cells with delicate processes, and scattered nuclear bodies.

The corneal epithelium is badly developed, the cells composing it are small and rudimentary. The anterior layers of the lamellæ of fibrous tissue are very irregular and the corneal corpuscles are numerous. Descemet’s membrane, with its lining epithelium, is well developed.
The iris is small but well formed on the side of the section which corresponds to the upper part of the globe. On that which corresponds to the lower part the iris is only represented by a small round nodule. The cyst was situated in exactly that position which is the most common seat for a coloboma of the choroid, viz., at the lower border of the optic nerve; this, together with the presence of a coloboma in the iris, would suggest that the origin of the cyst was in some way connected with the imperfect closure of the choroidal fissure. The presence of patches of retinal elements in the wall of the cyst, even at its most posterior part, would seem to indicate that the retina and sclerotic—which are always bulged at the seat of a coloboma, sometimes to such an extent as to produce the appearance of a deep cup with an abrupt bending of the vessels when viewed with the ophthalmoscope—have in this case become extremely staphylomatous. The non-formation of the vitreous chamber and the increasing growth of the retina have ultimately closed the communication between the cavity of the cyst and the interior of the eyeball. Fluid accumulating in the cyst has helped to increase its distention, and, consequently, the thinning of the previously stretched retina lining the coloboma.

The circular mass on the inner and lower part of the optic nerve would, from its microscopical appearance, seem to be a second bulging of somewhat similar nature, but situated further back.

This case must be regarded as an exception to Kundrat's generalization, viz.:—That accompanying the cystic microphthalmos there is always to be found some other congenital malformation, such as hare-lip, nasal cleft, &c. No such developmental defect was discoverable. He thinks also that true absence of the eyeball is either extremely rare or does not exist; that, in fact, a careful search will always lead to the discovery of the bulb, reduced, it may be, to the size of a hemp seed, but lying at the bottom of the conjunctival sac.* Even when reduced to this size

* Snell (Trans. Ophth. Soc., vol. iv, p. 333) gives an interesting résumé of the literature of this subject up to July, 1884. He quotes Van Duyse, who suggests some causal relation between the coloboma and the cyst, and recognises how easy it would be to overlook a well-marked microphthalmos
the condition is the result of secondary changes, bringing about absorption of previously formed rudiments. Ordinary cases of microphthalmos may be readily explained by a lack of development of the vitreous, and by an early interference with the closure of the foetal ocular fissure.

Regarding anophthalmos as only a high degree of microphthalmos, one may proceed further and trace this condition to an early deficiency in brain development (as was well shown in one of Kundrat's cases), where the normal evolution of the primary optic vesicle is interfered with.

Manz thinks that anophthalmos and microphthalmos are due to a lack of development of the muscular apparatus and of the orbit as a whole, but such cases as the one described here point first to an intra-uterine cerebral defect as the first cause, interfering in various degrees (corresponding to the degree of microphthalmos) with the development of the eye from the primary and secondary optic vesicles.

Regarding the cystic formation with which this paper has principally to deal, Arlt thought that intra-ocular pressure operating on the weakened wall of a colobomatous eye (such as is present in all these cases), where not only the choroid is absent, but the sclera and retina are partially deficient or lacking in normal thickness and strength, might bring about ectasiae of the lower wall, in the region of the foetal cleft.

On the other hand, the results of the microscopic examination point to another explanation—a much more complex one. The retinal tissue, or more properly the tissues of the primary optic vesicle, project forward through the open foetal fissure into a mass of embryonic connective tissue, and having been surrounded by it become shut off, and then go on to cyst formations. in the presence of such a tumour, unless a careful search were made for it. Van Duyse regards congenital cysts containing serous fluid as the result of a staphyloma of the weakened scleral wall corresponding to the choroidal and retinal coloboma.
Probably the embryonic areolar tissue masses (found in this case) surrounding the cyst cavities is vitreous from the mesodermal layer which has only been partially developed. After being in this way shut off from the body of the bulb, active growth in the separated portion does not cease, but up to a certain point proliferation of the elements proceeds, and it is easy to understand how in such an atypical growth of retinal tissue there can be no such regular size, number, or arrangement of the cysts so formed.

There is, however, as Kundrat points out, one constant factor; the cyst or cysts retain until growth ceases their first relation to the diminished bulb; they are found below and in front. The minute anatomical description which Mr. Collins has given differs in one important point from Kundrat's: the larger cyst was only partly clothed with retinal elements and these, when present, were disposed in thin patches. This disposition would bear out the idea which Von Arlt held, viz., that the cystic formation is more the result of an expansion of a weakened and thinned scleral wall—a true sclerectasia—than simply a portion of the bulb shut off, as it were, from the main part of the eye by an attempted closure of the foetal fissure. Kundrat looks to a defect in development of the middle cerebral vesicle* as the cause of the malformations which characterise these cysts, and the microphthalmos which invariably accompanies them, and in several of his cases gross deformities in the brain structure were discovered. If this be true it must mean that the arrest of development occurs very early in embryonic life, as it is at an early stage that the eye is shut off from its influence.

In Kundrat's article are figured several cysts of various sizes. The protuberance mentioned in Mr. Collins' report may be a very small tumour of the same nature.

* Michel (quoted by Snell, q. v.) in 1881 "Annales d'Oculistique," vol. ii, p. 144, reports a case where, with arrested development of one half the cranium, both the optic nerves and olfactory lobes were absent. He thinks that the non-development of the brain was the primary anomaly.
REMARKS ON KERATITIS PUNCTATA OR DESCemetitis.

By J. B. Lawford.

Clinical Assistant at the Hospital.

The name Keratitis Punctata has, unfortunately, been employed by writers on ophthalmology to designate at least two conditions which differ materially in their nature, although not very dissimilar in their general appearance. Some doubt has, in consequence, arisen as to the exact significance of the term. As I have recently looked up the literature of the subject, I venture to make the following observations, in which, I may say at the outset, there is nothing new.

Wardrop in 1808 first described aquo-capsulitis vel inflammatio tunica humoris aquei, "an inflammation of the parietes of the aqueous chamber and especially of the membrane which lines the internal surface of the cornea."

Tyrrell,* writing in 1840, defined aquo-capsulitis as "Inflammation of the aqueous membrane with deposition of fibrin." His description of the appearances met with in such cases would in many respects be adequate for a textbook of the present day. He says—"Attentive examination of the cornea . . . . evinces that the morbid change is not in the substance of the cornea or in its conjunctival surface, but subjacent to the former, in the membrane which lines its concavity or posterior surface." The same writer states that "the iris . . . . participates in the inflammatory action which extends to it from the aqueous membrane by vascular connection."

Jacob, in his classical work on "Inflammations of the Eyeball" (1849), discussed this subject at some length. He looked upon aquo-capsulitis as a special and peculiar form

of inflammation, affecting the lining membrane of the aqueous chamber, and expressed his firm conviction that this membrane (which he likened to that lining serous cavities) might be inflamed "without any accompanying inflammation of other parts of the eye."

The name was retained by Mackenzie in the last edition of his Treatise "to designate a very distinct disease;" he explained however that the term was not strictly correct, "as neither the front of the iris nor of the lenticular capsule has any epithelium." He also noted that the iris was frequently involved, although, as he believed, devoid of an anterior epithelial layer.*

Aquo-capsulitis is now an almost obsolete term, at least in print.

Sichel was, I believe, the first to use the name "Kératite ponctuée."

By some authors keratitis punctata is held to signify an inflammation of the corneal tissue proper in which the haze is not uniform; either there is slight diffuse cloudiness with dots of denser opacity, or there are dots of opacity with clear or nearly clear intervening spaces. This is the strictly correct use of the term. The majority of writers however mean thereby a condition in which the dots are situated not in the layers, but on the posterior surface, of the cornea. They are usually at the central lower part and exhibit a peculiar triangular arrangement. The name is thus interpreted by all British writers of the present day, and albeit, as thus used, it is not quite accurate, and, if taken in its literal meaning, gives at the outset a false idea of the pathology of the affection, it has become so widely known that there is but scant hope of success in attempting to substitute another name, more in accordance with our present pathological knowledge.

Among foreign authors the same uniformity is not

observed. Stellwag* under this heading speaks of dotted opacity in the posterior laminae of the cornea, sometimes extending as far forwards as Bowman's membrane; he also alludes to the punctate deposits on Descemet's membrane occurring in the course of irido-choroiditis.

Meyer† makes mention of a variety of parenchymatous corneitis affecting the deep layers, which, when it extends to Descemet's membrane gives rise to the special form of disease which has received the name keratitis punctata.

Schmidt-Rimpler‡ would restrict the term to a real keratitis, in the deep layers, and speaks of its incorrect application to an affection of Descemet's membrane.

All other foreign writers to whose works I have been able to refer, employ the name keratitis punctata in its generally understood sense, and mean thereby a condition signalised by small collections of cells on the posterior surface of the cornea. Several do not describe it under diseases of the cornea, but as "an accessory and secondary symptom of inflammation of the vascular tunics of the eye."

The most generally employed name next to keratitis punctata, and of more recent origin than it, is "Descemetitis." This, though not strictly correct, has this advantage: it cannot lead to any confusion between the condition indicated and a genuine affection of the cornea. From a pathological standpoint also it is nearer the mark. Although the changes in Descemet's membrane are I believe never primary, there is no doubt that this membrane is much more likely to be affected than the corneal tissue proper. To this point I shall refer again.

The error into which the earlier observers quite excusably fell was that of looking upon keratitis punctata or aquo-capsulitis as a disease sui generis. We now know that it is merely a symptom of disease of the deeper parts

‡ Augenheilk. u. Ophthalmoskopie, 4te Aufl., 1889.
of the eye, and probably of the uveal tract alone. We do not know the precise relation it bears to such affection, nor of what value it is as an indicator of the exact seat or the cause of the disease.

But little has been written in recent years on this subject, and almost entirely from the clinical side. Opportunities seldom occur for the microscopical examination of eyeballs affected by keratitis punctata except in the case of sympathetic ophthalmitis; in these latter instances there are such extensive and marked changes in nearly all the tissues that the dots of deposit on Descemet's membrane are rarely more than mentioned in the microscopical description. In addition it is by no means easy to prepare microscopical sections and retain the corneal deposits in situ.

Schweigger* seems to have been the earliest observer who described the microscopic appearances of the cell-heaps which form the dots visible through the cornea. He considered them due to morbid proliferation of the epithelial layer of Descemet's membrane.

Ivanoff,† who gave a good description of the deposits, held that the cellular elements were derived from the cells of Descemet's membrane, as a result of irritation.

Arlt‡ stated that the dotted deposit on the cornea was indicative of cyclitis.

The descriptions of the microscopic characters of the dots in question vary somewhat. All writers are agreed that the little conical or mound-shaped deposits are, at least in part, composed of cells, but opinions differ as to the nature of these cells. Thus one writer speaks of them as round cells produced by the proliferation of the epithelium on which they rest, while another states that he has no doubt that they are migrated and altered leucocytes, and that the epithelial layer beneath them plays no part in their production. Others again hold that the cells

* Handbuch, 1873, p. 346.
† Graefe-Saemisch., vol. iv.
‡ Arlt. "Diseases of the Eye." Eng. Trans†., by Ware, 1885.
may be the progeny of surface cells in the iris, ciliary body, or choroid, whence they have travelled forwards and become deposited on, and adherent to, Descemet's membrane.*

These cells, whatever their origin, are not the only elements found in the deposits. Small granular particles and pigment have been described, and in some instances threads of fibrin are noticeable. I have never seen pigment granules in the cell-clusters. In a certain number of cases, in addition to the punctate deposit, there is a thin layer of fibrinous material on the posterior surface of the cornea, extending over a much larger area than that occupied by the cell-heaps.

The condition of the epithelial cells of Descemet's membrane, in the cases which have been examined microscopically, has hardly been accurately determined. I think, from the appearances in the few specimens I have been able to examine, that the cells certainly undergo some change at those points at which the cell-heaps are situated: their outline becomes indistinct, and they appear swollen. But I am strongly inclined to the opinion of those writers who believe that the cells in the deposits are not due to proliferation of the epithelium, but are migrated cells from some other part of the eye. The changes in the epithelium, if present, might very well be secondary. I do not know that any good explanation has been given of the very striking arrangement in a triangle of the punctate deposits; it seems to me, however, that if these cell-heaps resulted from morbid proliferation of a continuous layer of epithelium they would be less likely to be so arranged than if they were formed of cells floating in the aqueous, and possibly influenced by the direction of the flow through this fluid.

