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THE

PRINCIPLES AND PRACTICE

OF

OPHTHALMIC MEDICINE AND SURGERY.

BY

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WITH

ONE HUNDRED AND TWO ILLUSTRATIONS.

EDITED

BY ISAAC HAYS, M.D.,

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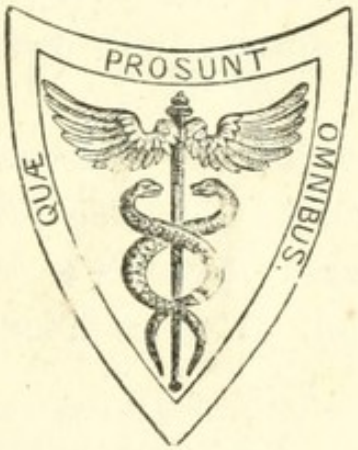

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ADVERTISEMENT TO THE AMERICAN EDITION.

THIS is one of a series of Manuals* the design of which is to furnish to the student, within a small compass, a complete and comprehensive digest of the several subjects of which they treat. The authors, whose co-operation was secured to carry out this conception, have proved themselves to be eminently qualified for the task entrusted to them, as is shown by the extraordinary favour with which their several works have been received.

The present volume, both in its plan and execution, is fully equal to the best of its compeers, and will doubtless meet with the same success. By great attention to conciseness of expression, a strict adherence to arrangement, and the aid of numerous pictorial illustrations, the author has been enabled to embody in it the principles of ophthalmic medicine, and to point out their practical application more fully than has been done in any other publication of the same size.

It not being in accordance with the character of the work to discuss controversial points, or to enter into an investigation of the views of different practitioners, and the author having fully posted it up to the knowledge of the

* Surgery. By Mr. Ferguson, F.R.S.E.
Physiology. By Dr. Carpenter, F.R.S.
Anatomy. By Erasmus Wilson, F.R.S.
Medical Jurisprudence. By Mr. Taylor, F.R.S.
Chemistry. By Dr. Fownes, F.R.S.
Materia Medica and Therapeutics. By Dr. Royle, F.R.S.
Natural Philosophy. By Dr. Golding Bird, F.R.S.

day, the Editor's task has been a very light one. He has restricted himself merely to the narration of the results of his own experience in a few instances in which they differed from those of the author.

There are a few points not noticed, in regard to which the Editor entertains somewhat different views from the Author, but he did not conceive it consistent with the scope of a Manual to discuss them in it; and this seemed the less necessary as his opinions will be found fully expressed elsewhere.*

The Illustrations have been carefully engraved after the originals by Gilbert.

The editor's additions are enclosed in [ ].

* See Lawrence's Treatise on the Diseases of the Eye. Second American Edition.

PHILADA., January, 1847.

ADVERTISEMENT.

To produce a work on the Diseases of the Eye, which should serve at once as a text-book for students and as a book of reference for practitioners, has been the great aim of the author in composing this manual. Accordingly, besides carefully discussing the principles, he has laboured to give such a practical exposition of the subject as will be found available at the bedside of the patient, and in the operating room. At the same time, he has not neglected the opportunity which the subject offers, of illustrating the general doctrines of pathology, especially those of inflammation.

In his descriptions, the author has studied to express himself with clearness and precision; but however clear and precise a verbal description may be, it, in many cases, fails to impart a sufficiently accurate conception to the reader. For this necessary imperfection of mere verbal description, it is hoped that the pictorial illustrations will, in some measure, make up.

To secure the accuracy of the figures, considerable pains have been taken. The steel engravings, which are from the *burin* of that excellent artist, Mr. Henry Adlard, are after drawings by the author himself, partly from nature, partly copied with such alterations as he considered necessary to render them more correct and illustrative. For the wood engravings, which are executed with Mr. Vasey's

accustomed accuracy and care, the drawings on the wood, most of them from original designs, were also made by the author, except a few, which, however, he revised and corrected.

In conclusion, the author thinks it proper to mention, that he has incorporated in the present volume the various contributions to ophthalmic medicine and surgery which he has made, some anonymously, in the course of the last fifteen years, and also that he has freely availed himself of the information contained in the principal works, British and foreign, on the subject.

George Street, Hanover Square,
London, Sept. 26, 1846.

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EXPLANATION OF THE PLATES.

PLATE I.

Figure 1.—This represents catarrhal inflammation of the conjunctiva, as described in ss. 301–309 and 454–459; and also the mode of examining the conjunctival surface of the lower eyelid, as described in s. 34.

Figure 2.—A well-developed granular state of the conjunctiva of the upper eyelid in Egyptian ophthalmia, as described in ss. 495 and 983. The enlarged papillæ are separated into groups by furrows or fissures. The figure also illustrates the mode of examining the conjunctival surface of the upper eyelid, as described in s. 36.

Figure 3.—A case of phlyctenular, or scrofulous ophthalmia, in which there is a burst phlyctenula on the cornea, with a fasciculus of vessels running from the conjunctiva into it, as described at s. 625. This figure also illustrates the mode of examining the eye in such cases, which occur in children, and in which there is great intolerance of light, as described in ss. 54, 56.

FIG. 1. PLATE I.

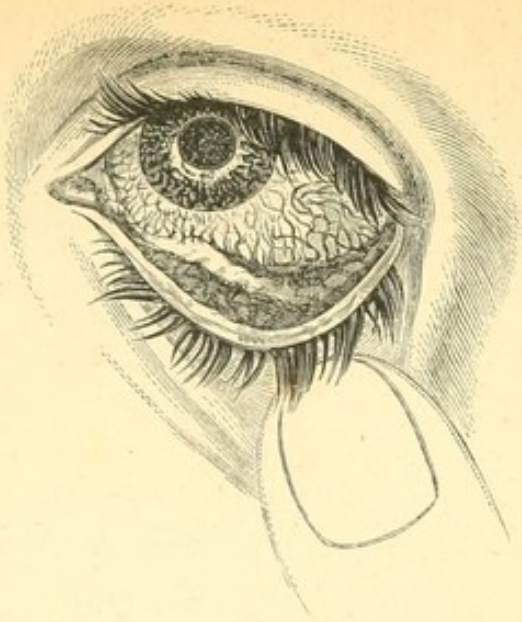


FIG. 2.

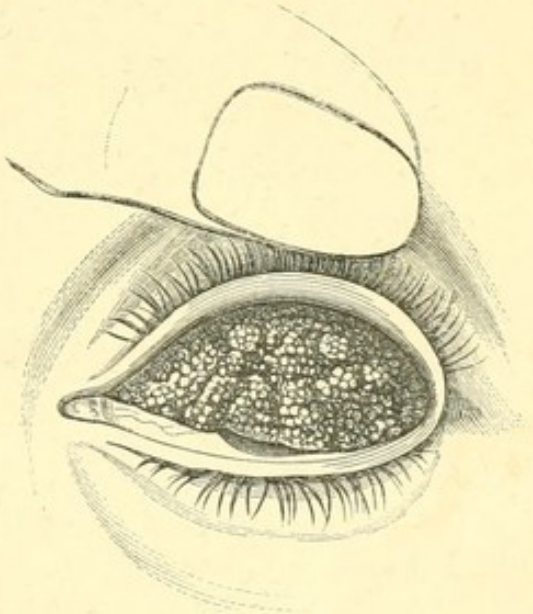


FIG. 3.

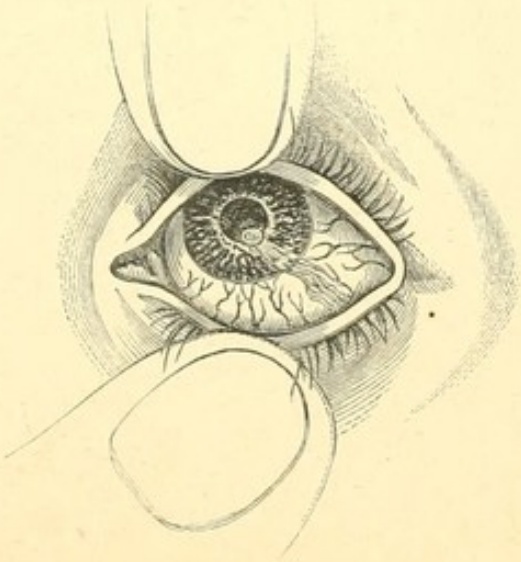


PLATE II.

Figure 1.—This figure represents a case of iritis, as above described in s. 364 et seq.; and also illustrates the mode of depressing the lower eyelid for examination of the front of the eyeball. See ss. 50–56.

Figure 2.—Arthritic iritis, as described in ss. 830–835.

Figure 3.—Arthritic posterior internal ophthalmia, as described in ss. 894–904. The figure also illustrates the mode of raising the upper eyelid for examination of the front of the eyeball. See ss. 50–56.

FIG. 1.

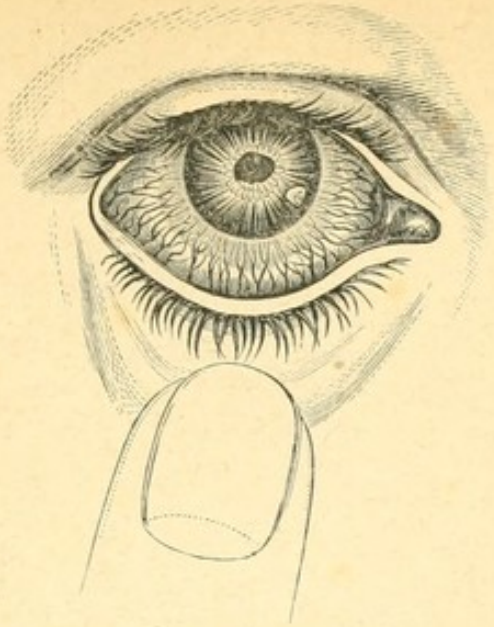


FIG. 2.

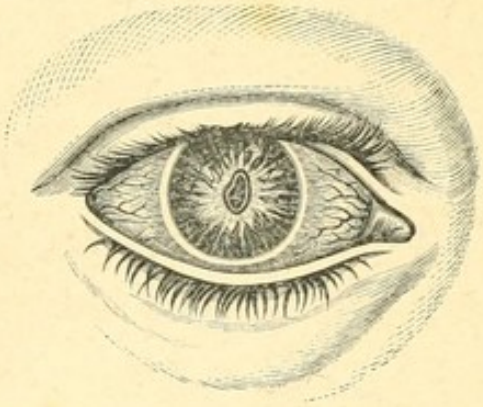


FIG. 3.

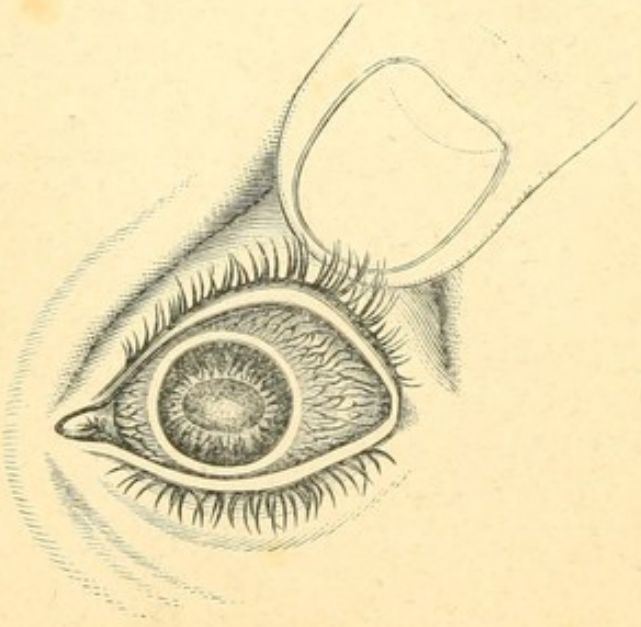


PLATE III.

Figure 1.—This represents a case of medullary fungus of the eyeball in its second stage, as described in s. 1167 et seq.

Figure 2.—A case of sclerotic staphyloma from traumatic inflammation of the eye. In this figure there is a good representation of varicose vessels. See ss. 875, 1075, &c.

Figure 3.—A case of melanosis of the eyeball, in which the iris has been detached at one part of its circumference, and the black mass is making its appearance from behind, as also through the sclerotica near the cornea. See s. 1193 et seq.

FIG. 1.

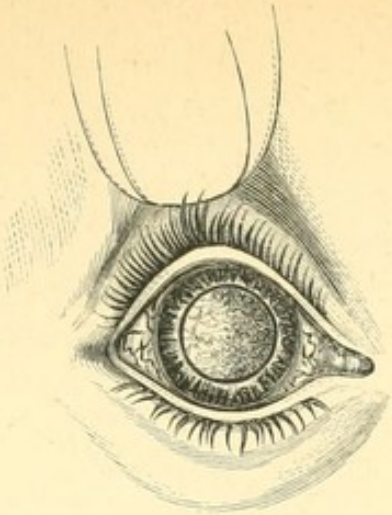


FIG. 2.

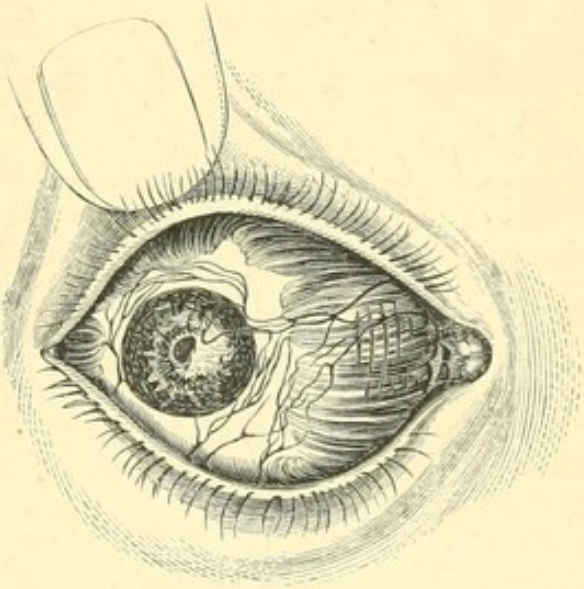


FIG. 3.

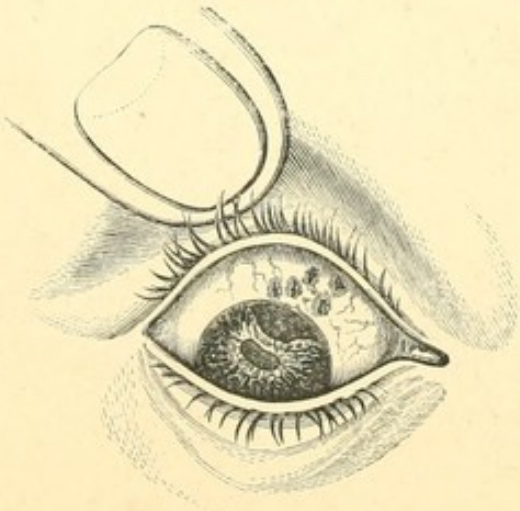


PLATE IV.

Figure 1.—The third case of hydatid in the anterior chamber, referred to in ss. 1150, 1151. The body and head of the animal are protruded from the tail vesicle.

Figure 2—Represents a case of dislocation of the lens into the anterior chamber; the lens being still clear, see s. 2641 et seq. This figure also illustrates the mode of fully exposing the front of the eyeball for examination, as above described in s. 50.

Figure 3—Represents the third case of cyst, in connection with the iris, above described in s. 1164.

Fig. 1. PLATE IV.

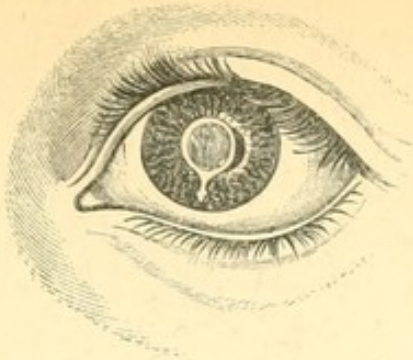


Fig. 2.