We know, moreover, that in a large majority of cases there is visible affection of some portion of the uveal tract, and it is not improbable, as suggested by Nettleship, that in the remaining cases similar changes might be discovered if looked for with sufficient care. It is much more reasonable to suppose that in inflammation of such a richly cellular and highly vascular structure as the uveal tract, numbers of small cells would be set free in the adjacent fluids (aqueous and vitreous), than that a single layer of epithelium should, by proliferation, give origin to the cellular elements present in the deposits.

In some instances dots of opacity very similar in appearance to those on the posterior corneal surface have been seen during life on the lens capsule. At least one observer* has also found them in microscopic sections, on the anterior lens capsule and anterior surface of the iris. I have myself seen them in the latter situation in several specimens. The presence of these clusters of cells is certainly in favour of their origin from the iris or ciliary body rather than from the epithelium of Descemet's membrane.

Large numbers of cells, closely resembling those in the deposits on the cornea, are usually present in the angle of the anterior chamber in these cases. This fact merely indicates that being free in the aqueous they have drifted with the stream, and does not help to explain whence they came.

If we assume, as I think we may, that the cell-clusters on the posterior surface of the cornea are derived from the uveal tract, we naturally wish to narrow the question and ask from what part of this tract they come—the iris, ciliary body, or choroid. This, I think, cannot yet be positively decided. There are clinical cases in which, with typical corneal deposits, the iris appears unaffected, its action to light and mydriatics remaining good. In these cases, moreover, there is generally visible disease of

* Fontan. Loc. cit.
choroid. I have recently had just such a case under observation, in which there was no evidence of involvement of the iris, and in which there was a large isolated patch of choroiditis near the optic disc. It is tempting to conclude that the cells on the cornea come from the inflamed choroid, in such instances, but it would, I think, be rash to assume that the iris is quite free from change, from clinical evidence alone.

A study of the development of the tissues affected in keratitis punctata affords us no assistance. The uveal tract and the posterior epithelium of the cornea are both derived from mesoblast; there is some doubt, however, as to the exact part of this layer from which the epithelium originates. There still exists some uncertainty concerning the anterior surface of the iris. The older observers were convinced that a single layer of epithelial cells directly continuous with those on Descemet's membrane, covered the front surface of the iris. This was denied by more recent authors, but at the present time the majority of writers describe such a layer which they hold to be an extension of that on the posterior corneal surface, from which, however, it is said to differ somewhat in the character of its cells.*

ON SOME UNUSUAL CASES OF INJURY TO THE EYE AND ORBIT.

By J. Hutchinson, Junior.

A list of the various foreign bodies that have been found lodged in the vitreous would be an almost unending one. The following case, under Mr. Waren Tay, is a curious example:—

Arthur C., æt. 12, fell across some iron railings with horizontal bars, injuring one eye so severely that it became necessary to excise it. On dissection a complete tin-tack was discovered in the vitreous; the nail measured 1 cm. in length, and its head was about 6 mm. in width. There had been no special reason to suspect the presence of a foreign body, and the boy stated afterwards that there were no nails in connection with the railings. The position of the nail and its exact size are shown in the accompanying drawing. It would seem theoretically almost impossible for a tin-tack with its broad head to traverse the sclerotic, unless through a very large rupture, which did not exist in this case. The specimen is preserved in the Moorfields Hospital Museum.

My friend, Mr. Percy Dunn, recently recorded* a remarkable instance of perforation of the globe by the knotted end of a whip. Panophthalmitis rapidly came on, and the eye was excised, the foreign body being then

* Illustrated Medical News, Nov. 10, 1888.
found lying in the vitreous. In this case there was a large jagged wound at the sclero-corneal margin.

A boy, æt. 9, came under my care at the Great Northern Hospital with the anterior chamber of one eye half full of brick-dust. The bright red particles lying between the iris and cornea gave the eye a most curious aspect. The injury was due to another boy having thrown a brick at him a fortnight previously; the rupture was at the sclero-corneal junction. Needless to say that the eye required excision.

Cases in which the cornea or ciliary region has been penetrated by some sharp instrument, but in which we can feel practically certain that no foreign body is imbedded, often present most difficult problems as to treatment. I wish to record the two following cases as bearing upon one point in particular, viz., the date at which the prolapsed part of the iris should be excised, when it has been determined to save the eye.

According to Mr. Nettleship* the iridectomy “may be done as much as three or four days after the injury.” It happened that in my two cases it was not performed until six and eight days respectively had elapsed, and no difficulty was found at the time of operation, the result being also very good as regards vision, &c. I do not mean to advocate waiting so long in ordinary cases, but special circumstances caused the delay, and it is interesting to note that no harm whatever resulted from it. There is a distinct advantage in allowing two or three days to elapse before operating, as we can then see whether violent reaction or suppuration would render excision a more appropriate operation than iridectomy. It may be said, on the other hand, that such a delay causes the iris to become united to the wound, and renders the iridectomy more difficult; this may be so in some cases, but in neither of the following was there any difficulty in drawing out the iris.

William D., æt. 15, a mechanic, was engaged in straightening

* "Diseases of the Eye," p. 147.
INJURY TO THE EYE AND ORBIT.

a coil of telegraph-wire, when the end struck him violently in the left eye. He came to the Great Northern Hospital shortly afterwards; there was a wound of the cornea close to the ciliary margin, and the anterior chamber was full of blood. He was at once admitted, and ice and atropine were applied. The haemorrhage was rapidly absorbed, and it was then found that the iris was somewhat detached from its point of ciliary insertion opposite to the wound, and prolapsed into the latter. Careful enquiry rendered it certain that the end of the wire could not have broken off, and there was no wound of the lens capsule. The anterior chamber refilled well, but the prolapse became more marked, and on the sixth day (as soon as the father's permission for an operation could be obtained) the prolapsed part was drawn out and freely excised. As usual, it was easy to free one edge of the iris from the wound, but a slight adhesion remained below.

There was some abnormal vascularity of the iris, but no other evidence of iritis. Under the vigorous use of atropine and ice the eye remained quiet, and the patient was discharged on the fifth day after the operation.

I have seen him several times since the accident during the eight months that have elapsed; there has been no irritation of either eye, and he sees as well with the injured one as with the other. The anterior synechia has persisted, and there is a large coloboma, but it gives him no trouble; V. = \( \frac{6}{6} \) and 1 J.

Mary Anne T., aged 8 years, was admitted into the Great Northern Hospital for a wound of the L. globe, inflicted, I believe, with a knife. The sharp edge had cut through the lower eyelid (this wound was united with silk and healed rapidly), and then passed through the sclerotic and cornea, the former being implicated to the extent of 3 mm. The iris was divided opposite to the wound, and it seemed probable that the lens capsule would also be implicated. This, however, proved not to be the case.

The iris was adherent to the wound, but did not at first prolapse much. Atropine and ice were vigorously used.

On the 4th day, pupil 6 mm., considerable ciliary congestion, mere bulging at wound, no iritis.
The child's father was very difficult to find, and it was not until a week had elapsed that permission could be obtained for "an operation." On the eighth day the attached and prolapsed part of the iris was excised. The wound rapidly united, the ciliary congestion subsided, and the vision was equally good in both eyes.

It may be held that the only safe treatment in this case was to excise the eye, but as the ciliary wound was clean cut, and as no marked inflammatory reaction followed, it seemed justifiable to use conservative treatment. The patient's father was charged to bring the child back to the hospital if any symptoms of irritation appeared, but I lost sight of the case when some months had elapsed; the eye then remained quite quiet and vision was practically perfect.

Case of a Slate Pencil almost two inches long imbedded in the Orbit for several weeks; the Eye escaping injury.

The following remarkable case occurred under the care of Mr. Waren Tay, at Moorfields, and he has kindly allowed me to publish it:—

A boy, Alex. H., aged six years, was brought to Moorfields first on December 13, 1888, on account of the condition of his right eye. There was much oedema of the lower lid, with general conjunctival congestion, and slight discharge.

There was a little bud of granulations at the outer canthus, with slight discharge of lymph from its depressed centre. There was a small cruciform scar over the outer end of the upper eyelid. The history of the case was as follows:—About six weeks previously he had fallen downstairs, but was not known to have injured the eye in the fall. The doctor who sent him to the hospital considered the case to be one of conjunctivitis aggravated by the injury. The presence of the sinus, however, excited suspicions of a foreign body being lodged in the orbit, and Mr. Tay, therefore, had the boy anaesthetised, dilated the sinus with dressing forceps, and felt a rough substance in its interior. With the forceps the foreign body, a piece of slate pencil of the exact size shown in the woodcut, was extracted. It apparently lay in the antero-posterior
axis of the orbit, and its length \(1\frac{1}{2}''\) made it certain that the point must have been close to the very apex of the orbit, possibly in the sphenoidal fissure.

Fig. 2.

The boy rapidly recovered, there being no irritation in the eye or impairment of its movements. Vision with either eye was \(\frac{6}{12}\).

I saw at the London Hospital two years ago a somewhat similar case, although the region in which the foreign body was imbedded was not the orbit. A young man came under care for a small sinus in the dense tissue of the heel, around which there was considerable granulation-growth. No cause could be found from the patient's history, but suspecting that there might possibly be a foreign body beneath the granulations, I made an incision and extracted a piece of shoe-leather, which was completely imbedded in the subcutaneous layer. How it got in was unexplained.

It is well known that the orbital tissues may tolerate for long the presence of a foreign body, and De Wecker appears to counsel abstention from operative interference in such a case. His argument is that such interference may set up orbital or intra-cranial suppuration, but the case which he quotes from M. Pagenstecher in favour of this, is hardly a strong one. A knitting-needle had broken in a fall, and part of it had lodged in the orbit of a girl aged seven. Frequent attacks of inflammation, and ultimately sympathetic symptoms in the other eye led to enucleation at the age of 24, and during the operation a foreign body was detected close to the globe. Foetid pus continued to be discharged, the patient had headache and loss of appetite, and about a month later a second operation was performed, and a fragment of needle four inches long.
extracted. The patient recovered for a time, but some few months later died of cerebral abscess. Seeing that before the excision of the injured eye was performed there was marked chemosis, it may be conjectured that the foreign body was at that time setting up trouble, and previous to its extraction there were symptoms definitely pointing to intra-cranial inflammation. Had the removal not been attempted it seems quite probable that the same result would have followed. In a case lately published by Dr. Stephen Mackenzie, part of a pen-holder had for years remained in one frontal lobe, the patient being then rather suddenly seized with cerebral symptoms, and dying of an abscess around the foreign body. In this case not only had no attempt at removal been made, but the presence of the pen-holder had not been suspected. The man was under the care of Dr. Mackenzie in the London Hospital, and it was only after careful enquiry after the post-mortem that a history of the accident was obtained.

Case of complete Traumatic Removal of Lens and Iris, with Retention of Fair Vision.

A Turk, aged 25, during a street-brawl in Constantinople, received a blow on the right eye, with either a broken pipe-stem or a piece of iron, the wound running across the upper segment of the cornea, nearly parallel to the section made in flap-extraction. At one end, however, the wound passed right through the ciliary region. In spite of treatment with bread-poultices no severe inflammation followed, and the wound healed well. Some 14 months later he came to Moorfields, where he was examined by Mr. Nettleship. There was no trace of the iris left, and the lens had evidently escaped (probably in its capsule) through the rupture. The ciliary processes were readily seen below, and just above them was a curious translucent fold, which Mr. Nettleship compared to "the ghost of an iris." Above and behind these was an opaque white fold, which might perhaps be the remains of the lens capsule, and at the upper margin were a few smaller white bands. The vitreous was practically clear, but for slight linear opacities running towards the scar. The
optic disc and retina were normal, though the former appeared distorted unless looked at through the exact centre of the cornea. The large size of "the pupil" and the alteration of corneal curvature rendered general vision with this eye very bad, but when a stenopaic disc was placed before the eye he read \( \frac{20}{50} \) with +13 D. V. of the left eye = \( \frac{20}{20} \). There was no congestion of either eye, and there had been no pain in the injured one. Should the second eye be injured the patient would still have a fairly useful one to fall back upon. Improbable though such an accident might be, one knows that such a contingency must be allowed for. For example, a man employed in a Government factory was struck on the R. eye by a fragment of steel—traumatic cataract followed with iritis—and the eye was operated on by my friend Mr. Allan Perry with very good result \( (V = \frac{6}{6} \text{ and } 1 \text{ J. with proper glasses}) \). Within a year his other eye sustained a precisely similar accident, but unfortunately the piece of iron lodged in the back of the globe and enucleation had to be advised.

The case of complete removal of the iris just recorded is similar to one exhibited by Mr. Lang at the Ophthalmological Society's meeting some months ago, and there are a fair number of parallel cases recorded.
AN EXAMINATION OF THE PATELLAR TENDON-REFLEX IN SIXTY-TWO CASES OF INTERSTITIAL KERATITIS.