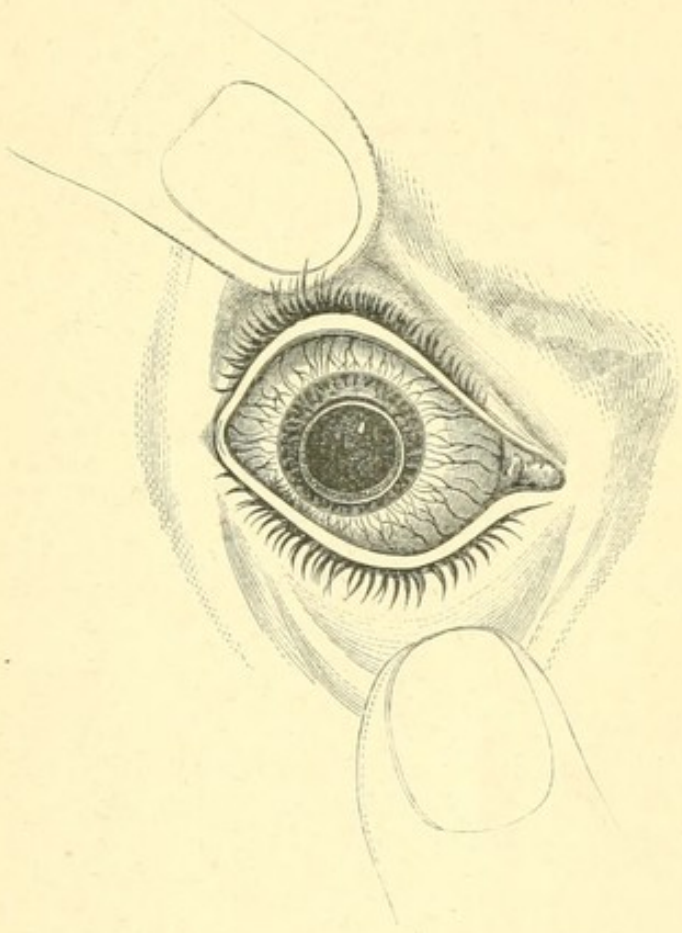
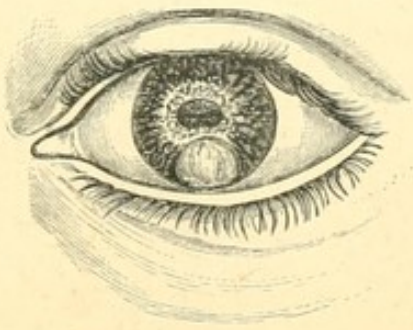


Fig. 3.



INTRODUCTION.

PECULIARITIES OF OPHTHALMIC MEDICINE AND SURGERY.

As there enter into the composition of the eye all the various tissues of the body, to say nothing of tissues peculiar to itself, so the same elementary forms of disease present themselves in it as in other parts; and so far the pathology and therapeutics of the organ of vision admit of being illustrated by, and are capable of illustrating, general pathology and therapeutics; the latter the more especially, as from the external situation of the eye, and the transparency of its front, the progress of disease and the effects of remedies may be observed, which in other parts of the body can only be guessed at.

But as all organs differ from each other in respect to structure as organs, and in respect to function, so also do they differ in respect to special pathology and therapeutics. In the case of the eye, these points of difference are perhaps more numerous and decided than in any other organ.

From this it is evident, that, although diseases of the eye must be treated on the same general principles as the diseases of any other part of the body, yet in consequence of the great peculiarity of its structure and functions, it is unsafe in practice to trust to these general principles only; for much depends on the observance of numerous minute details.

Such being the case, and considering the importance of the organ of vision, a course of medical education cannot be considered complete unless ophthalmic medicine and surgery have for some time specially engaged the student's attention.

HISTORY OF OPHTHALMIC MEDICINE AND SURGERY.

The oculists of Egypt,—a country where diseases of the eye are endemic,—were in early times in request among the other nations of the East, as appears from the story in Herodotus, of Cyrus, King of Persia, sending to Amasis, King of Egypt, for the most expert oculist of his dominions.

From Egypt the art of treating diseases of the eye was introduced into Greece. The Greeks being good observers, we find that, notwithstanding the want of accurate anatomical knowledge, which materially obstructed their study of the diseases of other organs, they were enabled, on account of the exposed situation of the eye and its transparency, to become great proficients in ophthalmic medicine and surgery. Some idea of the extent of the knowledge of the diseases of the eye possessed by the Greeks may be had, by considering that many of the names now in use have actually descended from them, and by casting a glance at the summary given by Celsus; for though Celsus wrote at Rome, it is to be remembered that his surgery was entirely that of the Greeks.

As the Greeks received from the Egyptians their first instructions in the art of healing, so the Romans were debtors to the Greeks. In fact, the medical practitioners of ancient Rome were either Greeks or persons who had been educated in the schools of Greece. That *medici ocularii* were not wanting among the Romans, we have sufficient evidence in the inscriptions on seals, &c., which are to be met with in collections of antiques.

Ophthalmic medicine and surgery continued to be successfully cultivated and practised by the later Greeks, and much on the diseases of the eye is contained in the works of the Arabian writers, derived, no doubt, from the Greek manuscripts which fell into their hands.

Until the commencement of the last century, little more was known of the diseases of the eye than what is found in the Greek and Arabian writers. But as the anatomy and physiology of the eye began to be more carefully studied, so its diseases became better understood. The

true seat of cataract which had been demonstrated by Rolfink, Borel and others, was now confirmed by Brisseau; and Kepler had, by his discovery of the real use of the crystalline lens, proved the retina to be the true seat of vision, and had explained the mode in which glasses (invented three or four hundred years before) help the sight.

It was in 1728 that Cheselden first succeeded in making an artificial pupil—an operation, the idea of which appears to have been previously suggested by Woolhouse, surgeon to James II. About the middle of the same century, Daviel, a French surgeon, practised extraction through an incision of the cornea, as a regular method of removing cataract; while, a few years later, Pott adopted laceration of the capsule, and the breaking up of the lens as a distinct mode of operating for cataract, independent of couching.

It thus appears, that the first grand improvements in ophthalmic medicine and surgery were all made by English and French surgeons. Before the establishment of the ophthalmic school of Vienna, ophthalmic medicine and surgery were in so low a state in Germany, that those who could afford it went to France to be operated on for cataract. A complete revolution in this matter, however, has taken place since, and the Germans have far outstripped the French, and were fast outstripping the English surgeons, until the breaking out of the Egyptian ophthalmia in the army forcibly recalled the attention of the latter to the subject of eye-diseases. More recently, the French have begun to bestir themselves also.

The ophthalmic school of Vienna, the establishment of which, in 1773, forms an important era in the history of ophthalmic medicine and surgery, owes its celebrity in a great measure to the labors of Professors Beer and John Adam Schmidt during the end of the last, and commencement of the present, century, the former at the General Infirmary, the latter at the Josephine Academy.

Beer is distinguished for the accurate descriptions and histories of the diseases of the eye which he has given in his works, and by the great reputation which he acquired by his clinical lectures, which attracted students from all

quarters. His cotemporary, Schmidt, though less generally known than Beer, was superior to him, perhaps, in originality and genius. To John Adam Schmidt, ophthalmic medicine and surgery are indebted for some most valuable contributions. He it was who gave the first correct account of *iritis;* for, strange as it may appear, surgeons were unacquainted with the real nature of that disease until the publication, in 1801, of his work on "Iritis and Secondary Cataract, occurring after Operations for Cataract."* Indeed, it may be said that we owe most of our knowledge of the internal inflammations of the eye to the Germans, though it must be confessed that they have occasionally refined too much in their distinctions.

Since the establishment of the Ophthalmic School of Vienna, the ophthalmic clinic has become an essential part of the medical curriculum of every German university; and, indeed, the language of Germany is so interwoven with the literature of ophthalmic medicine and surgery, that he who would claim to be an authority in the latter must be well acquainted with the former.

In Britain, ophthalmic medicine and surgery have always attracted a considerable share of attention. Indeed, English surgeons have contributed as much to the real advancement of ophthalmic medicine and surgery as those of any other nation.

The establishment of Ophthalmic Institutions in London has been an example well followed up in other parts of the kingdom. I cannot forbear instancing, in particular, the Eye Infirmary of Glasgow, as being the source whence has emanated the standard work of Mackenzie.

Until very recently, the school of Medicine of Paris, so famous for medical science in general, offered no adequate opportunity for the study of ophthalmic medicine and surgery, and French medical literature, so rich in other respects, boasted of no work of any merit on the subject. All this, however, is changed now, from the labours of French surgeons themselves, from those of Germans and Italians settled among them, and from the greater spread of information on the subject in the French language, through the medium of

* Ueber Iritis und Nachstaar nach Staaroperationen.

the *Annales d' Oculistique* of M. Cunier, established in Belgium, when the ravages of the Egyptian ophthalmia in the army of that country, some years ago, forced the importance of ophthalmic medicine and surgery strongly on public attention.

LITERATURE OF OPHTHALMIC MEDICINE AND SURGERY.

The subjoined is a list of the principal works on Ophthalmic Medicine and Surgery in the English, German, and French languages.

ENGLISH WORKS.

W. Adams, Practical Observations on Diseases of the Eye, &c. London, 1814.

G. J. Guthrie, Lectures on the Operative Surgery of the Eye. London, 1823.

R. Hull, Cursory Notes on the Morbid Eye. London, 1840.

W. Lawrence, A Treatise on the Diseases of the Eye. 2d Ed. London, 1841.

S. Littell, A Manual of the Diseases of the Eye, &c. A reprint of an American work, Edited by H. Houston. London, 1840.

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R. Middlemore, A Treatise on the Diseases of the Eye. 2 vols. London, 1835.

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F. Tyrell, A Practical Work on the Diseases of the Eye, and their Treatment, Medically, Topically, and by Operation. 2 vols. London, 1840.

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A. Watson, A Compendium of the Diseases of the Human Eye. 2d Ed. Edinburgh, 1828.

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C. G. F. Ruete, Lehrbuch der Ophthalmologie. Braunschweig, 1845 and 1846.

C. H. Weller, Die Krankheiten des menschlichen Auges, ein Handbuch für angehende Aerzte, &c. 4th Ed. Berlin, 1830.

FRENCH WORKS.

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F. Cunier, Annales d'Oculistique. From 1838 to the present time. Brussels and Paris.

A. P. Demours, Précis Théorique et Pratique sur les Maladies des Yeux. Paris, 1821.

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THE

PRINCIPLES AND PRACTICE

OF

OPHTHALMIC MEDICINE AND SURGERY.

CHAPTER I.

Section I.—OPHTHALMOSCOPY, OR EXPLORATION OF THE EYES IN ORDER TO A DIAGNOSIS.

§ 1. This exploration is of two kinds, viz., *subjective* and *objective*. The subjective exploration of the eye comprehends an inquiry into the patient's sensations in the affected organ, such as pain, tolerance of light, and state of vision. The objective exploration is directed towards the morbid conditions which admit of being perceived by the surgeon himself.

A. SUBJECTIVE EXAMINATION OF THE EYES.

a. Pain; its seat and character.

2. Pain, as if a foreign body were in the eye, with itchiness and smarting of the edges of the eyelids, and sometimes pain across the forehead, indicates conjunctival inflammation. Rheumatic pain, around the orbit, or in the temples, occurring in nocturnal paroxysms, points to inflammatory congestion of the sclerotica, as in iritis, &c. Deep-distending pain in the eyeball, with or without circumorbital or temporal pain, marks deep internal inflammation of the eye.

b. Intolerance of light, or photophobia.

3. Intolerance of light, in a greater or less degree, is a very frequent symptom in the ophthalmiæ; but that in which it occurs in the highest degree is the scrofulous ophthalmia of children. Intolerance of light may also occur in other affections not coming under the head of the ophthalmiæ.

c. State of vision.

4. Is the sight short (*myopia*), or long (*presbyopia*)? The pupil being greatly dilated, (*mydriasis.*) § 94, with indistinctness of vision, are objects seen more distinctly by looking through a small aperture in a card, blackened on the surface, held next the eye? Are objects seen distorted? Are they seen of another than their true colour, surrounded by a colored halo (*chroopsia*)? Is vision dim? if so, is it defective by day (*day-blindness*)? or it is defective by night (*night-blindness*)? or it is defective both by day and night? Do the eyes soon become fatigued, and the vision confused, when near objects are examined (*asthenopia*)? Are objects seen double (*diplopia*)? And if so, is the vision double when one eye only is used? or is it double only when both eyes are used? Is the half or a part of objects only seen (*hemiopia*, &c.)? Is there an appearance of motes or flies floating in the field of vision (*muscæ volitantes*)? Do objects continue to appear before the eyes, but of an opposite tint or colour, for a few seconds after they are no longer looked at (*ocular spectra*)? Are flashes and scintillations of light ever seen (*photopsia*)?—Such are the principal questions which may suggest themselves in the course of an inquiry into the state of vision.

B. OBJECTIVE EXPLORATION OF THE EYES.

5. In this exploration, the eyes should be first examined without touching them. This it is of importance to do, especially in inflammations, in order to avoid causing an increased determination of blood, lachrymation, &c., which in such cases are apt to be occasioned by the slightest touch, and which might complicate the appearance natural to the inflammation, and give an erroneous view of the nature of the case. In an hospital, the pupils should not, on any account, be permitted to touch the eyes of a patient, before the surgeon has made his examination.

6. The surgeon should, in succession, glance at the eyebrows and orbital margins, the eyelids and their movements, the borders of the eyelids and state of the eyelashes, and the corners of the eyes, and note the presence or absence of lachrymation, the form and appearance of the eyeballs generally—their size and degree of prominence—movements and direction—the correspondence of their axes; the appearance and colour of the white of the eye, the appearance of the cornea, the colour of the iris, and the state of the pupil.

7. Besides this direct examination of the eyes themselves, the general bearing of the patient, and the expression of his features should be carefully observed. The information thus obtained will sometimes reveal the nature of the case, or will guide in the further exploration of it. By the general bearing of the patient, and the expression of his features, it will be seen, for example, if he is affected with intolerance of light—if he be blind from amaurosis, or blind from cataract.

8. The patient, intolerant of light, keeps his head bent down, and covers his eyes with his hands, in order to protect them from the light. The eyelids are spasmodically closed, and at the same time the eyebrows are knit and depressed, and the cheeks drawn up, so that there is great distortion of the whole features. There is greater or less lachrymation.

9. Whilst the confirmedly amaurotic patient moves about with an air of uncertainty, his head erect, and the eyes wide open—not converged and fixed on any object, but staring forward as if on vacancy—perhaps moving about in a vacillating manner or squinting, the cataractous patient is more steady in his gait; and with his head bent forwards, his eyes half-closed, his eyebrows knit and depressed, he moves and directs the eyes naturally and steadily, in an exploratory manner.

10. This survey, constituting the first step in the objective exploration of the eye, may be taken during the time the patient is coming into the room, relating the history of his case, and describing his present sensations in the eyes. In the subsequent steps of the objective exploration, attention should be carefully directed to the relations which may exist between the subjective and objective phenomena of the case.

11. Most probably the result of the preceding objective survey, in conjunction with the subjective examination, will have been such as at once to direct the practitioner to the part affected, on which he will accordingly fix his attention, and subject it to the necessary exploration in order to an exact diagnosis, not neglecting, however, to take a rapid, but methodical survey of the other parts of the eye, lest anything should be overlooked. The account of the mode of conducting the objective exploration of the different parts of the eye in detail, to which I now proceed, will necessarily include references to the principal morbid conditions of the organ.

a. Exploration of the eyebrows, and orbital margins.

12. The affections of the eyebrows and orbital margins do not require much exploration for their diagnosis, a glance and

a few touches being in general sufficient, except in the case of a fistulous opening at the margin of the orbit, when it may be necessary to introduce a probe to ascertain the extent and direction of the fistula, and state of the bone.

13. In injuries and affections of the eyebrow and orbital margins, the eyelids are almost necessarily more or less implicated; and it is to be remarked, that in the case of blows, contusions and wounds of the eyebrow and margin of the orbit, there may have occurred injury of the fifth pair, concussion of the retina, or even of the brain, and as a consequence, amaurosis.

14. In the exploration, attention is directed to the state of the skin all round the margin of the orbit, and of the hairs of the eyebrow. The skin may be the seat of an eruption, or of cicatrices. The hairs may have fallen off, or they may be the seat of phtheiriasis. Tumours will not unfrequently come under notice in the eyebrows, or connected with the margin of the orbit. The injuries met with are burns, from which the eyelids in general suffer most; contusions and wounds with ecchymosis.

15. The affections found more particularly seated in the margin of the orbit, besides fracture, &c., which may complicate the injuries just referred to, are inflammation and abscess, involving the periosteum and bone. Abscess manifests itself by a dark red swelling, which at last bursts and discharges a thin or curdy matter. The carious or necrosed bone is felt bare and rough, on the introduction of a probe through the opening, now become fistulous. Lastly, the margin of the orbit may be thickened from periostosis, or hyperostosis, or be the seat of an exostosis, or of an osteo-sarcomatous tumour.

b. Exploration of the eyelids and their tarsal border, including the state of the cilia and Meibomian apertures.

16. The points to be noticed in regard to the eyelids, are, first, their position, their connections, and their movements; then their organic condition generally, and that of their tarsal border in particular; the direction of the eyelashes, the state of the Meibomian apertures, and of the Meibomian discharge, as indicated by the presence or absence of incrustation of the eyelashes.

17. The morbid changes in position, which the eyelids may be found to present, are, *eversion* or *ectropium*, *inversion* or *entropium*, *retraction* and *shortening* or *lagophthalmus*. The morbid connections are, adhesion to each other's edges,

or *anchyloblepharon*, which may be either mediate or immediate, total or partial, congenital or accidental; and adhesion of the inner surface of one or both eyelids to the globe, or *symblepharon*, which may likewise be mediate or immediate, total or partial.

18. In proceeding to indicate the morbid changes which the movements of the eyelids may present, it may be useful to premise that it is chiefly by the movements of the upper eyelid that the open or closed state of the eye is produced. The upper eyelid is both vertically and horizontally larger than the lower, and in the closed state during sleep covers much more of the front of the eyeball; but in voluntary or forced closure of the eye, the lower eyelid is drawn up, being at the same time impressed with a horizontal movement towards the inner angle, by the action of the orbicularis palpebrarum muscle, and meets the upper lid half-way. Or, if the upper lid be immovably retracted under the edge of the orbit, either by disease, or by the finger for the sake of experiment, the lower eyelid can of itself almost entirely cover the whole front of the eyeball. When the action of the orbicularis ceases, the lower eyelid falls back into its former state by its own elasticity and that of the skin of the cheek. It is by the levator palpebræ, that the open state of the upper eyelid is maintained. In winking, the upper eyelid falls and the lower rises considerably, in consequence of the momentary action of the orbicularis.

19. Nictitation may be observed to be morbidly frequent. The eyelids may be affected with a twitching or quivering motion, which is, however, sometimes so slight as not to be very apparent to the observer, though felt by the patient himself to be very annoying. Or, they may be spasmodically closed intermittently, or remittently, or continuously,—a symptom usually of the presence of a foreign particle in the eye, inflammation of the conjunctiva, or of intolerance of light.

20. The movements again may be defective, or lost from paralysis. There may be a constant open state of the eye, from palsy of the orbicularis muscle. Or, the upper eyelid may hang down over the eye from palsy or atony of the levator palpebræ superioris—*paralytic ptosis*. In the former case, there will probably be found palsy of the other muscles of the same side of the face; in the latter, there will probably be found, on raising the eyelid with the finger, dilatation of the pupil, and the eyeball more or less fixed, and turned towards the temple from concomitant paralysis of those muscles of the

eyeball which, in common with the levator palpebræ, are supplied by the third pair of nerves.

21. The eyelids may be the subject of various injuries, such as burns and scalds; contusions with ecchymosis, wounds incised or lacerated, or poisoned, as by the stings of the scorpion, wasp, &c.

22. The eyelids are sometimes the original and principal seat of erysipelas. In erysipelas of the face they are always involved. They may be the seat of phlegmonous inflammation, in which case, the redness, which is intense, and swelling are circumscribed, and the part very painful to the touch. Sometimes they present black sloughs from gangrenous inflammation. Both erysipelatous and phlegmonous inflammation of the eyelids are to be distinguished from the sympathetic inflammatory œdema of these parts, which attends some of the inflammations of the eye, especially the purulent inflammations of the conjunctiva.

23. The eyelids are often simply œdematous, sometimes emphysematous.

24. In children the eyelids are often the seat of porrigo larvalis.

25. The eyelids may be the seat of syphilitic ulcerations. In infants affected with syphilis, the eyelids, and other parts of the face and body, are covered with an eruption of flat broad pustules which break, scab, and spread. Such children have a peculiarly wrinkled and withered expression of face.

26. The eyelids may be the seat of nævus maternus, of warts, and of different kinds of tumours. Lastly they may be found cancerous.

27. In regard to the tarsal borders of the eyelids, it is to be premised that they are broad surfaces. The border of the upper eyelid is about one-twelfth of an inch broad; that of the lower about one-fifteenth. The edge bounding the border anteriorly corresponds to the insertion of the eyelashes, and is round. The posterior edge is much sharper and more defined than the preceding, and is the place where the delicate integument of the border of the eyelid is continued into the palpebral conjunctiva. On the border of either eyelid between the two edges or boundaries just described, but nearer the posterior than the anterior, and parallel to them, there is observable, on close inspection, a row of minute pores—the excretory mouths of the Meibomian follicles. Fig. 1.

28. The tarsal border of the eyelids may be found inflamed—perhaps ulcerated—(*ophthalmia tarsi,*) in which case, the eye-

lashes will be incrusted partly with dried Meibomian discharge, partly with the discharge from the ulcers. *Hordeolum* or stye is another form of inflammation at the free margin of the eyelids. Inflammation and abscess of the Meibomian follicles simulate the appearance of stye externally, but are rarer occurrences. The eyelids at their edges or close to their edges may present small tumours, thickening, and callosity, unattended by any great degree of inflammation, viz., grando, chalazion, tylosis, &c.

29. The eyelashes are sometimes the seat of *phtheiriasis*, which is apt to be overlooked, except a close examination be made. *Madarosis*, or loss of the eyelashes, is at once recognized.

30. The eyelashes are often found in greater or less numbers directed against and irritating the eyeball, constituting *trichiasis* and *distichiasis*. The surgeon should always take particular care to assure himself therefore of the direction of the eyelashes; and in order to do so, and to see properly the broad surface of the tarsal border, and the state of the Meibomian apertures, the eyelids should be slightly everted by gentle pressure with the point of the finger on the skin of the eyelid, the eyelashes being kept between the finger and the skin.

31. By this means it will generally be at once seen if any of the eyelashes are growing in against the eyeball. Sometimes, however, such eyelashes are so pale and fine that they are apt to escape notice. The presence of these may be detected by attention to the following point when they might otherwise be overlooked:—the tears, of which there are in such cases generally more than usual, rise up around the pale mis-directed eyelashes, and between the eyelid and eyeball, by capillary attraction, and occasion a marked reflection of the light at the place.

32. One or more of the Meibomian apertures may become covered with a thin film apparently of epidermis which prevents the escape of the secretion, so that the latter accumulates and raises the film up into a small elevation like a phlyctenula. The Meibomian discharge is increased, whenever there is any irritation of the edges of the eyelids, and especially of the palpebral conjunctiva.

33. The posterior edge of the tarsal border, which is in its natural state sharply defined, may be found rounded or obliterated in consequence of chronic inflammation of the palpebral conjunctiva and of the integument of the tarsal border. In such

cases, as no Meibomian secretion can be pressed out, it would seem that the Meibomian apertures are obliterated.

c. Exploration of the conjunctival surface of the eyelids, and of the palpebral sinuses.

34. The lower eyelid is readily everted for the purpose of examining its inner surface, by simply drawing down the skin of the lid and cheek; and in order that the lower palpebral sinus may be fully exposed, the patient is to be desired to turn the eyeball upwards, while the lower eyelid is thus held drawn down and everted.

35. The upper eyelid does not admit of being so readily everted as the lower; and as the operation is attended with some uneasiness to the patient, it ought not to be had recourse to unless the glimpse of the inner surface of the eyelid, which may be obtained by raising the upper eyelid, and drawing it slightly from contact with the eyeball by pressing up the skin of the eyebrow and eyelid itself, prove insufficient to satisfy the surgeon of the state of parts. If there is reason to suppose that a foreign body is lodged under the eyelid, then eversion is the only means of detecting and removing it.

36. In order to evert the upper eyelid, lay hold of the eyelashes between the forefinger and thumb of the left hand, for the right eye—and *vice versa*—in such a way, that whilst the eyelashes are securely held, the points of the thumb and forefinger may extend a little beyond their insertion, so that the former may be applied to the broad border, and the latter to the outer surface of the eyelid. Having thus got a secure hold of the eyelid, draw it away from its contact with the eyeball, and then, whilst applying counter pressure downwards on the outer surface of the eyelid, opposite the orbital margin of the tarsal cartilage, raise the ciliary margin upwards. The counter pressure may be applied either by the thumb of the free hand, or what most people find better adapted to the purpose, by a thick probe.

37. The whole extent of the upper palpebral sinus cannot be exposed like the lower. To explore it a probe must be used, whilst the everted lid is kept as much as possible withdrawn from the eyeball, and the patient is directed to turn the eyeball downwards.

38. By everting the eyelids, the state of the palpebral conjunctiva is ascertained; whether it be inflamed or granular and whether there be growths connected with or projecting at the inner surface of the eyelids, as chalazia. By the eversion

of the eyelids, also, foreign bodies in the eye are readily detected and removed. Small particles are especially apt to adhere to the inner surface of the upper eyelid.

d. Exploration of the angles of the eye, and of the lachrymal organs as regards their general state.

39. The inner and outer corners of the eye, where the eyelids join, are called *canthi*. The outer canthus, generally speaking, forms an acute angle; but on close examination, it is observed that the apex is rounded off, somewhat prolonged and turned slightly downwards. The conformation of the inner canthus is altogether peculiar and rather complicated. At the inner canthus, the palpebral fissure is prolonged into a secondary fissure, the borders of which being destitute of cartilage, are not firm and square, but soft and rounded. The secondary fissure is closed by the action of the orbicularis muscle at the same time as the eyelids. The space within the inner or nasal canthus is called *lacus lachrymalis*.

40. The state of the outer canthus is readily ascertained by slightly drawing the eyelids from each other. The most ordinary morbid condition met with there, is abrasion or ulceration of the skin. Sometimes there is eversion—sometimes inversion.

Fig. 1.

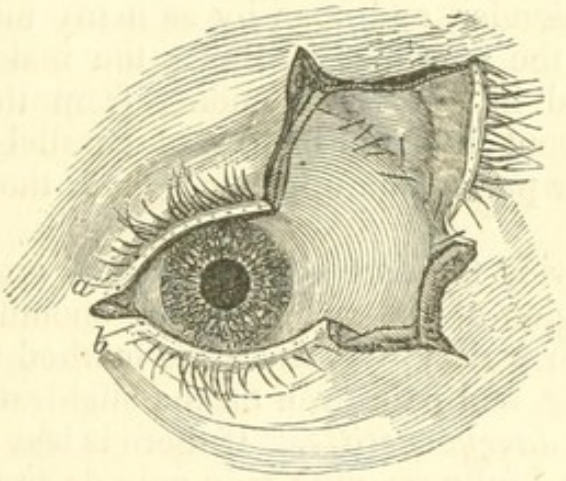


Fig. 1.—An eye, with the eyelids divided vertically, and the outer halves everted, to show the orifices of the ducts of the lachrymal gland, into which hairs are inserted. The letters *a* and *b* indicate respectively the upper and the lower puncta lachrymalia. Along the border of the eyelids are observed the Meibomian apertures.

41. The parts situated at the inner canthus are exposed, by drawing the eyelids from each other, and at the same time

slightly everting them. At the inner extremity of the border of either eyelid, where the fissure of the nasal canthus begins, the small papillary eminence called *lachrymal papilla* is seen, with the small orifice in its summit called *lachrymal point*, of such a size as to admit a thick bristle. These lachrymal points are, from their size and situation, sufficiently conspicuous not to be confounded with a Meibomian aperture. In the natural state, the lachrymal papillæ are inclined towards the lacus lachrymalis. The lower papilla is somewhat more prominent than the upper, and situated somewhat more towards the temple. At the bottom of the lacus lachrymalis, is the lachrymal caruncle, and between it and the white of the eye, the semilunar fold. The semilunar fold and lachrymal caruncle may be found swoln and enlarged, (*encanthis inflammatoria;*) sometimes the seat of growths, (*encanthis fungosa.*)

42. In reference to the exploration of the state of the secreting lachrymal organs, it is to be remembered that the lachrymal gland consists of two masses, an upper and a lower. The former is that which lies in the lachrymal fossa of the frontal bone; the latter, composed of a loosely connected aggregation of small lobules, extends from the upper mass down to the outer part of the upper margin of the tarsal cartilage of the upper eyelid, in the substance of which it lies at the outer part, and may be seen shining through the conjunctiva on everting the upper eyelid. The ducts of the lachrymal gland are some twelve in number, very slender, and open by as many minute orifices on the surface of the conjunctiva, lining the inside of the upper eyelid, arranged in a row, extending from the outer canthus inwards for about half an inch, and parallel to, but a little above, the outer part of the upper margin of the tarsal cartilage. Fig. 1.

43. In exploring the derivative lachrymal organs, the appearance of the region of the lachrymal sac should be particularly noted. If, with watery eye, there are marked redness, circumscribed swelling, and pain even on the slightest touch, the case is one of *acute dacryocystitis*. If there is less marked redness, merely unnatural fullness, with pain only on pressure, and when pressure is made, if there takes place regurgitation of tears with puriform mucus, through the puncta, the case is one of *chronic dacryocystitis*. If there is a large livid indolent tumour, more or less hard, pressure on which does not cause any evacuation of matter either through the puncta or into the nose, the case is one of *mucocele*. If there is a large flaccid tumour without pain, much or any redness, readily yielding to the pressure of

the finger; and if on that pressure a mucous matter is evacuated through the puncta, but especially into the nose, the case is one of *relaxation of the lachrymal sac.* Lastly, if there is a fistulous opening leading into the sac, the case is one of *fistula of the lachrymal sac.*

44. The state and position of the lachrymal papillæ and puncta should next be examined.

45. In addition to the examination now detailed, instrumental exploration of the derivative lachrymal passages may in certain cases be required, to determine the nature and seat of obstruction. But for this, see under the head of diseases of the lachrymal organs.

46. The state of the lachrymal discharge is to be noted. If the eye is overflowing in tears, it is to be determined whether this is owing to increased discharge from the gland—*epiphora*—or to diminished or obstructed derivation of the tears towards the nose—*stillicidium lachrymarum.* The point is determined by ascertaining the state of the derivative apparatus. If this is free from disease, the case is one of epiphora; if not, it is one of stillicidium. It is, however, to be observed, that stillicidium and epiphora may co-exist.

e. Examination of the direction and movements of the eyeballs.

47. Both eyes may be affected with squint, though one only appears to be so. To determine this, in the case of convergent squint, for example, cover the eye which appears well directed, by holding the hand before it, and direct the patient to look straight before him with the previously distorted eye. While he is doing this, look behind the hand at the other eye, and if it now be seen to be distorted, there is double squint; if on the contrary it remains straight, it is not affected, but the squint is confined to the one eye alone.

48. A partial rotatory movement of the eyeball to and fro on its antero-posterior axis (*oscillation*) may be met with; or a movement from side to side—(*nystagmus.*)

f. Examination of the front and interior of the eyeball.

49. The circumstances to be noted in this examination are, the state of the white of the eye, that is, of the ocular conjunctiva, and of the sclerotica, including the expansion of the tendons of the recti muscles underneath, the state of the cornea, the state of the iris and pupil, the state of the aqueous chambers and humour, the presence or absence of opacity behind the

pupil; and lastly, the degree of prominence and consistence of the eyeball.

50. *Mode of exposing the front of the eyeball for examination.*—The patient should be seated before a window, in such a way that the light falls obliquely on the eye to be examined, from the temporal side, whilst the surgeon, placed before the patient, applies the pulp of his thumb on the skin of the upper eyelid, previously well dried, near its ciliary margin, whilst it is gently closed, and raises it by traction of the skin. In doing this, no pressure should be made on the eyeball, but the skin of the raised eyelid may be secured by pressure against the margin of the orbit. The lower eyelid is to be depressed to the extent that is necessary in a similar way, by the fore or middle finger of the other hand. In separating the two eyelids, however, it is to be remembered that when the upper is much raised, the lower should not be much depressed; and when the lower is much depressed, the upper should not be much raised, in order to avoid putting the external commissure too much on the stretch.

51. The eyelids being thus opened, the surgeon can look directly into the eye, or from any one side, by requesting the patient to move the eye in different directions.

52. To avoid irritating the eye too much, the eyelids should not be kept more than a few seconds separated at a time; they should be occasionally allowed to close, and after a few seconds, re-opened when the examination requires to be prolonged.

53. In exploring the state of the interior of the eye, illumination greater than is afforded by the window merely, is sometimes necessary. In this case, the light is thrown concentratedly into the eye by means of a convex lens, about two inches in diameter, and three or four inches focus.

54. For the examination of the eyes in children, especially when affected with intolerance of light and blepharospasmus, considerable management is required, and even some degree of gentle force.

55. The surgeon is to seat himself on a chair, with a towel folded longways, laid across his knees. On another chair, on the surgeon's left hand, and a little in front of him, the nurse, with the child, sits in such a way that when she lays the child across her lap, its head may be received on the towel, and between the knees of the surgeon, and thus held steadily. The nurse now confines the arms and hands of the child, whilst the surgeon, having dried the eyelids with a soft linen cloth, proceeds to separate them by applying the point of the forefinger

of one hand to the border of the upper eyelid, and the point of the thumb of the other hand to the border of the lower, and then sliding them against the eyeball, but without pressing on it, towards their respective orbital edges. This mode of proceeding obviates the eversion of the eyelids, which is so apt to take place under the circumstances. The eyelids being thus opened, they are readily kept so during the examination, by the command which the points of the finger and thumb, resting against the edges of the orbit, have of their borders.

56. By this means the whole front of the eyeball is exposed, but it often happens that, to avoid the light, the eye is spasmodically turned up, so that the cornea is in a great measure concealed. By waiting a few seconds, however, enough of it will in general come into view to enable the surgeon to judge of the state in which the eye is. Having completed this part of the exploration, there is not much difficulty in so everting the eyelids as to ascertain the state of the palpebral conjunctiva.