By W. Lang,
Assistant-Surgeon to the Hospital and Ophthalmic Surgeon to the Middlesex Hospital, and

Casey A. Wood, C.M., M.D.,
Clinical Assistant at the Hospital; late Professor of Pathology, University of Bishop’s College; Physician to the Western Hospital, Montreal.

The following investigation is based upon an examination of patients attending, chiefly during the past six months, the Moorfields and Middlesex Hospital clinics of Mr. Lang, at whose suggestion it was first instituted. No case has been included which was not a well-marked example of parenchymatous or interstitial inflammation of the cornea, with or without evident iritis, cyclitis, or choroiditis. To insure uniformity as well as accuracy each patient was examined in the following manner: after the history and present condition had been gone into, and the local signs and symptoms noted, the patellar tendon-reflex was tested. If there were a ready response on both sides it was entered as normal. Decided diminution or apparent absence of the reflex led to a further examination. The person was placed sitting on the edge of a table with bared knees, and instructed to allow the legs to hang loosely. While his attention was directed away from the matter in hand repeated attempts were made with a Winterich hammer to produce the reflex movements. In Table No. I the sign —1 is to be taken to mean that there was, under the most favourable conditions for eliciting a response, but a faint though constant and undoubted movement of the limbs. In those instances
where there was much difficulty in producing, after numerous attempts, any reaction whatever the subnormal state is expressed by -2. In no instance was the reflex entered as absent unless there was proved to be no response whatever to the test applied as above. All these cases of diminished and absent patellar reflex were, moreover, examined at least twice, and most of them oftener as occasion permitted. In the same way a diminution of the normal excitability was considered a special reason for enquiring into possible causes of the condition outside of the mere local affection. The results have been stated in the following tables. The task of getting definite information from the patients or their friends was found to be not an easy one. Probably the number of attacks of interstitial keratitis from which a young adult has suffered during his lifetime is not known by himself, or, in the case of children, by the friendly neighbour who brings them to the hospital. Even the mother when interrogated cannot furnish an answer which will enable one to say positively whether the "bad eyes" her child suffered from a number of years before had been a catarrhal ophthalmia, a phlyctenular keratitis or an attack of specific keratitis. For this reason the date at which the patient first suffered from the disease (Table II) is in a number of instances uncertain. The writers have been to some trouble in their efforts to get at, in each case, the diathesis known to underlie, almost without exception, this form of corneal infiltration. In the absence of the Hutchinson teeth, the scars about the angles of the mouth, the frontal prominences, and the other signs of hereditary syphilis, search was made for indications of strumous or tubercular disease. The report upon the examination of the eyes for concomitant choroiditis, iritis, &c., is necessarily incomplete. Most of the patients were not seen in a condition to determine the existence or absence of deep changes in the eye, and without doubt in a much larger percentage of them uveal and fundus changes
were present than the table would appear.
The terms employed to indicate the usual state are relative only. A man, for example, who was nourished, had a good appetite, and could imperfect vision had permitted him, was entitled in good health, even if he was obliged to retire.

"Bad" health means that the patient had been incapacitated from following his ordinary

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Male or female</th>
<th>Age</th>
<th>No. of attacks of disease</th>
<th>Duration of disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>J. M.</td>
<td>M.</td>
<td>22</td>
<td>1</td>
<td>More than 6 months</td>
</tr>
<tr>
<td>2</td>
<td>F. N.</td>
<td>M.</td>
<td>12</td>
<td>1</td>
<td>More than 2 months</td>
</tr>
<tr>
<td>3</td>
<td>S. B.</td>
<td>F.</td>
<td>16</td>
<td>1</td>
<td>More than 4 months</td>
</tr>
<tr>
<td>4</td>
<td>E. L.</td>
<td>F.</td>
<td>14</td>
<td>3</td>
<td>About a year</td>
</tr>
<tr>
<td>5</td>
<td>I. B. S.</td>
<td>M.</td>
<td>21</td>
<td>3 or 4</td>
<td>1 to 6 months</td>
</tr>
<tr>
<td>6</td>
<td>A. S.</td>
<td>F.</td>
<td>26</td>
<td>1</td>
<td>More than 1 month</td>
</tr>
<tr>
<td>7</td>
<td>G. C.</td>
<td>M.</td>
<td>14</td>
<td>1</td>
<td>3 months (?)</td>
</tr>
<tr>
<td>8</td>
<td>C. H.</td>
<td>F.</td>
<td>29</td>
<td>1</td>
<td>3 weeks</td>
</tr>
<tr>
<td>9</td>
<td>L. P.</td>
<td>F.</td>
<td>31</td>
<td>2</td>
<td>Each several months</td>
</tr>
<tr>
<td>10</td>
<td>A. R.</td>
<td>F.</td>
<td>19</td>
<td>1</td>
<td>2 weeks</td>
</tr>
<tr>
<td>11</td>
<td>D. D.</td>
<td>M.</td>
<td>12</td>
<td>1</td>
<td>Several weeks</td>
</tr>
</tbody>
</table>
causes outside of the eye affection. "Indifferent" mean between these two extremes.

It was thought advisable to note the fact not the patient had been treated by mercurials or by both.

Where a space has been left blank, it is to mean that no satisfactory answer was obtained question at the head of the column.

No. I.

<table>
<thead>
<tr>
<th>Other affections of eye observed.</th>
<th>Usual state of health.</th>
<th>Patellar tendon-reflex.</th>
<th>Had patient been previously treated with Hg or KI.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td>With both Syr. ferri iod.</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Normal</td>
<td>-</td>
</tr>
<tr>
<td>Iritis and chorioiditis</td>
<td>Bad</td>
<td>Normal</td>
<td>No</td>
</tr>
<tr>
<td>Chorioiditis</td>
<td>Good</td>
<td>Absent</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Absent</td>
<td>-</td>
</tr>
<tr>
<td>Chorioiditis</td>
<td>Good</td>
<td>Normal</td>
<td>Both</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal</td>
<td>Both</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>-1</td>
<td>-</td>
</tr>
</tbody>
</table>

Rad. | 1 | Good
Hals | 1 | Good
Den. | 1 | Bad
Med. | 1 | Good
Oth. | 1 | Good
Ma. | 1 | Good

(Continued)
### Table: Examination of the Patellar

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Male or female</th>
<th>Age</th>
<th>No. of attacks of disease</th>
<th>Duration of disease</th>
<th>One or both eyes</th>
<th>Any definite history or signs of syphilis or struma?</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>W. F.</td>
<td>M.</td>
<td>21</td>
<td>2</td>
<td>Each several months 3 years &quot;off and on&quot;</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>19</td>
<td>W. M.</td>
<td>M.</td>
<td>30</td>
<td>3 or 4</td>
<td></td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>20</td>
<td>T. R.</td>
<td>M.</td>
<td>10</td>
<td>1</td>
<td>3 years</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>21</td>
<td>M. A. B.</td>
<td>F.</td>
<td>15</td>
<td>1</td>
<td>Short time</td>
<td>One</td>
<td>Struma</td>
</tr>
<tr>
<td>22</td>
<td>F. S.</td>
<td>F.</td>
<td>14</td>
<td>Several</td>
<td>Each several months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>23</td>
<td>K. L.</td>
<td>F.</td>
<td>15</td>
<td>2</td>
<td>1 year and 6 months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>24</td>
<td>G. D.</td>
<td>M.</td>
<td>10</td>
<td>1</td>
<td>Several months</td>
<td>Both</td>
<td>No</td>
</tr>
<tr>
<td>25</td>
<td>A. D.</td>
<td>F.</td>
<td>12</td>
<td>Several</td>
<td>4 years</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>26</td>
<td>L. W.</td>
<td>F.</td>
<td>14</td>
<td>1</td>
<td>3 months</td>
<td>Both</td>
<td>No</td>
</tr>
<tr>
<td>27</td>
<td>A. L.</td>
<td>M.</td>
<td>27</td>
<td>1</td>
<td>2 months</td>
<td>One</td>
<td>No</td>
</tr>
<tr>
<td>28</td>
<td>C. L.</td>
<td>M.</td>
<td>20</td>
<td>2</td>
<td>5 months and 2 weeks</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>29</td>
<td>M. C.</td>
<td>F.</td>
<td>27</td>
<td>Many</td>
<td>Several years</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>30</td>
<td>A. C.</td>
<td>F.</td>
<td>21</td>
<td>1</td>
<td>A week or two</td>
<td>One</td>
<td>No</td>
</tr>
<tr>
<td>31</td>
<td>E. M.</td>
<td>F.</td>
<td>13</td>
<td>1</td>
<td>1 week</td>
<td>One</td>
<td>No</td>
</tr>
<tr>
<td>32</td>
<td>M. P.</td>
<td>F.</td>
<td>14</td>
<td>1</td>
<td>1 month</td>
<td>One</td>
<td>Struma</td>
</tr>
<tr>
<td>33</td>
<td>J. R.</td>
<td>F.</td>
<td>28</td>
<td>2</td>
<td>6 months and 3 mos.</td>
<td>Both</td>
<td>No</td>
</tr>
<tr>
<td>34</td>
<td>A. C.</td>
<td>M.</td>
<td>14?</td>
<td>1</td>
<td>6 weeks</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>35</td>
<td>R. D.</td>
<td>F.</td>
<td>27</td>
<td>1</td>
<td>9 weeks</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>36</td>
<td>A. P.</td>
<td>F.</td>
<td>26</td>
<td>Several</td>
<td>Each several months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>37</td>
<td>E. P.</td>
<td>F.</td>
<td>12</td>
<td>1</td>
<td>1 year</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>38</td>
<td>J. T.</td>
<td>M.</td>
<td>26</td>
<td>1</td>
<td>Months</td>
<td>Both</td>
<td>No</td>
</tr>
<tr>
<td>39</td>
<td>F. W.</td>
<td>M.</td>
<td>12</td>
<td>1</td>
<td>2 weeks</td>
<td>One</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>40</td>
<td>F. W.</td>
<td>F.</td>
<td>16</td>
<td>2</td>
<td>6 months and 1 week</td>
<td>One</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>41</td>
<td>C. L.</td>
<td>F.</td>
<td>25</td>
<td>Several</td>
<td>Each several months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>42</td>
<td>M. S.</td>
<td>F.</td>
<td>21</td>
<td>2</td>
<td>Over a year</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>43</td>
<td>A. J.</td>
<td>M.</td>
<td>14</td>
<td>Many</td>
<td>Over 5 years</td>
<td>Both</td>
<td>Struma</td>
</tr>
</tbody>
</table>
### Table: Tendon-Reflex in Interstitial Keratitis

<table>
<thead>
<tr>
<th>Other affections of eye observed.</th>
<th>Usual state of health.</th>
<th>Patellar tendon-reflex.</th>
<th>Had patient been previously treated with Hg or KI</th>
<th>Remarks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iritis</td>
<td>Indifferent</td>
<td>Normal</td>
<td>KI</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>Normal</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td>Both</td>
<td>Never taken medicine. Married. Wife no live children, but several miscarriages.</td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>Absent</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>Normal</td>
<td>Both</td>
<td>Badly nourished subject, with constitutional disease well marked.</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal</td>
<td>Syr. ferri iod.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Absent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choroiditis</td>
<td>Indifferent</td>
<td>Absent</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iritis</td>
<td>Indifferent</td>
<td>Normal</td>
<td>Probably both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Absent</td>
<td>Syr. ferri iod.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Absent</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No traces of iritis or choroiditis</td>
<td>Indifferent</td>
<td>Normal</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Absent</td>
<td>Both</td>
<td></td>
</tr>
</tbody>
</table>