57. *State of the white of the eye—ocular conjunctiva.*—The ocular conjunctiva is connected to the sclerotica underneath by cellular tissue loose enough to allow the former to slide somewhat upon the latter. At the margin of the cornea the cellulo-vascular and nervous basis of the sclerotic conjunctiva stops—what of the conjunctiva extends over the cornea being reduced to the epithelium. This epithelium, however, forms a thicker layer than on the sclerotic conjunctiva. It is, of course, intimately adherent to the proper substance of the cornea.

58. The blood-vessels of the ocular conjunctiva ramify in a direction from the circumference of the eyeball towards the cornea, and form a vascular circle or wreath around it, but send no vessels in the healthy state into it. Except the ramifications derived from the seven recto-muscular vessels, which are often enlarged and varicose, the vessels of the ocular conjunctiva cannot be seen except in the inflamed state of the membrane.

59. The presence or absence of redness is a point which should be first noted in exploring the state of the ocular conjunctiva. If there is redness, it is easy to determine whether it is the redness of ecchymosis or the redness of inflammatory congestion. The redness of ecchymosis is dark and occurs in patches, abruptly defined, without any appearance of vascular ramifications: whilst the redness of inflammatory congestion presents contrary characters, as will be detailed in their proper places. The ocular conjunctiva may be the seat of an aphthous eruption, or of growths of various kinds, such as pterygium, pinguecula, warts, fungus, trichosis, and the like. It may be

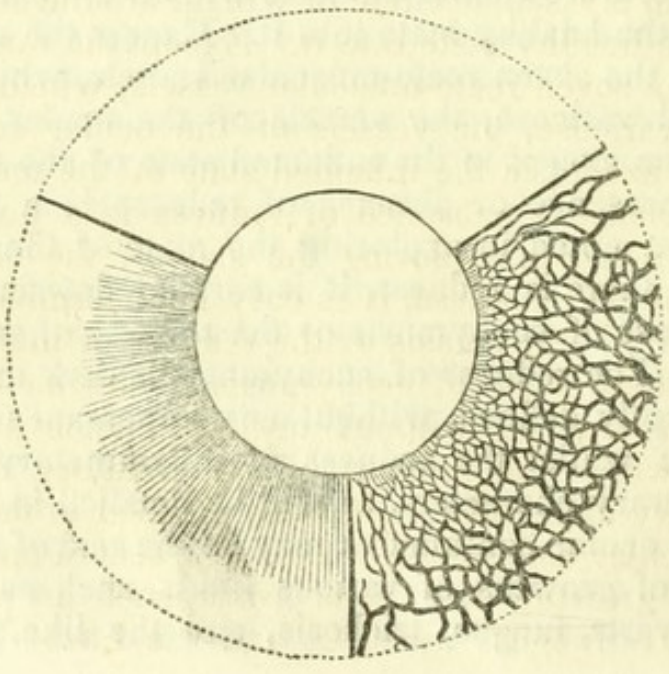
found stained from the long-continued use of nitrate of silver drops, &c.

60. The cellular tissue between the conjunctiva and sclerotica is sometimes the seat of extravasations of blood, *subconjunctival ecchymosis*, sometimes the seat of an accumulation of serous fluid, as in the œdema attending erysipelatous ophthalmia. It is sometimes the seat of a more serious form of œdema, that known by the name of *chemosis*, and common in the purulent inflammations of the conjunctiva. It may also be the seat of emphysema, and is occasionally so of phlegmon.

61. *State of the white of the eye—sclerotica, including the tunica tendinea, or expansion of the tendons of the recti muscles.*—In the natural state, the sclerotica, including the tunica tendinea, is white and glistening, like other fibrous membranes. The peculiar appearance of the white of the eye is owing to its shining through the semi-transparent conjunctiva. The bluish tinge of the white of the eye in childhood is owing to the thinness of the sclerotica at that time of life, allowing the dark choroid to shine through.

62. In the healthy state, the sclerotica is even more bloodless than the conjunctiva. The blood-vessels seen in it in certain inflammations are very minute, and converge in straight lines towards the margin of the cornea. Opposite the insertion of the ciliary ligament, some of these vessels pierce the sclerotica to gain the interior of the eye, where they join the vessels of the iris; whilst others anastomose with the circumcorneal vessels of the conjunctiva.

Fig. 2.



63. If the white of the eye is red from inflammatory congestion, it becomes a question whether the congestion be in the conjunctiva or sclerotica.—In conjunctival inflammation, the vessels of the sclerotic conjunctiva are large, somewhat tortuous, and arranged in a reticular manner; the colour is scarlet, or brick red, and it may be deeper towards the orbit, but more or less shaded off towards the cornea. In sclerotic injection, the redness is in the form of a pink or lake-colored zone, encircling the cornea; the injected vessels being very minute, and disposed in straight radiating lines, as if from its margin, where the tint is deeper, whilst it is shaded off, and disappears towards the orbit, the converse of what occurs in the injection attending conjunctival inflammation. The seat of the injected vessels, whether in the sclerotic conjunctiva or in or on the sclerotica itself, is easily proved, supposing any doubt exists, by making the conjunctiva slide on the sclerotica, when the vessels, if seated in the conjunctiva, will be observed to move along with it, whereas, if seated in the sclerotica, or closely applied to its surface, they will remain stationary. When both conjunctiva and sclerotica are injected at the same time, the pink hair-like vessels of the sclerotica are seen stationary through the larger meshes of the sliding conjunctiva. But when the conjunctiva is very much injected, the state of the sclerotica cannot be seen.

64. Tumours on the white of the eye are to be examined as to whether they have their seat in the conjunctiva only, or have their roots in the sclerotica. A part of the sclerotica may be found unnaturally prominent, and bluish-black—*sclerotic staphyloma.*

65. *State of the cornea.*—The prominence and breadth of the cornea, the state of its margin, its connection with the sclerotica, and its transparency and non-vascularity* in the mature and healthy state, as also its relations to the iris, and its composition of three principal layers of different tissue, viz., the proper substance, forming its principal thickness; the thick epithelium, or conjunctival layer, on its anterior surface; and the membrane of Descemet, on its posterior surface, are circumstances to be had in remembrance in examining whether it be the seat of disease.

66. In order to ascertain the prominence of the cornea, a profile examination of it should always be made. The cornea may be found unnaturally prominent; the prominence may be spherical, as in *corneitis*, or conical, as in *conical cornea.*

* The cornea is nourished by transudation from the vessels forming the conjunctival and sclerotic circumcorneal zones.

Besides these unnatural states of prominence, in which the transparency of the cornea is usually still more or less retained, there is the opaque prominence of staphyloma, which may be either partial or complete. The cornea may be found unnaturally flat. By a profile examination, also, it will be seen in any doubtful case whether an opacity is seated in the cornea or not. Facets and small ulcers of the cornea will also be detected.

67. The usual diameter of the cornea is 9–20ths of an inch transversely, somewhat less vertically, the outline of the cornea not being quite circular, but rather oval, and this is the literal sense; its small end being that next the temple. Any morbid increase or diminution of diameter which the cornea may present, is usually an accompaniment of increase or diminution in the size of the eyeball generally.

68. *State of margin of the cornea.*—Externally the sclerotica overlaps, or encroaches more or less on the edge of the cornea. In certain constitutions, and especially in old persons,* the overlapping part of the sclerotica is thicker and more opaque than usual—perhaps also encroaching more extensively on the cornea. The conjunctiva covering the overlapping sclerotica, especially when the latter is to any considerable extent, is like the sclerotic conjunctiva generally, composed of both chorion and epithelium; and although it adheres to the subjacent overlapping part of the sclerotica very closely by cellular tissue, it by no means presents the same intimate union with the subjacent structure which the extension of conjunctival epithelium over the transparent cornea does. The conjunctiva covering the overlapping part of the sclerotica has a vascular connection with the latter, no otherwise than by the anastomoses of the proper vessels of each—a vascular connection, which indeed subsists between the sclerotica and conjunctiva elsewhere. The disposition just described is connected with a point in the pathology of the eye, viz., the bluish-white ring which is observed to encircle the cornea more or less completely in certain internal inflammations of the eye, and so frequently in what is called arthritic iritis, that it has been considered a diagnostic of it, but certainly without just grounds.

69. In reference to the cause of the appearance, it is to be remembered that the insertion of the ciliary ligament is at some little distance from the apparent margin of the cornea; that the vessels which form the red zone of the sclerotica in the internal inflammations of the eye, and in inflammation of the proper substance of the cornea, are vessels which send branches in-

* The *arcus senilis* is not here referred to.

wards to the iris, opposite the ciliary ligament, branches outwards to anastomose with those of the conjunctiva, and lastly, branches which, following the original direction, go to be continued into those newly developed in the proper substance of the cornea. These vessels are not apparent in the healthy state, and one set of them only may become apparent in inflammation. Thus, in inflammation of the iris, they will be apparent only as far as opposite the insertion of the ciliary ligament. Between this and the clear part of the cornea, is the opaque overlapping part of the sclerotica, which of course, not being in the way of the progress of the vessels towards the inflamed part, remains white as usual; and the cornea not being affected, there are no vessels developed in its proper substance. Hence the overlapping part of the sclerotica is seen in contrast between the abruptly terminating red sclerotic zone, on the one hand, and the transparent cornea, (appearing dark on account of the dark structure behind it,) on the other, and forms the bluish-white ring.

70. From this explanation, the bluish-white ring round the cornea ought to exist more or less in all internal inflammations of the eye, unless obscured by vascularity of the conjunctiva in inflammation of the cornea. So it does; but in persons of otherwise sound constitution, and not of advanced age, the overlapping sclerotica is so transparent, and sometimes also so narrow, that it is not strongly contrasted by the transparent cornea. It is otherwise, however, in certain persons, especially such as are advanced in life, in whom the encroachment of the sclerotica and fully developed conjunctiva on the cornea exists to a great degree, and in a very opaque state; the bluish-white ring then appears in the exaggerated distinctness which has commonly attracted the notice of surgeons.

71. The condition of the eye necessary for the *distinct* appearance of the bluish-white ring round the cornea, occurring principally in old persons of bad constitution, and these being the very persons in whom an internal inflammation of the eye very often presents what is called the arthritic character, are circumstances which readily explain the error of supposing the bluish-white ring round the cornea diagnostical of arthritic iritis.

72. In degeneration of the structure of the cornea, the limit between its margin and the sclerotica may be quite obliterated.

73. The changes in the transparency which the cornea may present, are very various in seat, degree, extent, and nature. As regards seat, they are distinguished according to the different

layers of the cornea which they implicate. But as regards nature especially, they are to be distinguished into those in which opacity is for the time merely a secondary consideration in the case, viz., phlyctenulæ, pustules, abscesses, and ulcers, which are concomitants of inflammation, and those in which the opacity, whether removable or not, is now the principal defect, viz., opacities properly so called.

74. A foreign body adhering to the cornea may simulate an opacity.

75. Minute opacities of the cornea, otherwise previously not very evident, are brought into view when the pupil is dilated, being rendered distinct by contrast with the black background formed by the pupil.

76. When in its mature state, vessels are observed in the cornea; they are new formations developed from the lymph exuded into its substance, from the vessels, in a state of inflammatory congestion, of the adjoining conjunctival or sclerotic circumcorneal zone. New vessels may be observed:—1, between the epithelium and proper substance; 2, in the proper substance; 3, between the proper substance and membrane of Descemet—these being the situations where lymph is exuded in inflammation.

77. Foreign bodies getting into the eye, especially when projected with force, may adhere to or become imbedded in the cornea. The cornea is subject to be variously injured by mechanical or chemical agents. Certain chemical agents, such as mineral acids and lime, have the effect of rendering the epithelium of the cornea, in common with that of the conjunctiva, white and opaque, and causing it to become detached, and to peel off from the proper substance of the membrane.

78. The relation between the iris and cornea should not be passed unnoticed in reviewing the state of the cornea. When the cornea is penetrated by ulcer or wound, the aqueous humour escapes, and the iris is apt to be prolapsed. Of this prolapsus iridis there may be different degrees, according to the extent of destruction of the cornea; and as effects of different degrees of former prolapsus, there may be found *synechia anterior, partial staphyloma, total staphyloma.*

79. The cornea may be the seat of growths and tumours.

80. *State of the anterior chamber, and aqueous humour.*—The size and form of the anterior chamber are determined by the diameter and state of prominence of the cornea, on the one hand, and the position of the iris on the other—whether the

latter inclines forwards to, or backwards from, the cornea—circumstances to be determined by examining the eye from the side. (s. 85.)

81. The state of the aqueous humour is next to be attended to—whether it is of natural transparency, or whether it be mixed with any foreign matters, in the form of lymph, pus, or blood.

82. *State of the iris and pupil.*—The colour, striated aspect, and position of the iris, and the state of the pupillary margin, are the points first to be noted; then the form, size, and especially the motions of the pupil.

83. When the iris is inflamed, its colour is changed—if blue, to green; if brown, to reddish brown; and the striated appearance of its surface becomes indistinct, and its brilliancy impaired. In syphilitic iritis, its pupillary margin presents a tawny colour. Change of the colour of the iris may also follow an injury of the eye; but it is sometimes met with in cases in which it is alleged there has been no preceding inflammation, or any other apparent cause. In the cases referred to, however, the change of colour is attended with some impairment of the sensibility of the retina, or with cataract, indicating that there is something wrong about the nutrition of the eye—probably slow inflammation.

84. Sometimes dark spots are observed on the iris, looking as if its proper substance were at the place gone, and the uvea appearing, or even protruding through. Somewhat similar spots may be met with in healthy eyes; but the spots here referred to are met with, and sometimes very large, after long-continued unhealthy inflammation of the iris, syphilitic, arthritic, or cachectic. In such cases, the pupillary margin is adherent to the lens, and the middle of the iris projects towards the cornea. The proper substance of the iris, which remains evident, is much changed in colour, and presents a remarkable fibrous appearance. This change in the structure of the iris is called *iridoncosis*, or *staphyloma uveæ*, being supposed to be a protrusion of the uvea through the proper substance of the iris.

85. In its natural state, the iris is plane, neither inclining back towards the lens, nor forwards towards the cornea. Sometimes it is met with, in consequence of different morbid states of the eye, inclined towards the cornea. A deceptive appearance of this often occurs, if the eye be viewed from the front only; but all doubt is avoided by looking at it in profile. If the iris still retains its natural planeness, the pupil will be seen

nearer the margin of the iris which is next the observer, thus:—Fig. 3.

Fig. 3.

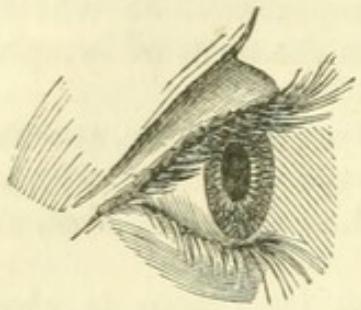
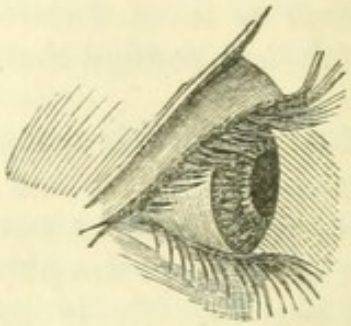


Fig. 4.



Whereas, if the iris be inclined towards the cornea, the pupil will be seen towards the opposite margin, thus:*—Fig. 4.

86. Sometimes the iris is inclined back from the cornea, being concave forwards, instead, as in the preceding case, convex. Sometimes, and especially in the cases just mentioned, the iris is seen to be tremulous—to shake on every motion of the eye, which indicates a dissolved state of the vitreous humour.

87. Besides other changes in the pupillary margin, such as the tawny colour in syphilitic iritis, thickening, a fringed appearance, &c., there may be, adhesion of it to the capsule of the lens (*synechia posterior*), producing distortion, contraction, and diminution in the mobility of the pupil. Analogous changes in the state of the pupil may be produced by other causes, but that they are owing to morbid adhesions will, in general, be observed, on careful examination, and very certainly if belladonna be applied: for by this the free parts of the margin of the pupil will be dilated, and the adhesions rendered very evident, whilst the distortion of the pupil will be much increased.

88. The iris may be adherent by some part of the cornea, *synechia anterior*, or *partial staphyloma*, according to the extent of the iris and cornea implicated, and the consequent presence or absence of prominence at the place. In this case also the pupil is found distorted, contracted, and more or less confined in its motions. These changes are readily detected, especially by viewing the eye from the side, and by the use of belladonna.

* It is curious to see how very generally artists, in representing the eye in profile, have committed the error of drawing the pupil as it appears only when the iris is unnaturally inclined towards the cornea. Another common mistake in profiles of the eye is the monstrous size of the palpebral fissure.

89. The pupil may be found completely closed, and this state may be either simple or complicated, with morbid adhesions, &c.

90. Excrescences or tumours sometimes present themselves connected with the iris.

91. The deviations in the form, size, and especially the motions of the pupil, now to be noticed, are such as are independent of morbid adhesions.

92. *Mode of examining the state of the pupil.*—The patient is to be seated opposite the light. The surgeon, standing or sitting before him, closes both the patient's eyes by bringing down the upper eyelids. These he rubs over the cornea with his thumbs, and then suddenly opens one eye to the light, and carefully notices how far the pupil was dilated, and how quickly it contracts on exposure to the light. Both eyes are again to be closed and rubbed in the same way, and then the other eye suddenly opened and examined.

93. If the surgeon were to examine both pupils at the same time, by unshading both eyes simultaneously, a mistake might be committed, as the pupil of a blind eye may move in concert with that of the other which is sound. But when the movements of the pupil of the latter are prevented by its being shaded, the pupil of the former will in general be found to be quite unaffected by the light.

94. The pupil may be found much dilated, and either sluggish in its movements, or altogether immovable; or, it may be contracted, and either sluggish or immovable. In these cases which are respectively named *mydriasis* (4) and *myosis*, there may be no other disturbance of vision than what the state of the pupil will account for, or there may be amaurotic defect of vision.

95. Changes in form or position of the pupil, not owing to morbid adhesions, are sometimes met with in syphilitic iritis, arthritic iritis, choroiditis, amaurosis,—a result probably of some affection of the ciliary or iridal nerves.

96. In consequence of blows, &c., the iris may be detached at some part of its ciliary circumference, the result of which is a false pupil.

97. *Coloboma iridis*, which consists of a fissure in the iris extending from the pupil towards the ciliary margin of the iris, is sometimes met with, either as a congenital malformation or as the result of injury.

98. Congenital absence of the iris sometimes presents itself. It is readily distinguished by the uniform dark, though not

black appearance, behind the cornea;* unless cataract has formed, which is, in general, sooner or later the case. If cataract has formed, the opaque lens is seen to its very circumference.

99. *Exploration of opaque appearances behind the pupil.*—Though the nature and seat of an opaque appearance behind the pupil may be, to a certain extent, determined by the experienced surgeon, without artificial dilatation of the pupil, it is always advisable, especially for the young surgeon, not to pronounce a formal opinion of the exact nature and seat of the opaque appearance behind the pupil in any case, until after an examination has been made with the pupil dilated.

100. *Artificial dilatation of the pupil.*—The dilatation of the pupil by belladonna or hyoscyamus, besides its use in the treatment of the internal ophthalmiæ, is a most valuable means of exploring the state of the pupil and the pupillary margin of the iris, as above shown, and also of exploring the nature and seat of opaque appearances behind the pupil.

101. The action of belladonna is stronger than that of hyoscyamus. They are usually applied either in the form of extract, reduced to the consistence of honey, which is smeared on the eyebrow and outside of the eyelids, or in that of a solution of the extract, (ext. belladonn. gr. xx, aq. destillat. ℥j, solve et per linteum cola,) which is dropped into the eye. They may be also applied in the form of a solution of their active principles, atropine or hyoscyamine, dropped into the eye, as originally recommended by Dr. Reisinger. (Atropiæ sulphat. gr. ij—jv, aq. dest. ℥j; or hyoscyamiæ gr. jv—viij, aq. dest. ℥j.)

102. When the belladonna is applied in the form of soft extract externally, the dilatation of the pupil takes place less quickly than when applied in the form of a solution dropped into the eye, the effect in this case being produced in a quarter of an hour or so.

103. *Opaque appearance behind the pupil depending on opacity of the crystaline body.*—When opacity of the crystaline is considerable, its seat can scarcely be mistaken even when we look into the eye directly, but when less considerable, it may in general be pretty certainly determined by looking into the eye sideways, when it will be known to be in the crystaline by the greater or less closeness of its situation behind

* In a case of congenital absence of iris, which I had the opportunity of seeing through the kindness of Mr. E. Smith, Billitersquare, when the light fell upon the eyes in a certain direction, a dark red reflection from their bottom was observed.

the iris. The opacity of the crystaline may, however, be so slight as not to occasion any very striking change in the black appearance of the pupil. In such cases, the state of the crystaline is ascertained by the catoptrical examination.

104. *Catoptrical examination of the crystaline body.*—The pupil being dilated by belladonna, and the patient sitting with his back to the window, if a lighted taper be held before the pupil, three images of it are seen situated one behind the other, if the cornea and crystaline are of their natural transparency. Of these images, the anterior and posterior are erect, the middle one inverted. The anterior is the brightest and most distinct, the posterior the least so. The middle one is the smallest, but it is bright. If the taper be moved, the two erect images follow its motions in the same direction, but the inverted image moves in the opposite direction, though not so quickly, nor through so great a range as the other two. The anterior erect image is produced by the cornea, the posterior by the anterior surface of the lens, and the middle or inverted image is produced by the concave surface of the posterior wall of the capsule.

105. The posterior erect and the inverted images are not produced, if the anterior part of the crystaline body be opaque, whether the rest be opaque or not, but if it is the centre or the posterior part only which is opaque, the posterior erect image is produced, but not the inverted one. When the opacity is as yet slight, the images may be produced, but will be more or less indistinct. Of course the anterior erect or corneal image is not affected, unless the cornea is diseased.

106. *The state of the posterior segment of the eye* cannot be so directly explored as the state of the anterior segment, but may be inferred more or less accurately from the presence or absence of opaque appearances behind the pupil depending on reflection of light from the bottom of the eye, and, from the attending subjective phenomena, together with the objective phenomena presented by the anterior segment, and by the eye considered as a whole.

107. *Opaque appearance behind the pupil depending on reflection of light from the bottom of the eye.*—An opaque appearance behind the pupil is determined to be of this nature, and at the same time, therefore, distinguished from opacity of the crystaline by the following marks:—The opaque appearance is evidently deep seated, but where it is seated exactly, it is not easy to determine, especially as it changes its place according to the direction, in which the light is admitted to the eye, it being always seen most distinctly on

the side opposite the light, indistinctly or not at all on the side next the light. It is most distinct in the ordinary state of the pupil, but when the pupil is dilated by belladonna, it ceases to be very evident. The three images observed in the catoptrical examination are distinct.

108. *The opaque appearance in glaucoma.*—The peculiar green opaque appearance in glaucoma partakes partly of the characters just described as belonging to opaque appearances depending on reflection from the bottom of the eye, and partly of the characters belonging to opacity of the crystaline. Thus, it appears deep and to change its seat according to the direction in which the light is admitted, and when the disease is advanced, the inverted image in the catoptrical examination is indistinct or obliterated. The cause and true seat of the appearance, in regard to which there is a difference of opinion, will be considered under the head of glaucoma.

109. *Consistence of the eyeball to the touch.*—By pressing on the eyeball with the finger through the medium of the tarsal edge of one of the eyelids, the consistence of the eyeball should be ascertained; whether it be normal or of unusual hardness or softness. Hardness of the eyeball indicates dissolution of the vitreous body, and too great quantity of the fluid. Softness or flexibility of the cornea or sclerotica, indicates atrophy of the vitreous body.

Section II.—APPLICATION OF REMEDIES TO THE EYES OR THEIR NEIGHBOURHOOD, AND PERFORMANCE OF MINOR OPERATIONS ON THEM.

a. Cold applications to the Eyes.

110. *Cold lotions.*—Cold spring water is the best cold lotion. It is applied by means of compresses of old linen or lint, which should be broad enough to extend over the neighbouring parts as well as over the eye, but not so heavy as to press unpleasantly. When once commenced, the application of the cold lotion requires to be assiduously kept up as long as is necessary, one compress, as soon as it becomes warm, being replaced by another just taken out of the water.

111. *Cold douche bath.*—This consists in a fine stream of cold spring water allowed to play on the closed eye and neighbouring parts. The application may be continued for about

a quarter of an hour at a time. There are particular douche apparatuses. A simple form of one may be readily constructed with a glass tube of the thickness of a barometer tube, and from three to three and a half feet long, bent like a syphon six inches from one end, whilst at the other it is drawn out small, and also bent, but only for about two inches; the short limb of the syphon being immersed in a vessel of water placed at a convenient height, the air is sucked out at the small end, when a fine stream of water will issue from it.

112. *Dry cold.*—In the weak and rheumy eyes of old persons, and in a similar state remaining after an attack of ophthalmia, it is often agreeable, and indeed, productive of great relief, occasionally to draw some cold body across the eyelids. For this purpose a long slender bottle with a smooth round bottom, and filled with ice, has been recommended.

b. Warm Applications to the Eyes.

113. *Warm cataplasms and fomentations.*—As applications to the eye, fomentations are much more convenient and elegant than poultices. Warm water simply may be used for the purpose, or chamomile decoction, poppy decoction, and the like. The application is made by means of compresses, as just described for cold lotions. The application requires only to be made occasionally, and that merely for a period of from five minutes to a quarter of an hour at a time. Warm cataplasms and fomentations should never be allowed to become cold on the eyes. After their removal, the eyes are to be gently dried with a soft linen cloth, and care taken that they be not exposed to a draught of air.

114. *Watery vapours.*—In order to receive watery vapours on the eyes, the patient holds his face over a vessel containing hot water; a cloth being thrown over all. When it is wished to have steam play more directly on the eye, a funnel is inverted over the vessel, and the tube directed towards the eye at a proper distance. After the application, the face and eyelids are to be well dried, and exposure to any draught of air carefully avoided.

c. Medicated Vapours to the Eyes.

115. *Medicated watery vapours.*—In some cases, the hot water is mixed with some aromatic or narcotic substance, such as tincture of opium, tincture of camphor, compound tincture of camphor, tincture of hyoscyamus, a spirituous or vinous solution of extract of belladonna, (℥j — ℥j,) in the proportion of a

teaspoonful or two to the cupful of hot water about to be used for steaming.

116. *Dry warmth and vapours of aromatic or narcotic substances.*—Bags of aromatic or narcotic herbs hung over the eyes are employed partly to keep up dry warmth, and partly for the sake of the exhalations they give out. The bags are made of coarse lawn or muslin, washed and rubbed soft. Being lightly filled, the bag is sewed close, and then quilted at different places, so as to keep the materials equally spread out, and to prevent them from sinking down. The bags ought to be made as light as possible, not more than of the thickness of a finger, and about the size of a playing-card. They are fixed to a band passed round the forehead, so as to hang free: they ought not to be bound over the eye. The bags are warmed before being applied. The materials used for filling the bags are aromatic species, (chamomile flowers, sage, rosemary, thyme, &c,.) mixed or not with shavings of camphor. The species are reduced to a coarse powder, from which all dust is to be separated by a sieve. To fill a bag of the size above indicated, one and a half to three drachms of herbs, flowers, &c., will be required. Bran or bean-flour is used as an excipient and diluent of the aromatic or narcotic materials. When *camphor* is the only active substance employed, it may be applied by means of a compress, prepared by enclosing a layer of cotton wool, impregnated with it, between two layers of gauze. The impregnation is readily effected by soaking the wool in strong spirit of camphor, and then allowing it to dry quickly; when dry, the wool is teased out.

117. Examples of materials for herb-bags.

℞—Flor. chamomill.
—— sambuc. āā p. j.
Farin. fabarum, pp. ij.
M. F. Pulvis.

℞—Pulv. hb. belladonnæ ℥j.
Farin. amygd. dulc. ℥j.
M. F. Pulvis.

118. *Stimulating vapours.*—The vapour of the weaker volatile fluids is applied by spreading the fluid out on a warm surface and allowing it to evaporate near the eyes. Thus, having poured a few drops of the fluid into one hand, and spread it out on the palms of both, by rubbing them quickly together, the hands are to be held one before each eye more or less close

according to the strength of the material and degree of action desired.

d. Collyria, &c.

119.—The word Collyrium, as at present understood, means an eye-water, but formerly it was applied to any medicine for the eyes, whatever its form. Recurring partially to the original and wider acceptation, it is purposed under this head to treat not only of eye-waters, but also eye-salves and eye-powders. The skin of the eyelids, and the conjunctival surface, are the parts of the eye which, under ordinary circumstances, are most open to the contact of remedies ; the derivative lachrymal passages, though also directly, are less easily accessible. Of the other parts of the eye the proper substance of the cornea, when laid bare by ulceration, and the iris when it is prolapsed in consequence of a wound or penetrating ulcer of the cornea, are those which may become the subject of the direct action of medicinal substances. The lachrymal gland and Meibomian follicles may be influenced by the action of collyria on their excretory orifices, in consequence of the sympathy depending on continuity of structure. The internal tunics, also, by virtue of their contiguity, may be sympathetically affected by applications to the conjunctiva; though in general, when these are irritating, rather injuriously than beneficially.

120. *Eye-waters and drops* are solutions of astringent, stimulant or narcotic substances, or of all combined. Their state of concentration regulates the mode of application, hence the division into eye-waters properly so called, and drops for the eyes.

121. *Eye-waters properly so called*, are the weaker solutions, and are used to bathe the eye occasionally in the course of the day. The fluid is to be put into a cup in sufficient quantity and made tepid. The patient, holding his head over the vessel, is to lave his eye with the water by means of a piece of sponge or soft linen rag; and after this has been done for a few minutes, some of the fluid may be dropped fairly into the eye by an assistant squeezing the soaked rag over it, while the patient lies on his back, and endeavours to hold his eyelids apart. After this, the eye may be laved again for a minute or so, and then carefully dried with a soft linen cloth. An eye-glass is not to be recommended.

122. A principal object in the process above described is to remove any discharge from the eye. In the blennorrhœal ophthalmia, when the eyelids are enormously swollen and cannot be opened, it may be necessary to inject the eye-water between

the eyelids, after they have been cleansed as much as possible by means of the bathing simply. In using the syringe, however, care must be taken not to injure the patient's eye by pressure or the like, and on the other hand, the operator should guard his own eyes from receiving any spirt of matter.

123. In order to act on the inner surface of the lachrymal passages, the simplest way of applying the eye-water is to drop it into the inner corner of the eye, and leave it there a short time till some is taken up by the puncta. It is sometimes also injected directly through the puncta and canalicules by means of Anel's syringe. Injections are occasionally thrown into the lachrymal passages from the opening of the nasal duct into the nose; but when an external opening into the lachrymal sac exists, whether it has been made by operation or the bursting of an abscess, we have the readiest access to the mucous surface of the lachrymal passages.

124. Examples of eye-waters.

℞—Belladonnæ extract ℥fs.
Aquæ puræ ℥viij.
Solve et per linteum cola.
Sig. Sedative eye-water, to be used tepid.

℞—Aluminis gr. xvj.
Aquæ ros. ℥viij.
Solve. Ft. aqua ophthalmica.

℞—Sulphat. zinci gr. xvj.
Aquæ ros. ℥viij.
Acid. sulph. dilut. gr. xvj.
F. Solutio pro aqua ophthalmica.

℞—Hydrarg. bichlorid. gr. j.
Ammoniæ hydrochlorat gr. vj.
Aq. ros. ℥viij.
Solve, &c.

℞—Lapidis divini* gr. xvj.
Aquæ destillat. ℥j.
Solve et cola.
Colaturæ adde aquæ rosarum ℥vij.
Misce, &c.
Sig. Eye-water.

* ℞—Æruginis,
Nitratis potassæ,
Aluminis āā partes xvj.
Terantur simul et liquefiant in vase vitreo in balneo arenæ. Liquefactis adde camphoræ tritæ partem j: Misce.
Massa refrigerata servetur sub nomine Lapidis Divini.

N. B. To any of the four last solutions, a drachm of vinum opii may be added. The following may be mentioned as directions for use :—To a wineglassful, add as much hot water as will make the whole lukewarm. With the quantity thus prepared, the eyes are to be bathed as directed.

125. *Drops.* These may be applied by means of a quill or glass tube, but a large camel's hair pencil will be found the most convenient instrument. It is to be remembered, however, that to avoid accidents, each patient should have a separate pencil, which ought to be well washed every time it is used. The lower eyelid being slightly everted, its inner surface is to be touched with the loaded pencil, when the fluid will be immediately drawn off and diffused over the lower part of the conjunctiva. Pains must also be taken to allow the drop to make its way underneath the upper eyelid by drawing this from contact with the eyeball, and then moving it slightly up and down. It is frequently necessary to evert the upper eyelid, and to pencil its conjunctival surface directly.

126. Applied in the ordinary way, salves, eye-waters, and drops, scarcely ever come into contact with the conjunctiva of the upper eyelid and eyeball* in any degree of concentration, and too often what does get there acts rather as an irritant than otherwise. I consider it of great importance to insure the access of an application to the upper parts of the conjunctiva, because I have seen cases treated unsuccessfully, or rather irritated for a long time by applications, which, when properly introduced, did not fail of a speedy beneficial operation.