Ps. a. \( V = \frac{6}{6} \) R. and L.  
A first miscarriage, and 1 healthy child.
<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Male or female</th>
<th>Age</th>
<th>No. of attacks of disease</th>
<th>Duration of disease</th>
<th>One or both eyes</th>
<th>Any definite history or signs of syphilis or struma?</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>B. D.</td>
<td>F.</td>
<td>16</td>
<td>1</td>
<td>1 year</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>45</td>
<td>G. C.</td>
<td>M.</td>
<td>36</td>
<td>2</td>
<td>6 months and 1 month For years</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>46</td>
<td>E. J.</td>
<td>M.</td>
<td>19</td>
<td>Several</td>
<td>4 years</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>47</td>
<td>M. C.</td>
<td>F.</td>
<td>50</td>
<td>2</td>
<td>1 year and 1 week</td>
<td>Both</td>
<td>No (?)</td>
</tr>
<tr>
<td>48</td>
<td>L. B.</td>
<td>F.</td>
<td>15</td>
<td>Many</td>
<td>Most of life</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>49</td>
<td>M. W.</td>
<td>F.</td>
<td>10</td>
<td>2</td>
<td>4 months and 3 weeks</td>
<td>Both</td>
<td>Struma</td>
</tr>
<tr>
<td>50</td>
<td>L. B.</td>
<td>F.</td>
<td>17</td>
<td>Several</td>
<td>4 years</td>
<td>Both</td>
<td>Struma</td>
</tr>
<tr>
<td>51</td>
<td>E. S.</td>
<td>F.</td>
<td>18</td>
<td>2</td>
<td>6 months and 2 months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>52</td>
<td>A. F.</td>
<td>F.</td>
<td>15</td>
<td>2</td>
<td>1 month and 2 months</td>
<td>Both</td>
<td>Struma</td>
</tr>
<tr>
<td>53</td>
<td>J. J.</td>
<td>F.</td>
<td>8</td>
<td>1</td>
<td>1 month</td>
<td>Both</td>
<td>No</td>
</tr>
<tr>
<td>54</td>
<td>G. S.</td>
<td>M.</td>
<td>21</td>
<td>2</td>
<td>6 months &amp; 3 months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>55</td>
<td>P. H.</td>
<td>M.</td>
<td>17</td>
<td>2</td>
<td>Each 1 year</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>56</td>
<td>A. S.</td>
<td>F.</td>
<td>18</td>
<td>1</td>
<td>2 weeks</td>
<td>One</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>57</td>
<td>W. J.</td>
<td>M.</td>
<td>33</td>
<td>Several</td>
<td>Each several months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>58</td>
<td>J. L.</td>
<td>F.</td>
<td>24</td>
<td>1</td>
<td>6 months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>59</td>
<td>M. A.</td>
<td>F.</td>
<td>36</td>
<td>1</td>
<td>3 weeks</td>
<td>Both</td>
<td>No</td>
</tr>
<tr>
<td>60</td>
<td>W. C.</td>
<td>M.</td>
<td>14</td>
<td>1</td>
<td>12 months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>61</td>
<td>E. A.</td>
<td>F.</td>
<td>24</td>
<td>Several</td>
<td>Each several months</td>
<td>Both</td>
<td>Cong. syph.</td>
</tr>
<tr>
<td>62</td>
<td>F. T.</td>
<td>M.</td>
<td>33</td>
<td>1</td>
<td>3 months</td>
<td>One</td>
<td>Cong. syph.</td>
</tr>
</tbody>
</table>

Of the 62 cases above tabulated 24, or 39 per cent., were males, and 38, or 61 per cent., were females; 13, or 21 per cent., were under 10 years of age when the disease first showed itself; 32, or 51 per cent., were between 10 and 20; while only 17, or 28 per cent., were above 20. Hereditary syphilis was proved to be present in 43 cases, or 69 per cent. Struma was found in 7, or about 1 per cent.; while in 4 no evidences of syphilis or struma could be detected, either in their own persons, or in their
<table>
<thead>
<tr>
<th>Other affections of eye observed.</th>
<th>Usual state of health.</th>
<th>Patellar tendon-reflex.</th>
<th>Had patient been previously treated with Hg or KI.</th>
<th>Remarks.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bad</td>
<td>−2</td>
<td>Probably syr. ferri iod.</td>
<td>Lately recovered (?) from some obscure brain disease.</td>
</tr>
<tr>
<td>Choroiditis and iritis, with eccentric pupil</td>
<td>Good Bad</td>
<td>−1 Normal Both</td>
<td>Both</td>
<td>Has rotatory nystagmus.</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Absent</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indifferent Bad</td>
<td>Normal</td>
<td>−</td>
<td>Married, 9 children, 5 living and healthy, 4 dead, 3 miscarriages. No H. teeth.</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal</td>
<td>−</td>
<td>Only child.</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>−1 Hg and syr. ferri iod.</td>
<td></td>
<td>Very severe attack.</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal</td>
<td>Hg and syr. ferri iod.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>Normal</td>
<td>Normal</td>
<td>Several other members of family have had same disease.</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td>Hg</td>
<td>One sister (large family) also had &quot;bad eyes.&quot;</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal Normal</td>
<td>Both</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>Normal</td>
<td>−</td>
<td>Interval of 4 months before second eye was attacked.</td>
</tr>
<tr>
<td>Iritis</td>
<td>Good</td>
<td>Normal</td>
<td>−</td>
<td>Signs and history negative, except doubtful ulceration of tongue. Married.</td>
</tr>
<tr>
<td></td>
<td>⋮</td>
<td>Normal</td>
<td>−</td>
<td>Deaf six years.</td>
</tr>
<tr>
<td></td>
<td>Indifferent</td>
<td>Normal</td>
<td>−</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indifferent Normal</td>
<td>−</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

families, or in their parents. During the continuation of the eye affection the general health was noted as being good in 26 instances, or 42 per cent.; indifferent in 23, or 37 per cent.; bad in 12 cases, or 20 per cent.; not noted 1.

Regarding the knee-jerks, these were found to be normal in 44 cases, or 70 per cent., and subnormal in 18 cases, or 30 per cent.

In not a single instance could the reflex be described
as decidedly exaggerated. Of the 62 patients observed, exactly 50 per cent. (and probably more) had been treated either with mercurials, iodides of iron, iodide of potassium, or with two or more combined, before coming under these observations.

Table No. II is intended to give some further information concerning those cases whose patellar tendon-reflexes were found to be below the normal. As a preface to it, it may be remarked that in each instance the examination of the patient included a search for signs and symptoms (present and past) of those causes known to be capable of producing loss or diminution of the knee-jerk, e.g., ankylosis of the joint; local disease of the lig. patellæ or quadriceps extensor muscle; loss of sensation or motion, or atrophy due to affections of the cord or brain; peripheral neuritis; diabetes; large doses of opium and the bromides; diphtheria, and tabes dorsalis.

Of the 18 cases thus tabulated congenital syphilis may be said to be certainly present in all but three. In one of these, No. 7, there is a clear family history of tuberculosis; in another, No. 47, specific disease is probably not present.

The writers regret that a fuller report upon the pupillary reaction to light and accommodation is not possible. The great majority of the patients were either under the influence of some mydriatic when examined, or the corneal opacity was too marked to properly apply these tests, or the accompanying iritis prevented it, or the photophobia made it uncertain. It is due to one or more of these causes that in only two cases showing subnormal knee-jerks could these extremely important observations be made.

Tabes, as likely to affect the adult section, and diphtheria as a possible cause of absent reflexes in children have been given a column to themselves. In Case No. 7 it is probable that diphtheritic sore throat, accompanied by some of its nervous alterations, has been the cause of
<table>
<thead>
<tr>
<th>No.</th>
<th>Age at time of first attack.</th>
<th>Constitutional disease.</th>
<th>Action of pupils to light and accommodation.</th>
<th>Past or present symptoms of diphtheria or tabes dorsalis (?)</th>
<th>Other diseases of nervous system present.</th>
<th>Knee-jerk.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>12</td>
<td>Congenital syph.</td>
<td>Unable to test</td>
<td>None</td>
<td>None</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>26 (?)</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td>None</td>
<td>Ditto</td>
<td>None (?)</td>
<td>None (?)</td>
<td>Absent</td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>12</td>
<td>None</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>14</td>
<td>17 (?)</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>22</td>
<td>12</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>8</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>28</td>
<td>19</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>29</td>
<td>8</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>34</td>
<td>14 (?)</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>37</td>
<td>11</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>40</td>
<td>10</td>
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<td>Normal</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
<td>44</td>
<td>15</td>
<td>Congenital syph.</td>
<td>Unable to test</td>
<td>None</td>
<td>Meningitis (?)</td>
<td>2</td>
</tr>
<tr>
<td>45</td>
<td>14 (?)</td>
<td>Congenital syph.</td>
<td>Ditto</td>
<td>None</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>47</td>
<td>32</td>
<td>None</td>
<td>Normal</td>
<td>None</td>
<td>None</td>
<td>Absent</td>
</tr>
<tr>
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<td>17</td>
<td>Congenital syph.</td>
<td>Unable to test</td>
<td>None</td>
<td>None</td>
<td>1</td>
</tr>
</tbody>
</table>

N 51
the absent knee phenomenon. In the next column there is noted but one instance, No. 44, of other diseases of the nervous system which might bring about a diminished knee-jerk.

Beyond an empirical collection of the above facts the writers do not set forth any theory to account for the diminution or absence of the patellar reflex in cases of interstitial keratitis. To do that would involve the discussion of questions far removed from the province of ophthalmology.

In what percentage of healthy people is the knee-jerk absent? Is that absence a congenital defect, or is it a sort of nervous habit acquired in after years?* Regarding even the nature of the phenomenon comparatively little is as yet known, and it seems unwise to assume a new cause as operative while the character of the reaction is yet a matter of speculation. Probably as much as can be safely said about it has already been stated by Waller;† "I am led to doubt," he says, "the now generally accepted theory that the reaction known as (patellar) tendon-reflex is subserved by spinal nervous arcs; while I admit as their highly probable sine qua non the reflex tonicity exerted by the spinal cord. The fact remains constant that spinal conditions, by some influence, be it mediate or immediate, modify the response of muscle to external vibration." On the other hand, this paper makes no claim to having decided many important questions in this connection. The comparatively small number of cases examined, and the short length of time they were under observation, render that impossible. What effect, if any, has the local eye disease upon the knee-jerk? What part does syphilis, for example, play in producing absence or diminution of patellar reflex? Is this subnormal condition one of the late manifestations of hereditary syphilis

* In a note to one of the writers, Dr. Gowers states that in his opinion the knee-jerk is never absent in healthy people.
† "Brain," vol. iii, p. 191.
without obvious disease of the posterior columns of the cord? It is at once apparent that not only a much longer period of time, but a much larger number of cases, will be required to furnish a satisfactory reply to questions of this sort. In the meantime the writers claim to have shown—

1. That in about 30 per cent. of all cases of interstitial keratitis the knee-jerk is decidedly subnormal.

2. That in about 10 per cent. of all cases it is entirely absent—all known causes of subnormal tendon-reflexes, outside of the constant fact that the local eye disease exists, having been eliminated.

3. It is probable also that in a very small percentage of cases of diminished and absent knee-jerks the usual constitutional dyscrasias cannot be demonstrated.

4. That it is rare to find a case of exaggerated patellar tendon-reflex in interstitial keratitis when unaccompanied by some of the affections known to produce the former.
THE ASTHENOPIA OF NEURASTHENICS.

By W. J. Collins, M.S., M.D., B.Sc. (Lond.).

The term asthenopia, like similar terms framed upon the same pattern, is liable to a vast amount of abuse. It is often sufficiently mysterious to mislead, and sufficiently ambiguous to fail to explain. It was the refuge of the destitute before the time of Donders; it was the *hebetudo visus* of Jüngken, the *disposition à la fatigue des yeux* of Bonnet; indeed, the names by which its true nature was successfully obscured were legion. Donders showed that “hypermetropia is usually at the bottom of asthenopia,” he went further and declared that “in the pure form of asthenopia hypermetropia is scarcely ever wanting;” doubts to the contrary he silenced by demonstrating a latent hypermetropia where the manifest alone had been sought for and not found. Whether accommodative asthenopia (for I do not refer to retinal or convergent asthenopia) does not unfrequently exist without attendant hypermetropia is a question which Donders would apparently have answered in the negative. Yet on p. 593 of his work, in speaking of paresis of accommodation, he says, under these circumstances “the emmetrope complains of fatigue on tension for near objects,” and adds that asthenopia quickly occurs.

I venture to think that varying degrees of accommodative asthenopia, due to cyclopaesis, are far more common than are generally supposed, more especially in that class of persons whom modern medical nomenclature affects to designate as neurasthenics. Persons of either sex of less than middle age constantly present themselves at cliniques and in private practice, whose complaints of asthenopia are both bitter and persistent. In such hypermetropia may have been sought for and only a small defect dis-
covered and accurately corrected, or none is present, or a slight astigmatism is neutralised with appropriate cylinders estimated by retinoscopy after dilatation of the pupils. Reading, even of J. i. at from 20 to 30 cm., may be effected, at any rate for the short space of time which is usually made to suffice for an ordinary trial. Yet the symptoms remain unrelieved and prolonged close work is impossible, so great is the discomfort. Such patients, though often exhibiting wide diversities of individuality, yet fall into the same class; they have been overtaxed, mentally or physically or both; a prolonged course of study, the wear and tear of nursing; a lavish expenditure of the midnight oil, whether in work or otherwise, have often precipitated if they have not occasioned the visual trouble.