127. In order to apply drops to the eye of a child with the least possible trouble, the surgeon is to seat himself on a chair, with a towel, folded longways, laid across his knees. On another chair, on the surgeon's left hand, and a little in front of him, the nurse with the child sits in such a way, that when she lays the child across her lap, its head may be received on the towel, and between the knees of the surgeon, and thus held steadily. The nurse confining the hands and arms of the child, the surgeon easily draws down the lower eyelid and drops in the fluid; he then draws the upper eyelid up a little, and also from contact with the eyeball, in order to allow the drop to get underneath. The eyelids are then alternately to be drawn from each other, and made to approach so as to favour the spreading of the fluid over the whole conjunctival surface.

* In illustration of this, it may be mentioned, that in most or all the cases in which, from the abuse of the nitrate of silver drops, the conjunctiva has become discoloured, it is the lower part of this membrane which is so affected.

128. Examples of eye drops.

Vinum opii, pure, or diluted with one or two waters, is often used for dropping into the eye.

℞—Nitratis argenti gr. iv—x.
Aquæ destillatæ ℥j.
Solve.

℞—Hydrarg. bichlorid. gr. fs.
Aquæ destillatæ ℥vij.
Solve et cola. Colaturæ adde vini opii ℥j.
Misce.

℞—Lapidis divini gr. v—x.
Aquæ destillatæ ℥vij.
Solve et cola. Colaturæ adde vini opii ℥j.
Misce.

℞—Extract. belladonnæ gr. xx.
Aquæ destillatæ ℥j.
Solve et per linteum cola.

℞—Atropiæ sulphat. gr. ij—iv.
Aquæ destillatæ ℥j.
F. Solutio.

129. *Eye-salves.*—Salves are applied to the borders of the eyelids, or to the whole conjunctival surface. In the former case only, should the patient or his attendants be intrusted with the application. In the latter case, more discrimination, as well as tact, being required, the surgeon should apply the salve himself.

130. Before applying a salve to the edges of the eyelids, all incrustations of matter about the roots of the eyelashes must be removed. This is done by first rubbing the part with fresh butter or lard, and after a while bathing it with tepid water; the incrusting matter is thus softened, and may readily be separated with the finger-nail or head of a pin.

131. The anointing of the edges of the eyelids may be performed by means of a hair pencil, or simply with the point of the finger. The eyelid being held slightly everted, the salve is applied along its border to the mouths of the Meibomian follicles, then smeared outside the insertion of the eyelashes, and afterwards carefully rubbed in at their roots, the eyelids being at the time kept gently closed.

132. When a salve is to be applied to the whole surface of the conjunctiva, a piece the size of a split pea is to be taken up on the point of a probe, or on the point of the nail of the little

finger, and insinuated under the upper eyelid, while this is drawn forward from contact with the eyeball. When the salve is fairly in the eye, the upper eyelid is to be gently drawn down, and rubbed over the eyeball with the finger for a minute or two, in order to diffuse the salve, now melted by the heat of the eye, between the eyelids and eyeball, and consequently all over the conjunctiva.

133. If the palpebral conjunctiva be the part on which the salve is principally to exert its action, the application may be limited to it, in which case the pain is less severe than in the former. Having everted the eyelids, the exposed conjunctival surface is to be rubbed with the salve either by means of a hair-pencil or the point of the finger.

134. Salves are sometimes applied to the lachrymal passages, by smearing the meshes, catgut-strings, &c., which are introduced into the nasal duct, whether from the nose or through an external opening into the lachrymal sac.

135. In regard to the application of a strong salve to the eye, it is necessary here to give a caution, viz., not to insert it in a lump within the lower eyelid and leave it there. I have seen the conjunctiva of the inferior palpebral sinus in a sloughy state from a lump of nitrate of silver ointment having been put in, and no care taken to diffuse it by rubbing the eyelid over the eyeball. In the case of ointment inserted under the upper eyelid, the natural motions of the part will make up in some degree for the neglect of the surgeon.

136. Examples of eye-salves.

℞—Oxid. hydrarg. rrbri bene lævigat. gr. iii—vi—xv.
Axungiæ præparat. ʒij.
Misce accuratissime: ft. unguentum ophthalmicum.

The two weaker forms are used for anointing the edges of the eyelids, and may be entrusted to the patient. The stronger form should be applied only by the surgeon himself. Applied to the whole conjuctival surface it is found a very efficient remedy in various inflammations of the conjunctiva, and ulcers, specks, &c., of the cornea. It is less severe in its operation than the nitrate of silver ointment.

The citrine ointment of the pharmacopœias, diluted with three or more parts of lard and oil, is a useful application to the edges of the eyelids.

℞—Argent. nitrat. gr. ij—x.
Aq. destillat. q. s. ad solvend. nitrat.
Unguent. cetacei ʒj.
Prius solvatur nitras; dein misceatur accuratissime solutio cum unguento.

This ointment has been used with much success not only in chronic, but also in cutting short acute inflammations of the conjunctiva; but the pain it causes is very severe.

The following is what is known by the name of Janin's ointment for the eyes.

℞—Præcipitat. alb. gr. xv.
Tutiæ præparat.
Boli armen. ppt. āā ʒfs.
Adip. suilli ʒi—ʒij.
M. exactissime: ft. ungt. ophthalmicum.

137. It is of great consequence that eye-salves should contain no gritty particles; the powders entering into their composition, therefore, should first be reduced by trituration to as impalpable a state as possible, and then carefully levigated with a little water or oil, previously to being mixed with the excipient. Substances soluble in a small quantity of fluid, such as the nitrate of silver and sulphates of zinc and copper, may be dissolved. When camphor enters as anin gredient into an eye-salve, it should first be dissolved in a fixed oil. The excipient best adapted for eye-salves is prepared lard, simple cerate, or spermaceti ointment.

138. *Eye-powders or Dry Collyria.*—The application of irritating powders to the eye is much less frequent now than formerly. They were principally used against specks of the cornea. Insufflations of calomel have been strongly recommended in the puro-mucous ophthalmia.

The powder, reduced to the greatest impalpability, *pulvis subtilissimus*, is blown into the eye through a quill, or applied by means of a moist hair pencil. The surgeon should always do the operation himself.

Refined sugar or sugar-candy reduced to a very subtle powder has been principally used either alone, or as an excipient and diluent of other substances.

139. Examples of eye-powders.

℞—Sacch. purif.
Oxid. zinci āā pp. æq.
Misce, et tere ut fiat pulvis subtilissimus.

℞—Oxyd. hydrarg. rubri gr. x.
Sacch. purif. ʒj.
Misce, et tere, &c.

℞—Calomelanos
Sacch. purif. āā pp. æq.
Misce, et tere, &c.

To this one-third of a part of powdered opium may be added.

℞—Aluminis usti,
Sulphat. zinci,
Boracis āā ℈j.
Sacch. alb. ℈ij.
Misce, et tere ut fiat pulv. subtiliss.

The proportions above given may be varied according to circumstances.

e. Potential cautery.

140. It is sometimes required to touch fungosities of the conjunctiva, ulcers of the cornea, prolapsed iris, partial staphyloma, &c., with caustic. The caustics usually employed, are the nitrate of silver, or caustic potass pencil, and the butter of antimony. The latter is applied by means of a hair pencil dipped in it, and freed from any excess. In performing the operation, an assistant secures one eyelid, the surgeon the other, and that in a way according to the part which is to be cauterized. The surgeon then proceeds to make the application of the caustic, carefully confining it to the particular spot. This being done, some sweet oil is to be pencilled on the part before the eyelids are allowed to close. Cauterization of the skin of the eyelids, by sulphuric acid, to remedy entropium, by producing contraction of the skin, will be described under the head of *Entropium*.

f. Local abstraction of blood.

141. *Cupping.*—When blood is to be abstracted by cupping in diseases of the eyes, it is usually on the nape of the neck, or on the temples, that the operation is performed.

142. *Application of leeches to the eyes.*—The region corresponding to the margin of the orbit all round, the side of the root of the nose, and the temple, close to the outer angle, are the places where leeches are most advantageously applied in inflammation of the eyes. A leech, or two, are sometimes applied within the nostrils, and occasionally to the conjunctiva, though the latter is a place of application not much to be recommended—first, because the resulting wounds are elevated, and cause irritation like foreign bodies; and secondly, because scarification is preferable.

143. Half a dozen is the average number applied around one eye in a grown-up person.* In infants, when it is necessary to abstract blood, one leech to the middle of the upper eyelid is sufficient. In very young infants, it is to be remembered,

* [The author here speaks of the European leech; of the American fifty or sixty may be applied.]

however, that the after-bleeding from even one leech may prove fatal, if allowed to continue. The abstraction of blood by scarification is, therefore, to be preferred, especially as the affection of the eyes in infants requiring abstraction of blood, is the ophthalmia neonatorum, in which a scratch or two on the conjunctiva of the everted lids produce a considerable and beneficial discharge of blood.

144. When the after-bleeding (which, it is to be remarked, usually takes place in any quantity from certain of the bites only, and generally more freely on a first than on subsequent application), has been kept up sufficiently long, by means of warm fomentations, these are to be laid aside, and the skin carefully dried, when the bleeding will in general cease of itself; if not, pressure is to be made on the bites with the point of the finger, for a short time, or the bites touched with much-diluted nitric acid (gtt. j—℥ij).

145. Discoloration of the eyelids from ecchymosis, generally results from the application of leeches, for which the patient should be prepared. From idiosyncrasy, erythema, or erysipelas—with very considerable œdema perhaps—is sometimes the result of the application of leeches to the face. In ordering leeches, therefore, to the face, inquiry should be made if leeches were ever applied before, and if any such tendency to erythema manifested itself. Though alarming to the patient, the erythema and œdema in general soon subside. A saturnine lotion may be used as an application in such a case. Sometimes, especially under the circumstances just mentioned, suppuration of the wounds takes place, and knotty cicatrices are left.

[These cicatrices usually produce some degree of disfigurement, and in females, therefore, the practitioner should not apply leeches to the cheek, or close around the orbit. Indeed, we consider it preferable not to apply leeches to those regions in any case, as they are there often productive of irritation, and we always direct their application to the temples or behind the ears.]

146. *Scarification of the conjunctiva.*—The simplest instrument for this purpose is a common lancet, rounded at the point.

147. *Scarification of the conjunctiva of the lower eyelid.*—In order to this, the lower eyelid is to be everted, by applying the points of the fore and middle fingers of the left hand on the middle of the eyelid, and in such a way that the extreme points correspond to the insertion of the eyelashes. The skin of the eyelid and neighbouring part of the cheek is now to be drawn down a little; and when this is effected, the extreme

points of the fingers are to be directed backwards, gently pushing them a little between the lower margin of the orbit and the eyeball. By this means the conjunctiva is fully exposed, stretched, and rendered prominent. Two or three scratches are then to be made with the instrument, held perpendicularly to the surface, in a direction from one angle of the eye to the other. The blood flows more or less freely in drops, and is to be taken up with a pit of dry lint held to the edge of the eyelid, but not allowed to touch the scarified part, as this is apt to cause the blood to stop. When, however, the blood begins to coagulate on the scratches, and its further flow is stopped, the flakes of coagulated blood may be removed with a bit of wet lint. The flow of blood is promoted by every now and then allowing the eyelid to become less everted, and then again fully renewing the eversion.

148. *Scarification of the conjunctiva of the upper eyelid.*—The upper eyelid is not so easily everted as the lower; but in those cases in which scarification is most required, the eversion is generally more easily effected, on account of the swollen state of the conjunctiva. The upper eyelid being everted, as already described (s. 36), it is to be kept so by means of the eyelashes pressed against the upper margin of the orbit, whilst the scarifications are made, and as long as the blood flows. When the conjunctiva is much congested and sarcomatous, as in ophthalmia neonatorum, more scarifications are to be made than in the lower eyelid. In some cases of chronic inflammation, the conjunctiva of the upper eyelid is red and spongy looking, towards the angles, but not much affected in the middle. In these cases, the scarification is to be confined to a slight scratch or two on the red and spongy places.

149. In granulated conjunctiva, a mode of scarification, which I have employed with advantage, consists in making a small crucial incision through each granulation, or when they are small and closely compacted, by making a number of cross hatches.

150. It has been objected to scarification, that the traumatic irritation which is occasioned does more harm than all the good effected by the loss of blood. But this is certainly not a correct view of the matter. In the proper cases, great and decided advantage is often obtained from scarification—not, however, so much by the mere quantity of blood abstracted, as by relieving the congestion of the conjunctiva, and thus preparing it to be more beneficially acted on by the applications made to it immediately after.

151. *Division of enlarged vessels in the sclerotic conjunctiva.*—This may be readily effected by means of a small sickle-shaped needle introduced through the conjunctiva under the vessel, and made to cut itself out, by which manœuvre the vessel is divided. But it is usually found better to excise a portion of the vessel in order to obviate the reunion of the divided ends, and the refilling of the vessel, which readily take place. To effect this, the eyelids require to be held apart by an assistant, as both hands of the surgeon are necessarily engaged, the one in taking up with a hooked forceps a fold of the conjunctiva, containing the portion of vessel to be excised,—the other in snipping it and a piece of the vessel away with a pair of curved scissors. The scissors should be held with the convexity towards the eye, and ready for use, before the fold is taken hold of with the forceps. Generally, though the fold of conjunctiva is snipped away, the vessel is not cut, but merely exposed; in this case the exposed part of the vessel is to be seized directly with the forceps and cut away.

152. *Excision and incision of chemosed conjunctiva.*—In chemosis, the elevated fold of conjunctiva all round the cornea is excised or incised, partly for the sake of the bleeding thereby occasioned, and partly to relieve the tension of the conjunctiva, and the pressure it exerts on the cornea. Three plans have been had recourse to:—

1. The excision, by means of a hooked forceps and curved scissors, of small folds of the chemosed conjunctiva, here and there; or, the excision of the whole of the chemosed conjunctiva all round the cornea.

2. Simple incisions into the chemosed conjunctiva, concentric with the cornea or in no particular direction.

3. The plan recommended by the late Mr. Tyrrell, of making incisions in the conjunctiva, in a direction radiating from the cornea, and at the places corresponding to the intervals between the insertion of the recti muscles. For this purpose, the eyelids being held apart, the one by the surgeon, the other by his assistant, the incisions are made by means of a cataract knife, which, with its back to the cornea and point towards the circumference of the eye, is to be made to transfix the overlapping fold of conjunctiva, and then pushed on till it cuts itself out.

g. Counter-irritation.

153. In diseases of the eye, counter-irritation is usually made on the nape of the neck, behind the ears, or on the crown of the head, [or on the arm,] by means of repeated blisters, tartar-emetic

plaster, or rubefacient liniments. When the counter-irritation is required to be long-continued, it is made by means of warm plasters between the shoulders, a seton in the nape of the neck, or issue in the arm.

154. Counter-irritation may sometimes be applied nearer the affected organ, as on the temple, or the forehead, above the eyebrow, by means of small blisters, or the momentary application of a salve containing strong liquor ammoniæ, in the proportion of ʒij or ʒiv to ℥j of lard. Counter-irritation has been recommended, in some cases, to the outside of the eyelids by means of cauterization with nitrate of silver, and even by the application of blisters.

h. Evulsion of eyelashes.

Fig. 5.

155. The instrument best adapted for the performance of this simple but nice operation, is a forceps with broad points, like tweezers, fig. 5; but a common good anatomical forceps will do. The eyelid being slightly everted and drawn from the eyeball with his left hand, (s. 30, 31,) the surgeon, with the forceps in his right hand, proceeds to pluck out one hair after the other singly; and the mode of doing so is to take hold of it with the forceps as near its root as possible, and to pull it out steadily —not too quickly nor with a jerk, as by doing so the eyelash is more apt to be broken short. If the eyelash should break short, its stump must be carefully looked for, seized with the forceps and plucked out, for if left, it would irritate more even than the eyelash did when whole. If eyelashes are to be plucked out from both eyelids, the operation should be commenced on the lower.

i. Foreign bodies in the oculo-palpebral space of the conjunctiva, and their removal.

156. When a foreign body has got into the oculo-palpebral space of the conjunctiva, it is in common language said to have got *into the eye.*

157. Chemical or mechanical irritation of the conjunctiva is followed by a spasmodic closure of the eyelids and the discharge of a flood of tears. If the irritation have been produced by a substance in a state of vapour, the conjunctiva is in this way protected from its further action, and the smarting soon subsides. Strong acid vapours, however,—of hydrochloric acid for exam-

ple,—may at once produce serious injury by decomposing the epithelium of the conjunctiva and cornea.

158. Consistent substances of a kind not calculated to adhere to the conjunctiva, are either immediately washed out of the eye by the tears, the discharge of which they have excited, or in the case of small particles, they may be found after some time lying enveloped in mucus in the lacus lachrymalis, having been carried there by the movements of the eyelids, and probably also by the action of the vibratile cilia of the palpebral conjunctiva.

159. When a foreign solid particle lies between the firm part of the eyelid and the eyeball, it causes great irritation, and excites the orbicularis muscle to strong spasmodic action. This serves but to aggravate the distress, by fixing the particle, if it be of a nature to adhere to the conjunctiva.