Weir Mitchell, in his valuable little book on "Fat and Blood and how to make them" (page 125), has faithfully described the class of case I am endeavouring to depict; he says: "Fatigue of vision for near work is a common condition of the cases I am now describing, and is apt to persist long after all other troubles have vanished. When there is no asthenopia I usually think well of the general chance of recovery; but in no case of feeble vision do I omit at some period of the treatment to have the optical apparatus of the eye looked at with care, because pure asthenopia, apart from all optical defects, is a somewhat rare symptom. Neither am I always satisfied with the ophthalmologist's dictum that there is a defect so slight as to need no correction, being well aware that even minute ocular defects are competent mischief-makers when the brain becomes what I may permit myself, using the photographer's language, to call 'sensitized by disease.'"

If the asthenopia of neurasthenics were based merely upon subjective symptoms and complaints a large element of uncertainty would undoubtedly attach to the existence and true nature of such cases, but the amplitude of accommodation, in any given case, can after the determination
and correction of any static or refractive defect be determined with tolerable accuracy by ascertaining the strongest concave glass which the individual can neutralise. Landolt* says "the strongest negative lens through which an emmetropic eye can yet see clearly at a great distance measures the amplitude of its accommodation. An emmetropic eye which can overcome a No. 11 concave in working at a distance has an amplitude of accommodation of 11 D., and its punctum proximum is situated \( \frac{100}{11} = 9 \) cm. in front of the eye, since the concave lens causes parallel rays to diverge as if they came from its focus (9 cm. behind it)."

Now the amplitude of accommodation at 10 is 14 D., at 20 10 D., at 30 7 D., at 40 4·5 D., at 50 2·5 D., at 60, 1 D.; so that if after ascertaining and correcting any static (spherical or meridional) defect the available accommodation falls short of that indicative of the age of the patient, we are dealing with so much cyclo-paresis, an efficient cause of asthenopia prior to the onset of presbyopia, and after due correction of hypermetropia manifest or latent.

A few cases from my note-book will illustrate the same in a more concrete fashion.

A. R., æt. 32; has had several children; aborted nine months ago at three months of pregnancy; since then has been delicate, and suffers from asthenopia. \( V. = \frac{6}{9} \) each eye, and worse with weakest + glass. Cannot read small print or sew. With +3 D. reads J. i. easily. Cannot see \( \frac{6}{60} \) c -3 D.

T. A. C., æt. 29, a gentleman in delicate health, but with no definite symptoms, except that he cannot read by artificial light, and reading "The Times" by daylight gives him pain. \( V. \frac{6}{6} \) with each eye, and with +·5 D. can just see the letters of \( \frac{6}{6} \).

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He cannot read J. i at less than 35 cm. without great effort. With $-4$ D. can hardly see $\frac{6}{7}$, and that only for a few seconds.

M. A. B., a lady's maid, ät. 24, looks delicate and anæmic, has had weak $+$ sphérico-cylinders ordered by another surgeon, which accurately correct the whole of her ametropia, yet she has experienced scarcely any relief from their use, and suffers intensely when she does any needlework for more than half-an-hour. Although at her age she should possess 8 D. or 9 D. of accommodation, she can only with great effort neutralise $-4$ D.

Miss R., a lady help, ät. 22. Has lost flesh of late, is pale and breathless, suffers from menorrhagia with only a fortnight's interval. Complains bitterly of the eyes aching on the slightest exertion. She was under the impression her spine was weak, but nothing abnormal could be discovered there. V. $\frac{6}{9}$ improved by $+1$ D.; no astigmation by retinoscopy. With $+1$ D. she could not read J. i nearer than 35 cm. She underwent Weir Mitchell treatment for five weeks, viz., seclusion, over-feeding, rest and massage, with result that she gained 8$\frac{3}{4}$ lbs., and the asthenopia disappeared.

In rare cases the defect is unilateral; I have only met with one instance, that of Miss W., aged 40, a governess, single. She had had "gastric fever" six months previously; laid up several weeks. Complained of recently acquired asthenopia, especially of the left eye. Catamenia irregular, occasionally misses a period. V. right eye $= \frac{6}{9}$; left eye $= \frac{3}{12}$; not so good with $+50$ D. With right eye reads J. i at 22 cm.; with left eye can only read J. 6, but with $+2$ D. reads J. i., and ten minutes after the instillation of eserine she can do the same without assistance.

In an earlier volume of these Reports* I have referred to that variety of cycloplegia or cyclopareisis, which is by no means rare, though often overlooked in women during

* Vol. xi, part iii, p. 347.
the puerperium and lactation. Paralysis of the ciliary muscle after diphtheria is so well recognised, although it was first mentioned by Trousseau and Bretonneau so recently as 1860, and soon after elucidated by Donders, that it only requires passing mention.

The failure of accommodative power, after diphtheria, in the puerperal state, or in association with miscarriage or disturbed menstruation, and also that to which I desire to draw more particular attention, the asthenopia of neurasthenics, I take to belong to the same category. In all there is a faulty blood-metabolism and consequent neuromuscular debility, and it would seem that unstripped muscle suffers seriously from such defective hæmopoiesis, the heart and arterial muscles exhibit lack of tone, the pulse is soft, often irregular, and palpitation is common; the muscular fibre of the intestines suffers, and chronic constipation is a frequent concomitant; the ciliary muscle, with or without associated affection of the iris, is similarly weakened, and the amplitude of accommodation is seriously restricted. The treatment of such cases is happily hopeful and uniformly successful; that which is general is most important; and if the health has seriously suffered, as is generally the case, and emaciation has been going on, the systematic treatment which Weir Mitchell has taught, is, I am satisfied, of paramount value. For the eyes themselves I give weak eserine drops (half a grain to the ounce); insist upon entire abstinence from all close work; and when the general health begins to improve, allow reading or work for a definitely limited period daily with progressively weaker convex glasses, and later stimulate the ciliary muscle by the gymnastic exercise of overcoming progressively increasing strengths of concave glasses. The latter, of course, are not to be used as spectacles, but a 6, 7, or 8 D. concave is carried in the pocket, and distant objects occasionally focussed through it. The ammoniated citrate of iron with the addition of strychnine seems to accelerate the cure.
A FURTHER NOTE ON CASES OF ORBITAL SARCOMA IN CHILDREN.

By J. B. Lawford,
Clinical Assistant to the Hospital.

At page 43 of this volume will be found a short report of four cases of orbital sarcoma in children. When those notes were written, three of the four patients were alive and well, one case (No. IV) had terminated fatally. In the twelve months following the publication of my notes, two more of the patients have died, and it seems worth while now to complete these cases, and to record the condition of the survivor up to a recent date.

Case I.—Percy N——. Primary growth removed by Mr. Tweedy, November 20, 1885. The former account carries us to December, 1887, shortly after the recurring growth had been removed for the sixth time.

In June, 1888, another mass of tumour was removed by Mr. Doyne, who sent it to me for examination. Its microscopical characters were similar to those of the portion removed in the previous December (vide p. 45).

Recurrence again took place, and on December 13, 1888, I had an opportunity, through Mr. Doyne’s kindness, of seeing the child. There was then a large hard tumour filling the outer part of the left orbit; it was quite fixed, and protruded the skin over it, in which were large dilated veins. There was no tenderness, no swelling of frontal bone, no fulness of temporal fossa. The child had had, a short time previously, severe headache with vomiting, lasting for some days, but when I saw him was quite well and free from any cerebral symptoms. In January, 1889, headache again came on, followed by loss of consciousness, and irregular movements of the right leg and arm, and the child died in coma on the 25th. Unfortunately, no post-mortem examination was permitted.

This case is remarkable for its long duration, a period
of rather more than five years having elapsed since proptosis was first noticed by the parents, and of over three years since the first removal of the tumour. It is also noticeable that the malignancy of the tumour showed itself, till within two months of the patient's death, by purely local recurrences. In this feature it contrasts strongly with Case IV (p. 48).

Case II.—Rebecca W—. This patient was seen in the last week of February, 1889. She was then (15 months after the second operation) in good health, and there was no sign of recurrence of the orbital growth.

Case III.—O. J. The latest note in the previous account of this case, made in January, 1888 (p. 48), is to the effect that no recurrence of the tumour had taken place. Very soon after this, however (the exact date is uncertain), recurrent growth manifested itself, and on April 21, 1888, the child was admitted to the Middlesex Hospital under Mr. Lang's care. Cerebral symptoms soon developed, and death supervened on May 27, 1888.

The following is a brief abstract from the post-mortem notes:—

The right orbit is completely filled by a soft vascular growth, from the anterior part of which a pedunculated mass, the size of an orange, projects between the eyelids. The growth has partially destroyed the outer and inner walls of the orbit, and has extended into the nasal and temporal fossae, as well as into the left orbit, and over a large part of the anterior and middle cranial fossae. No trace of secondary growth in the thoracic or abdominal viscera.

I am indebted to Mr. Lang for the further history of Cases II and III.
REPORTS OF CASES.

By T. Phillips,

Clinical Assistant to the Hospital.

For permission to publish the following cases I am indebted to Mr. Tweedy.

I. Protracted Convalescence after Optic Neuritis.

B. H., aged 18, came to Moorfields under Mr. Tweedy, two years ago, with very bad diffused phlyctenular ulceration of both cornea. She had had chicken pox, mumps, and scarlet fever. Father living and well. Mother died of phthisis when B. was an infant.

Treated with iron and cod-liver oil internally. Boracic lotion and atropine locally. The cornea got rapidly better and cleared almost completely, when it was noticed that there was some uvea on the anterior capsule of the lens.

An ophthalmoscopic examination was made about three months afterwards, and it was found that she had marked optic neuritis of both eyes; \( V = \frac{20}{70}, L = \frac{20}{50} \). She was ordered 20 grs. v of iodide of potassium three times a day in addition to the iron and cod-liver oil. A fortnight afterwards the condition of the eyes, both as regards vision and ophthalmoscopic appearances, showed no change: two grains more of the iodide were added. In a fortnight she came again, the vision of the right eye having improved, \( V = \frac{20}{20} \); no change in the left. The ophthalmoscopic appearances of both were the same as on the previous visit. A month afterwards she came saying that she was much better. The neuritis had nearly all disappeared, with the exception of parts corresponding to where the vessels cross the margin of the disc: \( V = \frac{20}{30} \) in both eyes. A month afterwards she was able to pick out letters of \( \frac{20}{20} \). About a fortnight later she came saying she was quite well; the disc and fundus looked healthy in both eyes. She was getting tired of medicine and was allowed to go without. She
returned in three weeks saying she could not see so well; \( V = \frac{20}{40} \) in each; the discs appeared oedematous, the upper and lower margins being decidedly blurred. She did not look so well and had lost flesh. Recourse was again had to the iodide of potassium and cod-liver oil, with the application of blisters to each temple. She came back in a week saying she could see much better, \( V = \frac{20}{30} \); in another fortnight she appeared again to be quite well, but the treatment was strictly followed for nearly three months; when she was again allowed to try without medicine. She returned again in a little over a month, saying she could not see so well, \( V = \frac{20}{30} \) in each. Discs looked hazy and had the appearance of being seen through a clear fluid; this was thought to be exudation. The same treatment was applied again. Having spoken of the case to Mr. Gunn, he expressed a wish to see it, and when he examined her he pronounced the disc and fundus normal, and, in order to test the case, treatment was suspended for six weeks, when she came complaining of the sight being not so good. Mr. Gunn again saw her and pronounced the discs slightly blurred, and the adjoining retina oedematous looking. July 26, 1889. She is now improving once more under the above treatment.

II. Right Lateral Hemianopsia after Injury.

H. R., aged 34, labourer, came complaining of bad sight since an accident five months ago, when a piece of iron fell on his head. There was no open wound. He was unconscious for three weeks. Soon after he recovered consciousness he noticed that he could not see very well. \( V = \frac{20}{200} \). He is "no scholar" and cannot pick out any letters of Jaeger's test types. Refraction normal. There was a marked depressed fracture of the skull just below the posterior superior angle of the left parietal bone. The ophthalmoscope revealed no gross change except that the veins were a trifle fuller and more tortuous than ordinary.

The accompanying perimetric charts will show the condition of the field of vision in both eyes.
CURATOR'S PATHOLOGICAL NOTES.

By E. Treacher Collins,
Curator of the Museum.