160. In a case in which a foreign body has got into the eye, and from the seat and severity of the irritation it is supposed to be lodged between the firm part of the upper eyelid and the eyeball,—if on gently raising the upper eyelid, and carefully examining the surface of the cornea and white of the eye, the foreign particle be not detected there, and if after taking hold of the upper eyelid by the eyelashes, and drawing it down over the edge of the lower eyelid, so that the ciliary edge of the latter may sweep the inner surface of the upper eyelid, the particle is not felt to be removed, the upper eyelid should be everted, and its conjunctival surface examined as above described (ss. 36, 38), when most probably the offending particle will be discovered adhering to it. If the foreign particle is not at once detected, the possibility of its being transparent should be taken into consideration, and an examination of the whole exposed surface made with great care.

161. The foreign particle having been detected, it may readily be removed by the touch of a hair pencil, moistened and brought to a point, or of a toothpick, or the eyed end of a probe, or any other flat blunt-pointed instrument.

162. Foreign bodies when within the lower eyelid do not cause so much irritation as when within the upper, and their detection is more easy, the lower eyelid being more readily everted than the upper, (s. 34.)

163. Foreign bodies which have entered the oculo-palpebral space, sometimes get lodged in the palpebral sinuses of the conjunctiva, and may there be retained for a length of time, without causing much or any irritation, the conjunctiva of the sinuses being so loose, and the subjacent cellular and adipose tissue of

the orbit so soft, that the body is not much pressed on by the opposing surfaces. The large size of the bodies which have been found lodged in the palpebral sinuses without having given rise to irritation, is astonishing.

164. When, therefore, notwithstanding the absence of much, or any irritation, there is still reason to believe that a foreign body is in the oculo-palpebral space, and when, by the mode of examination above described, it has not been detected, attention should be directed to the palpebral sinuses, and an exploration of them made as above described, (ss. 34, 37.)

165. A foreign body, especially when projected with force into the eye, may at once adhere to the ocular conjunctiva—generally the conjunctiva corneæ. It sometimes happens that the husks of small seeds, and other analogous bodies, such as the wing-case of certain insects, or, as I have seen in a fisherman, one of the valves of a minute bivalve shell, getting into the eye, adhere very closely to the sclerotic or corneal conjunctiva. Inflammation having set in, these foreign particles are liable to be mistaken for pustules or phlyctenulæ, resulting from the inflammation. This, therefore, should lead to a careful examination in any suspected case, when the nature of the body on the cornea cannot fail to be recognized. Removal is readily effected by any of the instruments above mentioned.

166. The ignited sparks detached from iron instruments in the course of various operations, called *fires*, and which so frequently strike and sink into the conjunctiva cornea of the workman, appear as small dark points on the surface, with some dimness of the cornea around. They give rise to more or less pain, especially when the eyelids are closed, together with redness and lachrymation.

167. The foreign body is at first firmly fixed, but afterwards becomes loose. It is in general easily turned out of its nidus by means of a toothpick or small silver spatula.* When removed it is found, on close examination, to be black oxide of iron fused into a minute globule.

168. If the removal from the eye, of such foreign bodies as are above mentioned, is effected soon, the distress is in general at once relieved or greatly mitigated. Sometimes a sensation remains as if the foreign body were still in the eye; this is owing either to vascular injection or to abrasion of some part of the conjunctiva.

169. Caustic, or hot substances, whether solid or fluid, getting into the eye, so quickly exert their action, that much, if not all,

* [We usually employ for this purpose a cataract needle.]

the injurious effects have already occurred before means can be taken for their removal.

170. While solid caustic substances are still in the eye, the best application to make in the first instance is sweet oil. After that, the surgeon may proceed to remove the foreign substance, and to effect this some pains will often be required, especially if it has been lime or mortar, for the particles of these substances are apt to adhere very closely to the conjunctiva. Exploration of the palpebral sinuses should not be neglected lest pieces may have lodged there. After the eye has been freed as completely as can be done from particles of lime or mortar, water should be injected into the eye in order to carry away what remains of the caustic may exist.

171. When gunpowder has been exploded into the eye, besides the burn which results, the grains may fix in the conjunctiva and in the cornea—in which case, unless carefully picked out, they will leave indelible marks and opacities.

172. Particles of such substances as potass, nitrate of silver, &c., getting into the eye, quickly become dissolved in the tears, and their injurious operation may spread like that of a caustic fluid, before they can be removed.

173. In this case, and in the case of caustic fluids, the application, in the first instance, should be some substance calculated to decompose them and render them inert, so as at least to arrest their further destructive action; thus, in the case of sulphuric acid, which has sometimes been thrown into the eyes of persons with a criminal intention, a solution of subcarbonate of soda—gr. iv aq. ℥j, or magnesia suspended in water, should be immediately used as a lotion and injection for the eyes.

174. Simply hot substances, such as melted tallow, pitch or lead, quickly cool of themselves, and all that requires to be done in the first instance is their removal. If pitch cannot be readily removed, sweet oil will promote its separation.

175. The effects of the intrusion of different foreign bodies into the eye, and their treatment, will be considered under the head of *Injuries of the Eye.*

k. Paracentesis of the cornea, or evacuation of the aqueous humour.

176. The various objects for which this operation is had recourse to, are detailed in their proper places. Here the operation itself only falls to be described. It is simply the first step in making the section of the cornea for the extraction of a cataract. A cataract-knife or a lancet-shaped knife is the

instrument best adapted for the purpose. If the operation is undertaken when the eye is very intolerant of light, there is great difficulty in exposing the cornea sufficiently for the purpose, as on the eyelids being opened, the eyeball is involuntarily rolled upwards. One eyelid requires to be secured by an assistant, while the surgeon takes charge of the other. The knife is entered at about one-twentieth of an inch from the sclerotica, and, in doing so, the principal precaution to be observed is not to push the point on in the substance of the cornea, under the impression that it has penetrated into the anterior chamber. The thickness of the cornea and the direction of its surfaces, are such, as to require the point of the instrument to be at first directed towards the centre of the pupil. The point of the instrument having fairly pierced the cornea, its handle is to be inclined towards the temple before pushing the blade farther into the anterior chamber. The extent to which the blade is pushed into the anterior chamber should be such, that its point do not advance beyond the temporal margin of the pupil, so that were the aqueous humour suddenly evacuated, the iris might be between the point of the instrument and the lens. Hence the propriety of using an instrument of the shape mentioned, which is calculated to make a sufficiently large puncture without penetrating far into the anterior chamber. The puncture having been sufficiently made, the instrument is to be withdrawn a little and slightly turned on its axis, so as to make the wound gape, and thus allow the aqueous humour to flow out. In proportion as this takes place, and the iris approaches the cornea, the knife is withdrawn.

CHAPTER II.

OPHTHALMIC INFLAMMATION.

177. As many of the most important of the diseases of the eye consist either in inflammation itself, or in its effects, and as all our operations on the organ must be regulated by the kind and degree of inflammation we expect to follow, an accurate knowledge of the ophthalmiæ must ever be considered the master-key of our subject. Ophthalmic inflammation, therefore, is worthy of the most particular attention of the prac-

titioner. Preparatory to entering on its study, it will be useful to give a brief exposition of the nature of inflammation in general.

Section I.—INFLAMMATION IN GENERAL.

178. When a part of the body visible externally is affected with inflammation, the observer perceives it to be the seat of *redness*, *swelling*, and *heat;* the patient moreover says that he feels it to be the seat of *heat* and *pain*. The conditions on which these symptoms depend are briefly these:—

a. The *redness* is owing to the stagnation and accumulation of red blood-corpuscles in the small vessels—in other words, to *congestion*.

b. The *swelling* depends partly on the distension of the small vessels by the accumulated blood, but principally on the infiltration of the part with exuded matters.

c. *Heat*.—The objective increase of heat, or that actual increase ascertainable by the thermometer, may be, in a general way, correctly enough attributed to the increased accumulation of blood, and other attendant conditions, favouring a more active operation of those causes on which the natural production of heat depends. The patient's sensation of increased heat depends partly on the actual increase of heat as ascertained by the thermometer, and partly on an increased susceptibility of the sensitive nerves.

d. *Pain*.—The pain which may occur at first is owing to the change of state of the sensitive nerves, occasioned by the exciting cause of the inflammation. The increase of pain, the new kinds of pain, and the extension of pain to other parts which subsequently occur, are owing, in addition to the irritation produced by the pressure exerted, by the distended vessels and by the exuded matter, on the common sensitive nerves already in a state of excitement, to sympathy, &c. When there is much throbbing, the attending pain is aggravated at each pulsation in consequence of the increase of pressure occasioned at the time.

The nature of the process which leads to these conditions —in other words, *the theory of inflammation*, now claims consideration.

A. INFLAMMATION PROPER.

a. Phenomena attending the first steps of the inflammatory process.

179. Retardation of the flow of blood in the small vessels, coincident with dilatation of their calibre, and accumulation, and at last stagnation of the blood corpuscles in the vessels, constitute the first phenomena, constantly appreciable by the microscope in the inflammatory process, as observed in the frog. The *macroscopical* phenomena of inflammation in man, being similar to those observed in the frog, seem to warrant the inference, that the *microscopical* ones also are essentially the same in him as in the frog. The explanation of these phenomena, therefore,—their sequence and relations,—is justly considered the key of the whole theory of inflammation.

180. That the dilatation of the small vessels is primary, and the retardation of the flow of blood in them secondary,—the necessary physical result of the preceding dilatation—is the opinion maintained by most recent authors. And the opinion is to be considered just but only so far as it goes, for it does not embrace the whole truth. The truth appears to be this:—The dilatation is primary, but the retardation of the flow of blood is only partially the effect of it, being greater than the dilatation is sufficient physically to account for. The other cause in operation is what at last determines the accumulation and stagnation of the blood, as will be explained below. By the accumulation of the blood, however, there is a secondary dilatation of the vessels—one from distension, but which more particularly implicates the capillaries—perhaps the sole dilatation of which the capillaries proper are the seat, as will immediately be shown.

181. Having thus determined that there is primary dilatation of the vessels, the next subject of inquiry is the nature of the dilatation. Does it depend on an active state of the walls of the vessels, or on a state of relaxation? The prejudice that inflammation is a state of increased action of *all* the parts concerned, which has led some (justly believing that constriction is the active state of the vessels) to maintain that the vessels are constricted in inflammation, has led others (knowing that the vessels are really dilated in inflammation) to maintain that their dilatation is an active state. These opinions, however, are equally inconsistent with established physiological principles, as they are opposed to the results of direct observation.

182. The fact is that, as was originally suggested by Vacca,

and in corroboration of which microscopical observations were first adduced by Wilson Philip, and now admitted by most authors on the subject, the dilatation of the arteries in inflammation is a state of relaxation or paralysis, not of activity. The increased force of the pulsation of the arteries leading to an inflamed part, and on which throbbing depends, it is to be particularly remarked, is not owing to increased contractile power of the walls of the arteries, but, on the contrary, to diminished contractile power. Being thus relaxed, they yield more readily to the impulse of the blood propelled into them at each stroke of the heart.

183. Whether the capillaries and venous radicles have contractile coats, and therefore subject to dilatation from relaxation is a point which has not been so satisfactorily determined.—I am disposed to believe that dilatation of the capillaries and radicles of the veins is secondary to the retardation of the flow of blood in the arteries, and is owing to distension from the accumulated blood. The constriction of calibre which the capillaries are said to present, though to a small amount, may be ascribed to elastic reaction of their walls, as it exists at the time when the arteries are constricted, and when the flow of blood is accelerated and not impeded by any tendency of the red corpuscles to accumulate.

b. Cause of the accumulation and stagnation of the blood corpuscles in the relaxed and dilated vessels.

184. Retardation of the flow of blood has no effect in producing accumulation and stagnation of the red corpuscles, and though in consequence of it accumulation and stagnation of colourless corpuscles may take place, this is never to such an extent as to arrest the flow of the red corpuscles.

185. The appearances attending the stagnation of the red corpuscles, viz., the red corpuscles agglomerating together, and applying themselves here and there flat against the walls of the vessels and adhering to them, whilst other red corpuscles apply themselves to those already adherent, are such as might be supposed to be the effect of a suspension of the conditions by which, in the natural state, the red corpuscles keep in the middle of the stream, neither adhering to the walls of the vessels nor to each other, and do not readily enter the smallest capillaries —the effect, in fact, of the establishment of an attraction between the red corpuscles on the one hand, and the walls of the vessels on the other, as well as among the red corpuscles themselves, instead of the absence of attraction or the actual repulsion which

naturally exists. But supposing all this—supposing that attraction does come into operation, the question remains, How is the attraction called forth? or what are the conditions on which it immediately depends ? or even which attend it ?

186. Before entering upon an exposition of the theory which appears to me to harmonize most completely with all the facts of the case, I assume the following propositions :—

1. That the constriction and dilatation of the calibre of the small arteries at least, if not of the capillaries, are owing to contraction and relaxation of their walls by virtue of the vital endowment of contractility or tonicity which they possess ; the exercise of which contractility is dependent on nervous influence.

2. That the constant moderate exercise of this endowment on which the ordinary state of tone of the vessels depends, is determined by the constant moderate discharge of nervous influence.

3. That whilst a greater state of constriction of the vessels than ordinary is owing to an increased discharge of nervous influence, the relaxation, atony, or paralysis of the walls of the vessels on which their dilatation depends, is owing to the suspension of nervous influence.

4. That the relaxation, with dilatation of the vessels from suspension of nervous influence, is the precursor of the retarded flow of blood and stagnation.

187. How the suspension of nervous influence from the walls of the small arteries on which their dilatation depends, is produced, involves the question of the mode of operation of the exciting cause of inflammation. To this attention will by and by be directed. At present inquiry has to be made how the suspension of nervous influence from the small arteries, and the consequent relaxation and dilatation of these vessels are connected with the retardation of the flow of blood and subsequent stagnation.

188. In entering upon this inquiry, I have in the first place to remark, that it appears evident that the well-known agglomeration of the red corpuscles of newly-abstracted blood, is owing to their being withdrawn from some influence under which they were while in the body—an influence which keeps down the tendency to aggregate.

189. The circumstance that the red corpuscles of extravasated blood aggregate, shows that that influence is exerted on the blood only while within the vessels. But the circumstance, that the red corpuscles do aggregate in inflammation

within the vessels, shows that the influence here spoken of may cease to be exerted on the blood even there.

190. Now it has been seen, that it is not when the vessels are constricted, and consequently when they are receiving nervous influence, but when they are dilated, and when, consequently, there is a suspension of nervous influence from them, that aggregation of the red corpuscles and consequent stagnation of blood take place in the capillaries. The natural inference from this is, that the influence which keeps down the tendency of the red corpuscles to aggregate, is communicated to them by the nerves accompanying the small vessels—arteries, as well as capillaries.

191. When, then, the nervous influence is withdrawn from the small arteries, and they have in consequence become relaxed and dilated, and when any nervous influence which may naturally be discharged on the capillaries is from the same cause withdrawn, the blood flows slowly into the capillaries as into an indifferent cavity, and in the same condition, as regards tendency of the red corpuscles to aggregate, as blood newly drawn from the body, or extravasated, as well as with the same change in appearance.

192. Aggregation of the red corpuscles accordingly takes place, some at the same time adhering to the walls of the vessels. The latter, a phenomenon which is to be attributed in like manner to the suspension of nervous influence.

193. The other cause, besides dilatation of the paralyzed vessels, referred to s. 180, of the retardation of the flow of blood, now appears, from what has been above said, to be the commencing agglomeration of the red corpuscles, and attraction between them and the walls of the vessels. By the dilatation of the vessels, retardation of the flow of blood as a whole—as a fluid is determined; the additional retardation by the commencing attraction affects the corpuscles only, hence their accumulation in increased quantity while the plasma passes on.

c. Mode of action of the exciting cause of inflammation.

194. Seeing that the essential condition of stagnation of the blood in inflammation, is suspension of supply of nervous influence to the small vessels, the action of the exciting cause of inflammation must consist in producing this suspension.

195. In explanation of the mode in which this takes place, Professor Henle has suggested the following theory:—

The exciting cause, of what nature soever it may be, whether external or internal, acts primarily on sensitive nerves, exalting their activity. The motor nerves of the vessels which have

sympathetical relations with the excited sensitive nerves, are secondarily affected. But this affection of the motor nerves of the vessels, which supervenes by reflex action on the excitement of the sensitive nerve, is not a corresponding state of excitement, but an opposite one of depression—of suspension of action—of paralysis.

196. This form of sympathy, in which the state of excitement of one nerve determines depression of another, Henle calls *antagonism*; the name of *sympathy*, in a restricted sense, being applied to that form in which a state of activity of one nerve is called forth by a corresponding state of another.—This latter form is more common in the domain of the cerebro-spinal system; the former in the domain of the ganglionic system, the source of the nerves of the vessels.