I. Dragging forwards of the Retina in the Region of the Ora Serrata without General Detachment.

In two of the following cases the eye was lost as the result of ophthalmia neonatorum. The following series of events, which is applicable to both, had occurred. The cornea sloughed, and the greater portion of the lens escaped. The false cornea which formed became staphylomatous. The iris and what was left of the lens and its capsule adhered intimately to this pseudo-cornea. This advanced attachment of the lens capsule, and the bulging forwards of the cornea, caused a considerable drag on the suspensory ligament of the lens, and on the structures into which it is inserted. Thus the ciliary processes became elongated. The most of this drag, however, would be felt by those parts to which the posterior fibres of the ligament are attached, viz., the pars ciliaris retinae and the ora serrata of the retina. The former being firmly adherent to the ciliary body was not detached; the latter, however, became prolonged forwards in the form of a fold, thus covering over the ciliary processes and the pars ciliaris retinae. In one of the cases also the retinal pigment layer became projected forwards and inwards for a short distance.

In the third case a similar result as to the dragging forwards of the retina was brought about in a different way. There had been a penetrating wound in the ciliary region which had passed through the suspensory ligament of the lens on one side, and also wounded the lens itself; absorption of the greater portion of it followed; a band of
cicatricial tissue formed in the track of the wound, the contraction of which, together with the shrinking of the lens, produced the drag on the suspensory ligament and a localized prolongation forwards of the retina.

These cases are interesting in demonstrating how an extension forwards of the retina can take place in this way without, or, in one case, with one slight detachment elsewhere; they also show how firm an insertion the suspensory ligament must have into the ora serrata, and how unyielding a structure is the pars ciliaris retinae compared with the retina itself.

Case 1 (Reg. No. 2726).

Henry D——, æt. 4, was admitted on October 23, 1888, with a history of having had ophthalmia neonatorum, and of the lens of his right eye having dropped out into the mother's hand when he was a few days old. The cornea of his right eye was opaque, vascular, and very staphylomatous, the most marked bulging being at the lower and outer part. T. n.

The right eye was excised the following day.

Pathological Report. Macroscopical Examination.—The antero-posterior diameter measured 29 mm. and the transverse 12 mm. Cornea was much enlarged, and presented very different degrees of thickness; in the centre it measured 2.5 mm., and gradually tapered off on either side, but more above than below. Iris: the uveal pigment layer was spread out in the form of a network, and was intimately adherent to the posterior surface of the cornea. In many places it projected backwards in the form of pleats, and in the centre formed an irregular thickened stellate mass. Lens: to the apex of this stellate mass was attached a small triangular piece of white thickened membrane, from which several tags passed backwards. The retina from the region of the ora serrata was prolonged forwards, and was attached to the tags above-mentioned, thus overlying the ciliary processes. The remainder of the retina was in situ. The choroid was apparently normal. Optic nerve cupped.

Microscopical Examination.—The cornea is composed of irregular bundles of fibrous tissue, between which several patches of small round cells are placed. These are more
numerous between the anterior layers. No trace of Descemet’s membrane can be distinguished. The posterior surface of the cornea is lined by the pigment epithelium of the iris. None of the other layers of the iris remain. At one part of the posterior surface of the cornea there is a break in the continuity of this pigment layer, and some fibrous tissue passes backwards from it, of which the triangular piece of membrane before mentioned is composed. Adherent to this fibrous tissue, and passing backwards from it, are the fibres of the suspensory ligament of the lens. These can be traced to their insertion into the ciliary processes and the ora serrata. The former are very much atrophied, stretched, and drawn forwards. The retina, which projects at the region of the ora serrata, and which overlies the pars ciliaris retinae, is composed of a delicate network of fibres with fine branching cells and some scattered nuclear bodies. Behind the ora serrata there are several large colloid excrescences springing from the lamina vitrea of the choroid, with some disturbance of the retinal pigment overlying them.

Case 2 (Reg. No. 2759).

Boyton, M., aet. 15, on December 19, 1888, had his right eye, which was blind and staphylomatous from ophthalmia neonatorum, excised by Mr. Tweedy.

Pathological Report. Macroscopical Examination.—T. was +2. The staphyloma involved the entire anterior third of the globe. The cornea was densely leucomatous, except at the extreme margin on each side; it was much thinned.

Iris.—Pigment layer the only part that could be distinguished, and this intimately adherent to the cornea.

Lens.—A small circular body about the size of a pin’s head, also attached to the cornea, was all that remained of it.

Retina.—The teeth of the ora serrata, much elongated, were continuous by fine processes with this remnant of the lens. The indentations between the teeth were very deep. This anterior portion of the retina was overlying the ciliary body and pars ciliaris retinae. At the posterior border of the pars ciliaris retinae a pale line could be seen, and behind it several pigmented spots. The remainder of the retina was everywhere in situ.

The choroid had several atrophic patches with pigmented margins in it. Optic nerve apparently healthy.
Microscopical Examination.—The cornea is covered by a laminated epithelium, the bases of the deepest cells of which form a very irregular line. It is composed of irregular bundles of fibrous tissue, with scattered small round cells between them. The pigment layer of the iris lines the posterior surface of the cornea, thus causing obliteration of the anterior chamber, except at one angle, where Descemet's membrane with its lining epithelium can be seen, and where the iris is of its normal thickness. In the centre of the cornea there is a break in the pigment layer of the iris which lines it, in which is situated an irregular network of fibres, and from this proceeds backwards the fibres of the suspensory ligament of the lens. The most anterior of these pass to their insertion into the pars ciliaris retinae and ciliary processes, which latter are much elongated. The posterior are attached to a process of tissue lying internal to the ciliary processes, which is composed of branching cells and fibres supporting numerous nuclear bodies. This tissue is continuous with the retina at the posterior margin of the pars ciliaris retinae. A fold also of the pigment layer of the retina projects forwards and inwards in this region for a short distance, with some colloid material around it. The ciliary muscle is very much atrophied and elongated. The choroid has numerous colloid excrescences springing from its elastic lamina, and causing considerable disturbance of the retinal pigment.

Case 3 (Reg. No. 2767).
Charles H., aet. 15, admitted under Mr. Hulke on January 9th, 1889. Twelve years ago his right eye was struck with a piece of broken glass. It has been blind since then. A month ago it became painful, and for the last fortnight he has had pain in the left eye also.
On admission: R.E. Cornea much bulged, with a scar on the outer side, extending into the ciliary region; anterior chamber shallow. Iris adherent to the scar. T. +1. No p. l.
L.E. Pupil active; no changes in fundus. T. n. V. = \frac{6}{12}.

Hypermetropic.

Pathological Examination. Right.—T. +1. Antero-posterior diameter measures 27 mm., and lateral, 25 mm. The anterior portion of the globe is staphylomatous; there is a
linear scar extending into the ciliary region, and running up and out in the cornea; there are also some small dotted opacities around this, and there is an anterior synechia, as above mentioned.

Examination of a section of the eyeball after hardening shows the iris drawn forwards by the adhesion, but the angle of the chamber apparently not narrowed. The lens is much shrunken and opaque. The retina in the outer half is detached in the form of a ruck; in the region of the ora serrata, at the upper part of the eyeball, it passes forwards, covering over the ciliary processes. The choroid has several atrophic patches in it, around which there is an increase of pigmentation. The optic nerve is deeply cupped, and the cup has a very abrupt margin.

Microscopical examination of sections of the eyeball through that portion where the retina passes forwards over the ciliary body shows that the wound in this region has perforated at the junction of the root of the iris with the ciliary body. The capsule of the lens is thrown into numerous folds, and has a small quantity of degenerated lens substance within it. Behind this is a mass of fibrous tissue continuous with the inner part of that forming the cicatrix of the wound. Adherent to this fibrous mass is a process of tissue composed of a fine network of fibres and nuclear bodies, which is prolonged from the ora serrata, and overlies the pars ciliaris retinae. At the situation of the ora serrata the pigment layer of the retina is prolonged for a short distance into the projecting process, and is considerably thickened. In the retina itself, behind the ora serrata, the fibrous elements are increased, and they form a network with small spaces left in it. In this region also there are several nodules of colloid substance sprouting from the elastic lamina of the choroid, causing considerable disturbance in the pigment layer of the retina by its upheaval.

II. Three Cases in which a Foreign Body, after entering the Eye, rebounded from the back of the Globe.

The first two cases related below were injured by pieces of steel, and there was, when the patients first pre-
sented themselves, much doubt as to whether or not the foreign body was retained within the eye. In the first case, where the lens was unwounded, two separate white patches could be seen in the fundus. It seemed likely that one, the smaller and more anterior, was the place of entrance, and the other the place of exit of a foreign body, it having passed right through the eye. It was only on examining the eye, after removal, that the nature of these patches became evident. The smaller patch corresponded with an external scar; the foreign body entering here struck the back of the globe in the position of the larger patch, without, however, sufficient force to perforate its coats. It then rebounded and came to lie on the ciliary body at the lower part of the eyeball, the rebound probably being assisted by the resistance of the unyielding walls of the orbit, felt through the intervening soft structures.

In Case 2 the foreign body, after having passed through the cornea and lens, must have struck the back portion of the outer half of the globe, where was situated a white patch in the choroid, very similar in appearance to the larger white patch in Case 1; from here it rebounded, and finally rested on the lower part of the ciliary body.

In Case 3 the injury was from a shot, and its track could be traced through the cornea, iris, and lens, into the vitreous, in which a band covered with haemorrhage passed between the posterior surface of the lens and retina, where there was a hole, and from which the shot must have rebounded into the anterior portion of the vitreous, where it was found. That the shot must have struck the back of the globe with considerable force is rendered probable from the fact that the shot was facetted. There was no reason to think it was a glance shot which had rebounded from some object previous to entering the eye.

Case 1 (Reg. No. 2692).—James W., set. 42, came to Mr
Nettleship as an out-patient on August 20th, 1887, having on May 27 of the same year had his right eye struck by a chip of iron about the size of a pea. Ever since then he had had photopsias (blue flashes).

On examination of the right eye it was found the pupil was fixed = 6 mm., T. n.; V. not = $\frac{6}{60}$ J. 18; H. 5 D. = $\frac{6}{12} \frac{7}{8}$ J. 2.

No evidence of any external wound could be discovered, while in the nasal half of the fundus two large areas of disease could be seen. Mr. Nettleship noted that the largest area which consisted of exposed sclerotic, with retinal vessels running over it, looked as if it might have been a counter wound. The other was a mottled grey patch, bordered by bright yellowish white, apparently deposit; there was faint white tracing in the retina and vitreous around.

In his left eye V. = $\frac{6}{9}$. Hm. 3 = $\frac{6}{6}$.

On October 5 it was noted that a nearly obliterated vessel, artery or vein, runs straight from o. d. to the lower patch, which is unaltered and probably retinal.

On August 25, 1888, he came with an acute attack of iritis and conjunctivitis in his right eye, which had commenced four days previously. The pupil was small, irregular, and immobile; it dilated very imperfectly after the use of a strong solution of atropine (4 grains to the ounce). Three days later the eye had not improved; the T. was slightly —, and the fundus could not be seen. He then for the first time stated that the chip that struck him made a red mark on the white of the eye.

The eye was excised on September 1.

On examination after removal it was found that the tension was normal. There was a nebula running in the form of a line vertically upwards and outwards, in the outer third of the cornea. Beneath the lower border of the internal rectus was a small horizontal scar about 2 mm. in length. There were three posterior synchiae down and in, and a patch of uveal pigment on the anterior capsule of the lens.

After being hardened in Müller’s fluid and frozen, an antero-posterior vertical section was made. In the inner half of the eyeball, at a point corresponding to the scar described externally
at the lower border of the internal rectus, was a small white spot, in the neighbourhood of which the retina was puckered, and the tunics of the globe were adherent. From this spot, running backwards and slightly upwards, was a fold in the retina, which terminated in a larger white patch, which had a pigmented margin and in the centre a slight depression. This patch was situated upwards and outwards from the optic disc. In the same half of the eyeball, lying on the ciliary body at the lower part, and just behind the lower margin of the lens, was a piece of steel covered by some white flaky substance, and measuring about 3 mm. in length by 1 mm. in breadth. The anterior chamber was shallow.

Case 2 (Reg. No. 2722).—Isaac S, æt. 17, came to Mr. Couper as an out-patient on December 6, 1887. He had been recently struck on his right eye by a piece of steel, the size of which he did not know.

There was a jagged wound in the centre of his cornea, a wound of the lens, and what appeared to be some air bubbles in the upper part of the anterior chamber; T. was — ; there was no entanglement of iris. An incision was made upwards in the cornea, and a piece of iris removed, some vitreous escaping. The eye continued to be painful and irritable at times, and on November 1, 1888, he complained of his left eye aching also. At that time the a. c. of the right was full of blood-stained fluid, so that the iris could not be seen, and he had no perception of light with it. It was excised the following day.

Pathological Examination. Right Eye.—T. n., general haze of cornea. Scar of operation at upper part of cornea. Scar of wound in upper and outer third of cornea. Coloboma upwards, with a yellow opaque membrane in the lower part of it. There is also a yellow mass in the upper part of the anterior chamber. The aqueous is discoloured. After section of the globe. The lens is absent, its capsule and an inflammatory membrane are adherent to the scar in the cornea. The vitreous is shrunken and detached from the retina below. In the outer half of the globe is a circular white patch in the choroid, where the tunics of the eye are adherent. In the lower part of the eyeball, behind the iris and lens capsule, lying on the ciliary processes, is a small piece of steel.
Case 3 (Reg. No. 2905).—Frank B., æt. 21, was shot in his left eye on July 7, 1889, two days previous to his admission into the hospital under Mr. Lawson. The person who shot him was standing at a distance of 15 yards when he fired. He believes only one pellet entered the eye.

The left eye on examination was found to have a wound in the centre of the outer half the cornea. There was a hole in the outer half of the iris corresponding to this wound, and some opacity of the lens on its outer side and at the posterior pole. There was general injection of the eye. No reflex could be obtained from the fundus. V. = \( \frac{6}{18} \) partly, T. -1. The eye was excised on July 9, 1889.

Pathological Examination.—A wound penetrating the outer half of the cornea and iris was found as above described. The lens was shrunken, especially the outer part; from its posterior surface, passing through the vitreous to the retina just below the yellow spot, was a narrow band covered with haemorrhage. In the retina where this band joined it was a small starred rent; there was no opening in the sclerotic externally corresponding to this. The vitreous contained a quantity of recent blood clot in its outer part, and in its anterior part, just posterior to the lens, a shot was found. This shot was facetted on the surface.

III. Hernia of the Lens through a Perforation in the Cornea.

In both of the cases detailed below there was ulceration of the cornea; in one the ulcer had perforated, in the other a Saemisch’s section had been made across the base of the ulcer. In both a portion of the lens protruded through the perforation in the cornea without any rupture of its capsule.

On examining the first of these eyes directly after removal, a clear projecting spot was seen in the centre of an opaque cornea. It presented just the appearance of an ulcer which had extended down to Descemet's membrane, and where that membrane had become bulged forwards into its base, and I took that to be the condition of things until after the eye was opened.
It is remarkable that in both cases it occurred in elderly patients, and it shows how elastic a structure the lens is even in advanced life. It is possible the projection of the lens was to some extent increased by the pressing forwards of the eyeball to divide the optic nerve during removal.

**Case 1** (Reg. No. 2702).—George W——, æt. 68, was admitted under Mr. Lawson on September 13, 1888. He stated the sight of his right eye had been defective all his life, that for some time past he had had a discharge from his nose, and that four months ago a piece of diseased bone was removed from it at St. Bartholomew's Hospital. He thinks the discharge from his nose affected his right eye, which had been inflamed the last six months. He had no perception of light in it. It was excised the following day.

**Macroscopic Examination.**—Cornea was much flattened, and on section appeared quite straight. It was opaque and vascular, and there was a central perforation through which a clear body projected. Iris passed into the perforation. The clear projecting body mentioned above on section was found to be a portion of the lens. Vitreous turbid. Retina and choroid in situ, and apparently healthy.

**Microscopic Examination.**—The whole of the anterior layers of the cornea are extensively infiltrated with small round cells, and numerous blood-vessels course through them. At the seat of perforation the infiltration extends throughout all its layers. Descemet's membrane on each side is much wrinkled. The free extremity of the iris on each side turns round the edge of the perforation in the cornea, and here its anterior layers are atrophied. The projecting portion of the lens is derived entirely from the cortical part, and is composed of fibres very irregularly carved and folded. The fibres forming the nucleus are not the least bent opposite the perforation. There are several groups of small circular globules in the cortical part. The capsule is quite intact. The retina has some cystic spaces in it, immediately posterior to the ora serrata.

**Case 2** (Reg. No. 2776).—John S——, æt. 79, came to Mr. Tay as an out-patient on January 14, 1889, with a central ulcer of his left cornea. There was considerable chemosis of the con-
junctiva, and some regurgitation from the lacrimal sac. There was no history of any injury to the eye, or of any definite cause for the ulceration.

On January 17, hypopyon had formed. He was admitted into the hospital on January 21, when a Saemisch’s section was made through the ulcer, the hypopyon evacuated, and the galvano-cautery applied to the margins of the ulcer. On January 24, the ulceration having extended, the eye was removed.

**Macroscopical Examination.**—Cornea opaque, with extensive central ulceration, and a perforation through which appeared a central clear nodule, which was level with its surface. Iris pushed forward into contact with the posterior surface of the cornea. Lens projected into the perforation of the cornea. The choroid in its lower part, just behind the situation of the ora serrata, contained an atrophic patch, where it was adherent to the retina. Around this was some scattered pigmentation. Retina in situ.

**Microscopical Examination.**—On each side of the perforation in the cornea the superficial epithelium is absent, and there is considerable small cell infiltration between the layers of fibrous tissue. Descemet’s membrane is wrinkled. Iris and ciliary body much thickened by infiltration of small round cells. Free margin of iris on one side turns round the edge of the perforation and projects through it, and on the other, the cornea turns round the free margin of the iris and projects inwards. At the periphery on one side the iris is adherent by inflammatory exudation to the posterior surface of the cornea for a short distance, not, however, blocking the angle of the anterior chamber. The central layers of the lens are not bent where it is bulged forwards. In the cortical part there are many different sized globules and irregularly shaped masses. The projecting portion is granular, and has no well-defined laminated arrangement; it seems to be produced entirely by the cortical parts. There is no break in the capsule covering it. The vitreous has some small cell infiltration in its anterior parts. Immediately posterior to the ora serrata, the retina has several cystic spaces in it and is slightly prolonged forwards.
IV. Rupture of the Globe with Displacement of Lens.

Several interesting points are presented in these three cases of rupture of the globe. In the first I was fortunate enough in obtaining a specimen of sub-conjunctival dislocation of the lens, in which the relation of the parts was preserved as they were during life. In this case the whole iris had become detached and expelled from the interior of the eyeball; it lay beneath the conjunctiva, and posterior to the lens. It is usual in cases of this sort to get some displacement of the part of the iris opposite the rupture. This occurred in Case 2, the condition of parts in which may be regarded as a stage through which Case 1 must have passed, for in it the lens was slightly displaced forwards and upwards, the upper part of the iris having been driven in front of it and tucked into the sclerotic. Total detachment of iris, however, appears to be very uncommon. A case has been recorded by Dixon* in which both lens and iris had escaped from the globe and the conjunctiva had been ruptured.

The position of the two layers of the capsule superficial to the lens in Case 1 is difficult to explain.

The third case, for the notes and drawing of which I am indebted to Mr. Doyne, is an example of a very unusual condition, viz., sub-conjunctival dislocation down and out. Dixon, in the paper before referred to, collected 26 cases which had been recorded, and found that not in one was the sclerotic torn below or to the outer side of the cornea. The reason the rupture is so much more frequently upwards, or upwards and inwards, is that it occurs opposite to the position of the blow. The eye being protected on the upper and inner sides by the orbit and nose, the outer and lower parts are the most commonly struck. In this case the blow was said to have struck the eyebrow. Lawson†

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* Lancet, 1852, p. 486.
relates a case of rupture down and out with the lens displaced subconjunctivally down and in.

Case 2 raises the question of the possibility of sympathetic ophthalmitis occurring without perforation of the external coverings of the globe. The patient was seen for the first time three days after the injury, and no external wound could be found. The examination of the eye after removal did not reveal either to the naked eye or microscopically any evidence of there having been a perforation. On the other hand, ruptures of the conjunctiva are possible in cases of this sort, and conjunctival wounds heal very rapidly with little scarring. It is also just possible the iritis of the other eye may not have been sympathetic, but due to some other cause. It commenced remarkably soon after the injury (18 days) for sympathetic ophthalmitis, though in its appearance and ultimate course it resembled that disease. Whether there was an external wound or not, it shows that cases may present themselves in which no sign of there having been one can be made out, and yet sympathetic ophthalmitis supervene. This case illustrates the necessity of bearing such a contingency in mind in deciding what course of treatment to adopt.

Case 3 shows the result of non-interference with a case of subconjunctivally dislocated lens. Most of the text books recommend that the conjunctiva should be incised over the tumour and the lens removed. The disadvantage of this is that by opening the conjunctiva microorganisms may gain entrance to the interior of the globe and may give rise to sympathetic ophthalmitis. In some cases it must be performed at once for the relief of pain.

I may sum up then the principles of treatment of ruptured globe which I think are indicated by the following cases as follows:—If the eye is blind it should be excised even though no perforation of the conjunctiva is discovered. If some amount of useful vision is likely to be gained an attempt to save the eye may be made, but a
very careful watch should then be kept on the patient for some considerable time. If the lens is dislocated subconjunctivally, and there is much pain, the lens must be removed; if there is no pain and no wound of the conjunctiva it is best left alone, at any rate until the sclerotic wound has healed.

Case 1 (Register No. 2772). Elizabeth M., æt. 70, was admitted to the hospital under Mr. Silcock, on January 17, 1889. She stated that on December 22nd of the previous year, she struck her left eye against the foot of a chair, since when the sight had been bad and the eye inflamed.

There was general injection and tenderness of the left eye, a rupture of the sclerotic at the upper part, and a steaminess of the cornea. The anterior chamber was full of blood, and beneath the conjunctiva at the upper and outer part, near the margin of the cornea, was a rounded prominence which appeared to be the lens displaced. She only had perception of light with that eye and the T. was full. Her right eye was myopic but otherwise healthy.

On January 18 her left eye was excised, the conjunctiva being cut round behind the dislocated lens.

Pathological Report. Macroscopical Examination.—Antero-posterior diameter measures 30 mm., the vertical and lateral diameter 25 mm. Anterior chamber filled with blood. The sclerotic has a large rupture in it about 18 mm. in length, and running concentric with the corneal margin and about 5 mm. posterior to it. The conjunctiva is continuous over the rupture without any break in its continuity. Lens lies between the conjunctiva and the sclerotic at the upper and outer part of the globe. On section it is seen to be surrounded by a yellowish-white ring. The iris has entirely separated from its attachment, the uveal tracts ending anteriorly at the ciliary processes. Behind the lens, between the conjunctiva and sclerotic, is a small pigmented mass which is probably the displaced iris. The vitreous has the remains of several old hæmorrhages in its anterior part. The retina and choroid in situ; the latter has some patches of atrophy in it from stretching. Optic nerve apparently healthy.

Microscopical Examination.—Immediately beneath the con-
junctiva over the seat of the rupture is seen the capsule of the lens thrown into numerous folds, its two layers being separated from one another only by some inflammatory leucocytes. They are quite separate from the lens substance, which is situated deeper and surrounded by a mass of round cells. The pigmented mass posterior to the lens is composed of branched pigmented cells and blood-vessels, and also pigmented cells like those on the uveal surface of the iris.

Case 2 (Register No. 2456).—Rose S—, aet. 56, was struck on her right eye by a fist on October 1, 1887; three days later she attended as an out-patient under Mr. Lawson, and it was noted that she had a ruptured globe, without any apparent external wound of the conjunctiva, no perception of light and T. —1. She was admitted to the hospital on October 25, 1887. She then stated that a week previously, i.e., 18 days after the injury, she noticed for the first time a dimness of sight in her left eye.

Condition on Admission.—Right eye: general injection; rupture of sclerotic extending round the upper half of the globe in the posterior part of the ciliary region; no visible perforation in the conjunctiva; haze of the upper part of the cornea; iris drawn up into the rupture so as to simulate a coloboma upwards; opacity at posterior part of lens. A grey reflex only was obtained from the fundus; no p l.; T. —1. Left eye: circumcorneal injection; no keratitis punctata; numerous posterior synechiae: deposit of lymph on the anterior capsule; V = fingers at 2 feet. T. n.

October 27. Right eye excised.

November 24. Left eye has still considerable injection. No pain. She never had any inflammation or trouble of any sort in this eye previous to the accident. It subsequently became quite blind.

Pathological Examination of the excised Eye (made by Mr. Lawford).—The conjunctiva has been cut far back at the upper part behind the rupture. The rupture of sclera at the upper part is almost concentric with the corneal margin and extends nearly half way round. The conjunctiva is thickened and very vascular, and it extends smoothly over the rupture: there is now no scar in it, and as far as can be made out it has not been
ruptured. The iris at the upper part has disappeared. The cornea is nearly clear; anterior chamber shallow. Optic nervesheath is not dilated. Eye opened by an equatorial section; subsequently an antero-posterior section made. Some thin blood-stained fluid escaped. The retina is detached except at the optic disc; it contains some blood clot and remnants of vitreous. Choroid partially detached from the sclerotic by haemorrhage beneath it. The iris is prolapsed into the rupture, which is just beyond the posterior limit of the cornea. The lens has some patchy opacity on its posterior capsule, and is displaced forwards and upwards. It is of nearly normal shape but a little rounded. It is in contact with the cornea in the upper half, and the iris is jambed between it and the cornea except where it has escaped into the rupture. The ciliary processes are swollen, and close to their lower part there are numerous posterior synechæ.

Microscopical examination of sections at the seat of the rupture shows the epithelium of the conjunctiva forming an unbroken layer; there is not any scar tissue in the structures immediately beneath it. At the line of rupture there are bundles of fibrous tissue running in various directions with a quantity of small round cell infiltration between and around them. The iris is folded in two in the middle, and drawn into the fibrous tissue at the rupture; it is thickened by infiltration with small round cells in this part, and also at its root opposite the seat of rupture, as also is the ciliary body.

Case 3.—Catherine W——, aged 63, was in November, 1871, struck on her right eyebrow by a piece of wood, which flew off while she was chopping. She attended at the Moorfields Hospital as an out-patient, under Mr. Critchett and Mr. Couper, on July 23rd, 1872. The note on her out-patient letter of that date states that in her right eye there was, at the lower and outer part, a cicatrix in the sclerotic, half a line from the corneal margin, and a large coloboma of the iris. The lens was displaced, lying beneath the conjunctiva, down and out. The fundus of the eye was quite healthy, and her V. = $\frac{\Delta}{100}$ +11D. $\frac{20}{100}$, and $\bar{c}$ +18 D. J. 19. There was considerable astigmatism, the weakest meridian being in the long axis of the coloboma. No operation was performed.
She was seen by Mr. Doyne (who had the accompanying drawing made of her eye), at the Oxford Eye Hospital, in the early part of this year, that is, nearly 18 years after the receipt of the injury. The eye had not given her any trouble during that time. All that now remains of the sub-conjunctivally dislocated lens is a small, slightly raised, yellow patch at the lower and outer part of the globe.
A CASE OF DISTENSION OF THE FRONTAL SINUS WITH MUCOUS POLYPI.

By Cyril H. Walker,
Senior House Surgeon.

T. L., a shoeblack, aged 18, first came to the Hospital on March 7, 1888, complaining of a painful swelling over the left eye, and was placed under the care of Mr. Hulke. On examination proptosis of the left eye was found, the globe being also pushed a little downwards and outwards. There was a firm swelling to be felt along the upper margin of the orbit, which was tender and the skin over it oedematous. Periostitis of the roof of the orbit was suspected. The swelling had only been noticed a few days, and no history of recent injury was elicited. The patient was a fairly healthy lad; there was no evidence of tubercle, syphilis, or strumous disease. It should be stated that though the patient could give no history of injury at the time, the following facts were afterwards ascertained. There was a small scar over the internal angular process of the frontal bone on the left side. It was not deep, and was stated to have been caused by the patient having fallen against the bars of a grate when he was about three years old. He also said that one or two years previously he had been struck on the left side of the forehead by a board, but there was no evidence of the injury having been severe.

The patient attended once a week until April 18, when it was evident that an abscess had formed in the roof of the orbit and was beginning to point just below the outer edge of the left eyebrow. The patient was taken into the hospital; the abscess was opened and a little healthy pus evacuated. The cavity was explored with a probe, but no bare bone could be felt. No inflammation followed, and the wound rapidly healed up though the proptosis continued. A month later the patient attended again, the abscess having in the meantime reformed. It was opened and syringed and again healed up in a few weeks. The vision remained quite good, and no changes could be detected with the ophthalmoscope.
No further trouble was experienced until the beginning of the following October, when again an abscess formed in the same place. An incision was made and much pus evacuated; the sinus continued to discharge freely for some days. For a time the inflammation subsided, but on November 17 there was a fresh accession of inflammation, and for the first time the patient’s temperature was found to be raised to 100° F. The incision was freely enlarged and, free exit being given to the discharge, the inflammation and pyrexia rapidly subsided. Examined with a probe the sinus was found to curve round towards the inner side, and a small area of bare bone could be felt in the roof of the orbit near the plate of the ethmoid. On November 28 (more than eight months after the commencement of symptoms) the wound was further explored. An incision was made along the inner end of the palpebral fold to meet the end of a probe passed along the curve of the sinus. A hole was found in the roof of the orbit large enough to admit the tip of the finger. Through this hole a mucous polypus the size of a Barcelona nut protruded. This was removed, as were also some small portions of other similar polypi. Drainage-tubes were inserted and the wound was syringed twice a day with perchloride of mercury lotion.

In the Curator’s Report Mr. Treacher Collins gives the following particulars of the mucous polypus:—“A smooth, soft, gelatinous-looking mass 20 mm. long, 13 mm. wide; composed of a quantity of loose mucoid tissue with patches of small round-celled infiltration; the tissue is denser at the periphery than in the central part; the surface is covered with laminated epithelium, the cells being mostly circular or irregularly polygonal.”

The patient went on well till January 6, 1889 (though the drainage of the cavity was not free owing to the viscid nature of the discharge), when he had a succession of rigors followed by pyæmic symptoms. Dusky phlegmonous inflammation spread over the whole of the face and scalp; the discharge from the wound ceased; the temperature repeatedly rose to 104°, and for three weeks he was very ill indeed. About 10 days after the commencement of the attack of pyæmia a double murmur was detected near the heart’s apex beat. This was pronounced to be due to aortic and mitral regurgitation, and the patient’s
pulse and general symptoms favoured this view, although the diastolic murmur was rough in character and not quite like aortic regurgitation. The urine was tested several times, but no albumen was found nor any signs of nephritis. Ophthalmoscopically no changes could be found. The grave symptoms gradually disappeared, the inflammation subsided, and the sinus began again to discharge healthy pus. The patient was kept in bed until all symptoms of aortic regurgitation had subsided. Various lotions were used to syringe the wound—perchloride of mercury, carbolic acid, boric acid, "salufer" (sodium fluo-silicate), quinine, and iodine. This last was found by far the most effectual, rendering the discharge less abundant and less viscid; but it stained the instruments and linen, and if a drop chanced to run into the eye caused so much irritation that it was abandoned in favour of perchloride of mercury.

April 23. The sinus still discharges viscid purulent matter. To-day, after syringing, another small portion of a polypus came into the orifice of the wound and was removed with forceps. A drainage-tube has been kept in hitherto, but the opening is closing and renders its introduction difficult. The patient is much better in general health, although a little weak.

V. Right \( = \frac{6}{24} \, \text{c} \quad -3 \, \text{D, sph.} \quad = \frac{6}{18} \, \text{V. Left} = \frac{6}{9}; \, \text{c} + 1 \quad = \frac{6}{6} \)

July 20. The sinus still discharges a little, but the fluid has becomes clear, yellowish, and only slightly viscid. There is no pain or tenderness. There is about the same amount of proptosis as when the patient was first seen. The vision still remains good. The pulse is still very irregular, but there is no cardiac bruit, and the patient does not exhibit any symptoms of heart disease. A soft mass can be sometimes felt with a probe, apparently on the roof of the sinus; with this exception there has been no evidence of any more polypi in the sinus. No polypi can either be seen or felt in anterior or posterior nares, nor has the patient ever had any symptoms leading to the supposition that he has polypi anywhere except in the left frontal sinus.

Cases of polypi in the frontal sinuses are certainly not common; and it is apparently very rare indeed to find
polypi affecting the frontal sinus unassociated with polypi in the nose. For this reason the present case seemed worth recording.

As regards the sequence of events in this case, it does not seem very clear whether either of the injuries referred to above caused (indirectly) blocking of the infundibulum with subsequent distension of the sinus (the growth of polypi being favoured by retained secretions); or whether the polypi blocked the infundibulum, and then distension and abscess followed. In support of the former view, the growth of polypi is said to be determined, or at any rate favoured by chronic nasal catarrh, and it would seem natural to suppose that retained secretion would also favour their development. And in connection with this point it may be mentioned that polypi have been found in some cases of "persistent dropping of clear fluid from the nose, accompanied by optic atrophy," a fact which tends to show that they are to some extent dependent on irritative secretions. The length of time that elapsed between the injury and the commencement of the distension cannot be stated even approximately, as the patient had not noticed the prominence of the eye at all, and it may have existed for some years.

Another feature of the case is the site at which the distended sinus pointed; it being far more common for the abscess to point immediately above the inner canthus. The pointing of an orbital abscess at the outer side did not suggest the possibility of any connection with the frontal sinus. If it had been thought advisable to reopen the infundibulum (so as to drain the cavity through the nose), it could not have been as easily accomplished as in most cases, on account of the opening being so far from the middle line.

With regard to the septicaemia which occurred at one stage of the case, it was apparently due to the trivial damage done by probing the cavity which contained at the time a large quantity of pus so viscid and tenacious
that it could not be removed by syringing, and which was not aseptic. A writer in one of the medical journals has recently had similar experience, and advises the precaution of syringing a sinus both before and after exploring it with a probe.

[The subsequent progress of the case would seem to indicate that the double murmur heard over the apex of the heart was pericardial.]
THE DIVISION OF ANTERIOR SYNECHLÆ.

By William Lang.

That an anterior synechia should, if possible, be divided, is a proposition which will be readily conceded by every ophthalmic surgeon. It is simply the risk of wounding a clear lens, and the difficulty of completing the division of the adhesion in a partially or completely empty chamber, which drives the operator to perform an iridectomy, or even two small iridectomies, one on either side of the adhesion, instead of separating the iris from the cornea.

Many methods have been tried, and many instruments devised for accomplishing this latter object, but the premature escape of the aqueous or the difficulty of manipulating a sharp-pointed instrument in the anterior chamber has hitherto prevented any method from being generally adopted.

For operative purposes it is well to divide anterior synechiae into three groups:—1. Where the adhesion has been small and has stretched, allowing the iris to return to its normal plane. 2. Where a large piece of iris is adherent to or entangled in the cornea, but does not involve the whole width of the iris, so that an instrument can be passed between iris and cornea at the periphery of the anterior chamber. 3. Where the adhesion is very extensive (adherent leucoma) or where it extends to the periphery of the anterior chamber. The method of treatment varies for each group. In the first group a Knapp's dissection-knife answers perfectly well for the division of the small thread, the lens being in no danger, as the aqueous can only escape on withdrawing the knife.

In the second group an iridectomy is usually performed, or the case is left without treatment, in the hope that secondary glaucoma will not supervene.
In the third group iridectomy is called for, and should be performed as soon as possible after the inflammatory symptoms, set up by the disease or injury, have subsided.

It is in the second group of cases that the following operation has given me a perfect result on every occasion that I have performed it.

The two knives here depicted are essential for performing the operation:

They are an ordinary Knapp's discision-knife, and a similar knife with a blunt point.

The eye being cocainised, and the lids separated by a speculum, the globe is fixed close to the adhesion, and the sharp-pointed knife passed into the anterior chamber through the cornea, at a point as far removed as possible from the synechia, but so chosen that the blunt-pointed
knife, which is inserted through the opening in the cornea made by the sharp-pointed knife, can be easily made to pass between the cornea and iris beyond the synechia.

No difficulty is experienced in dividing the anterior synechia, if a sawing motion be given to the knife at the same time that it is pressed against the adhesion.

The opening in the cornea is of necessity very small, and it is therefore advisable to select some point in the iris as a landmark, so as to find it readily when the blunt knife has to be inserted. I have never found any difficulty in discovering the opening; but to ensure success I never take my eye off the wound, my assistant exchanging the knives for me.

If the sharp-pointed knife is entered in a manner similar to that usually done for cataract extraction (a little obliquely through the layers of the cornea, and not at right angles, as in needling), no aqueous escapes on its withdrawal, and the blunt knife enters into a full chamber.

Care must be exercised not to do anything more than puncture the cornea, or the wound will be too large to be plugged by the shaft of the blunt-pointed knife.

On withdrawing the blunt-pointed knife after the completion of the division, the aqueous sometimes escapes, but as the opening in the cornea is so small the chamber is soon reformed, and without further treatment the iris regains and retains its normal plane.

The six cases in which I have performed this operation have all been successful, and in four, at least, iridectomies were thus avoided, and in each only a small fragment of iris remained adherent to the cornea after the division.

Messrs. Weiss have made the knives in the most perfect manner, the blunt-pointed knife accurately plugging the hole made by the sharp-pointed one, so that no aqueous escapes, the essential point in the operation.
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GENERAL INDEX

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