197. Sometimes, however, sympathy is exemplified in the vessels by constriction supervening on irritation and preceding dilatation. But, in most cases, relaxation and dilatation of the vessels are not preceded by constriction, but directly supervene on the irritation, no matter whether that irritation have been violent or moderate. Hence Henle contends, that the relaxation of the vessels on which their dilatation depends, cannot be a mere consequence of exhaustion of the vessels from previous action, as has been suggested, but can only be antagonistic. Into this, however, it is not necessary to enter; for, provided suspension of nervous influence and consequent dilatation of the vessels do take place, it is indifferent for the theory of the proximate cause of inflammation above expounded, whether that state of the vessels be the result of antagonism or of exhaustion succeeding a state of activity induced by sympathy.

198. Inflammation excited by exposure to cold, often affects some part other than that to which the cold was immediately applied. In such a case it may be said—*hic stimulus, ibi fluxus;* but in most cases of external inflammation which come under notice, the congestion occurs at the place where the irritation was applied—*ubi stimulus, ibi fluxus.* Hence the widely-spread belief, that the irritation affects the vessels directly; but to say nothing of physiological examples of reflex action on remote vessels which may be adduced in contradiction of the belief referred to, such, for example, as the circumstance that irritation of the conjunctiva, or of the mucous membrane of the nose, excites the congestion in the lachrymal gland, on which the discharge of tears, resulting from the irritation, immediately depends; a pathological one—in various ways more instructive—will be adduced below in the inflammatory congestion of the

conjunctiva and sclerotica which supervenes on a wound of the cornea.

199. *Explanation of the occurrence of inflammation of a part after section or disease of its nerves.*—In those cases in which inflammation of an organ occurs after section of some part of the sympathetic system—inflammation of the eye, for example, after section of the sympathetic in the neck,—as also in those cases in which inflammation of the eye supervenes on section of the fifth pair, and inflammation of the lungs and stomach on section of the par vagum, the inflammation was at one time attributed to the suspension of some peculiar influence supposed to be exerted by the nerves over the nutritive process. It is now, however, admitted, that the nerves do not exert any peculiar influence over nutrition, but that they act indirectly only, and that by virtue simply of their ordinary sensiferous and motiferous endowments. Even the sympathetic, as first declared by Stilling, acts in no other way. Why it appears to be more particularly the nerve governing nutrition, is explained by the circumstance, that it is the principal source of the nerves of vessels.

200. Section of some part of the sympathetic nerve appears to produce inflammation, by directly suspending the nervous influence from the walls of the vessels of the part.

201. The inflammation which takes place after section of such nerves as the fifth pair, the par vagum, &c., appears to belong, as is suggested by Henle, to the same category as that which occurs after section of branches of the sympathetic; it being assumed, that sympathetic filaments or nerves of vessels are mixed with the fifth pair, par vagum, &c.,—a postulate—in favour of which there are not only anatomical facts, but also physiological analogies.

d. Exudation.

203. On stagnation of the blood, exudation speedily supervenes. At first serous, the exuded fluid comes at last to be pure plasma, or at least a fluid containing a greater or less quantity of fibrine.

204. None of the corpuscles of the blood pass out along with the exuded fluid as long as the vessels are entire. But it is often observed, that at certain points the walls of the vessels in which the blood was stagnated have given way and permitted an extravasation of both red and colourless corpuscles.

205. With exudation is completed the inflammatory process properly so called.

e. Inflammation of non-vascular parts.

206. In certain non-vascular parts, morbid actions may go on in all respects similar to those which usually attend or result from inflammation. The cornea, for example, though it is vascular whilst being developed, is, in its fully-developed and healthy state, non-vascular, and yet inflammation of the cornea is spoken of.

207. The cornea, there is reason to believe, derives the materials necessary for its nutrition from the blood circulating in the vessels of the adjoining parts of the conjunctiva and sclerotica. Let us inquire what takes place in the cornea when there is applied to it such an irritation as would excite inflammation in one of the vascular parts of the eye.

208. When the cornea is injured, then, congestion of the vessels of the adjoining parts of the conjunctiva and sclerotica takes place, and exudation into the substance of the cornea by and by ensues. Thus, though non-vascular, and, of course, not the seat of inflammatory congestion, it becomes the seat of a very important part of the inflammatory process—the most important part, perhaps, as regards the events of the process.

209. The cornea in this state may therefore be said to be, to all intents and purposes, inflamed—the only difference in respect to it, as compared with vascular parts, being, that the vascular congestion is *not in it*, but *in adjoining structures*.

210. On the other hand it is to be remarked, that although these adjoining structures are the seat of the congestion, little or no exudation may take place in them or on them, and they may therefore be said to be scarcely or not at all the seat of inflammation as regards the events of the process. When the conjunctiva and sclerotica are really inflamed, exudation in or on them may occur, but then the congestion is different in seat and extent from what it is when the cornea is the seat of the inflammation, and there may be no exudation into the cornea—the cornea may remain unaffected.

211. In the progress of inflammation of the cornea, this structure may become vascular, but such an event is owing to the development of new vessels, such as also happens in inflammation of vascular parts, and as will be considered below.

212. Though inflammation of the cornea, considered as a non-vascular part, has been thus dwelt on, the truth is, that all tissues, as regards their component elements, are, properly speaking, non-vascular, and differ from the cornea only in the degree of proximity to the vessels, and therefore in inflamma-

tion only in the degree of proximity to the source of the exudation.

213. But this very difference affords a natural analysis of the inflammatory process. It enables us to observe separately the two great stages of inflammation proper,—the *congestion* and *exudation*,—the congestion in one place, the exudation in another. It also enables us to observe, as will be shown below, in an uncomplicated manner, the eventual stages of inflammation, such as reorganization and suppuration. Lastly and especially, it enables us to analyze the mode in which the inflammatory irritation is communicated to the vessels—the mode of action of the exciting cause.

214. In what is ordinarily called a vascular part, the irritation, for aught that could be said to the contrary, except by a round-about process of reasoning, as above seen, might act directly on the vessels, as some maintain; but in the case of irritation, applied to the cornea alone, and not either to the conjunctiva or sclerotica, it cannot do so. And for the very simple reason, that there are no vessels in it to be acted on. The vessels which are affected are those of the conjunctiva and sclerotica.

215. The mode in which these vessels are affected, in consequence of irritation applied to the cornea alone, appears to be this:—Excitement of the sensitive nerves of the cornea (for the cornea has nerves, though no vessels) calls forth antagonistically, according to Henle's principle, a state of depression, a temporary paralysis of the motor nerves of the contractile fibres of the walls of the small arteries opening into the capillary network of the conjunctiva and sclerotica adjoining the cornea. The consequence of this is, first, relaxation and dilatation of those arteries, and then accumulation and stagnation of blood in the capillaries, in the manner already explained.

f. Changes in the blood in inflammation.

216. *Change in the stagnant blood.*—The red corpuscles, stagnant within the vessels, cease to be distinguishable individually, and appear as if fused together into a uniform red mass. This change in the appearance of the blood supervenes on stagnation more or less quickly—a circumstance which seems to show that it is owing to some condition coming into operation subsequently to the stagnation.

217. The apparent fusion of the red corpuscles, stagnant within the vessels, being like what is observed in buffy blood out of the body, and the same as may be artificially produced

by an increase of viscid matter and diminution of salts in the plasma, it appears to me very probable that the change is owing to the action of the plasma, inspissated as regards its proteine constituents, but deprived of a portion of its water and salts by exudation of serum.

218. To transudation of colouring matter from the blood in the vessels into the adjacent parenchyma, as also to the endosmotic changes in the red corpuscles connected with their apparent fusion, the variations in the tint of the redness of an inflamed part appear to be owing.

219. *Changes in the general mass of blood.*—Inflammation may arise without any previous change in the general mass of blood, and if limited in extent, may run its course without the supervention of any such change. As, however, in inflammation of any severity and extent, changes in the general mass of blood early show themselves, and as these changes, when they occur, exert an important influence by reaction on the inflammation and its events, they here require some consideration.

220. The most characteristic and important change which the general mass of blood in inflammation presents, is an increase in the quantity of fibrine, and a decrease in that of the red corpuscles. In connection with this change in respect of composition, there is a remarkable increase in the tendency of the red corpuscles to aggregate into rolls, when the blood is drawn from the body.

221. In consequence of the decrease in the quantity of red corpuscles, blood drawn in a well-marked case of inflammation appears paler, thinner, and more fluid than natural. So much more fluid is it, that if a prick be made in the finger of the patient, the blood, instead of oozing slowly out in the form of a drop, flows out quickly, and spreads on the surface of the skin.

222. In consequence of the increase in the quantity of the fibrine, and of the increased tendency of the red corpuscles, diminished in quantity, to aggregate together, blood drawn in inflammation presents the buffy coat—an effect produced by the following process, as I have elsewhere explained: "The minute process leading to the separation of the liquor sanguinis from the red corpuscles, the visible condition for the formation of the buffy coat, consists in an exaltation both of the rapidity and closeness with which the red corpuscles naturally aggregate into rolls, and these again into a spongework, thus squeezing out the liquor sanguinis from among the corpuscles, and allowing the greater specific gravity of the latter

to come more fully into play, whereby the liquor sanguinis, which in such cases is in relatively greater quantity, collects at the top, and coagulating, gives rise to the buffy coat."*

B. TERMINATIONS OR EVENTS OF INFLAMMATION.

Inflammation terminates either in the healing process or in mortification.

a. Nature of the healing process.

223. In the course of the healing process, epiphenomena may occur, which, on account of their prominence and practical importance, are usually spoken of as separate and distinct terminations or events; but the inflammation may not terminate on their supervention, and it is obvious that in the abstract they are merely species of the healing process, and this though their tendency may sometimes be to interrupt rather than promote the cure.

224. With this explanation, *resolution*, *adhesion*, *suppuration*, and *granulation*, are to be looked upon as different species of the healing process, in which inflammation may terminate. Only it is to be remarked, in regard to resolution, that it being the immediate and direct process by which the healing of inflammation takes place, it is also truly a *termination* of inflammation.

225. Inflammation itself, it is known, may, by virtue of the species of the healing process in which it tends to terminate, act as a means of cure of some other disease. Again, one species of the healing process may counteract the wrong direction which another species is taking. Lastly, the termination in mortification itself, may come in as a curative process.

226. As stagnation and exudation are the essential parts of inflammation, so the essential objects of the inquiry into the healing process of inflammation are, how the circulation is re-established in the part, and what becomes of the exuded matter.

α. *Microscopic phenomena attending the re-establishment of the circulation, and their explanation.*

227. Re-establishment of the circulation is observed to take place in consequence of a breaking up of the agglomerations of the red corpuscles, and a loosening of them in the vessels, whereby they yield to the *vis à tergo*, and are carried along in the stream of the circulating blood.

* Br. and For. Med. Rev., Oct., 1842.

228. The absorption of exuded matter, and the disappearance of the red tinge of the adjacent parenchyma, which had resulted from the transudation of hæmatin, eventually ensue, and in time the dilated vessels fully recover their usual calibre.

229. In regard to the re-establishment of the circulation, it is, in the first place, to be observed, that though the vessels may be found still dilated, this is not to be assumed as an indication that nervous influence has not been again restored to them. The overstretched fibres are unable all at once to contract as usual; and as regards the capillaries, they have not recovered their elasticity weakened by over-distension.

230. The re-establishment of the circulation may be said, in a general way, to depend on the cessation of the disposition which the red corpuscles had to remain aggregated, and to adhere to the walls of the vessels, in consequence of which they now yield to the *vis à tergo*.

231. As to the cause of this cessation of the disposition of the red corpuscles to remain aggregated, and to adhere to the walls of the vessels, if the opinion as to the immediate cause of the stagnation of the blood above enunciated, ss. 191, 192, be well founded, it may be naturally inferred that the return of nervous influence to the walls of the vessels is the cause sought for. When, however, the changes in the stagnant blood are taken into consideration (ss. 216, 217), it must be admitted that besides restoration of nervous influence, some other cause is in operation.

232. As the apparent fusion of the red corpuscles, which supervenes more or less quickly on stagnation, even when the mass of blood is healthy, is like that which is presented by the red corpuscles of buffy blood, and appears to be owing to the action of plasma inspissated as regards its proteine constituents, but deprived of some of its salts by exudation of serum (s. 217), so the additional cause sought for, may perhaps be found, by comparing with the changes of the red corpuscles in the process of re-establishment of the circulation, those presented by the red corpuscles of buffy blood out of the body, after the coagulable plasma has been by their close aggregation pressed out from among them. The red corpuscles have then lost much of their disposition to remain aggregated, as is shown by the little cohesion of the under part of the clot. This, without going minutely into the matter, may be said to be owing partly to the abstraction of the coagulable plasma from among the red corpuscles, and partly to the direct action on them of the serum, which is by and by separated. The addi-

tion of a saline solution, at the same time that it causes collapse of the distended corpuscles, disposes them to separate.

233. To apply the inference which may be drawn from the comparison now made, in explanation of the process of re-establishment of the circulation in inflammation:—In consequence of the abstraction of coagulable plasma from among the red corpuscles, stagnant within the vessels by exudation, and the reabsorption of the serum into the obstructed vessels, the red corpuscles are disposed more readily to separate from each other, and from the walls of the vessels, and thus to yield to the *vis à tergo*.

234. The fate of the exuded matter constitutes, as above mentioned, one of the essential objects of the inquiry into the nature of the healing process of inflammation, but before proceeding with this inquiry, it is necessary to consider more particularly than has yet been done, the exuded matter itself.

β. *Exuded matter.*

235. Exudation takes place either into the interstices of the parenchyma, or on surfaces natural or raw, and raw rather. In the case of a natural surface, its epidermis, or its epithelium, if it be resisting, is raised up into a blister by the exuded matter.

236. As already said, the exuded matter from being at first serous, comes at last to contain a greater or less quantity of fibrine, and in this state it is a clear viscid fluid usually called *lymph*.

237. Examined microscopically, the recently exuded matter appears quite amorphous, without any trace of organization.

238. The corpuscles which it is very soon found to contain, are new formations developed after exudation.

γ. *Absorption of exuded matter.*

239. If much matter has not been exuded, absorption of it takes place, as the circulation in the obstructed vessels becomes re-established, and this the more readily if the exuded matter is still fluid.

δ. *Development of organic elements in the exuded matter.*

240. When absorption does not take place, the exuded matter becomes organized; in it, as in a blastema, organic elements are formed. The process by which this takes place is altogether the same in principle as that by which the normal development is originally effected.

241. There are three principal ways in which the exuded matter has been found to be developed and disposed of.

1. After having attained a certain development, the organic elements are, if formed in the interstices of a parenchyma, dissolved and removed by absorption, or if formed on a surface, thrown off.

2. The organic elements undergo further development into tissues, homologous or heterologous. The homologous are principally epithelium, cellular tissue and vessels. In regard to new vessels, it is here proper to remark, that it is a not uncommon, though a very erroneous, notion, that many of the vessels which for the first time become visible in an inflamed part—the conjunctiva for instance—at the commencement of inflammation, are new productions. Not only is this not the case, but even in an advanced stage of inflammation, when exudation has taken place, it may be that no new vessels are formed, although the exuded matter undergoes development into other structures. It is also proper to remark, that what is often meant by "organization," is the development of new vessels; but as has been already said, organization of exuded matter may take place quite independently of the development of blood-vessels. The development of new vessels, in fact, is in itself a process of organization which presupposes the development or organization of other tissues. New vessels are not formed for the purpose of "vitalizing" "effusions of the organizable materials of the blood," for such effusions are already vitalized. It is from such effusions that the new blood-vessels themselves are developed, and this along with the development or organization of other tissues, such as the cellular. The blood-vessels are formed in order to fetch and carry away the materials concerned in the nutrition and further development of these tissues.

3. The organic elements formed in the exuded matter are pus-corpuscles, which undergo no further development, but are discharged from the body, in greater or less quantity, along with the fluid in which they are suspended (*liquor puris*), in the form of pus.

242. The re-establishment of the circulation and the fate of the exuded matter having been considered, a review may now be taken of them in their correlations, as they are exhibited in the different species of the healing process.

ε. *Resolution of inflammation.*

243. When resolution of inflammation of a vascular part, visible externally, takes place, the pain and heat cease, the red-

ness disappears, the swelling subsides, and the part is at last restored to its natural state.

244. When resolution of inflammation of the cornea above referred to takes place, the irritability of the eye ceases, and, on the one hand, the congestion of the neighbouring conjunctiva and sclerotica diminishes; then, on the other, the exudation in the substance of the cornea disappears.

245. Resolution of inflammation consists in the re-establishment of the circulation, and absorption of the exuded matter. The exuded matter may have been still fluid, and may not have become in any way organized, but it is probable that in many, if not in most cases, apparently ending in resolution (such as it has just been defined), the exuded matter has already attained the first degree of development above referred to, and then again become dissolved in order to be absorbed.

ζ. *Healing of a wound.*

246. In the healing of a wound, conversion of the exuded matter into tissues takes place under two different kinds of circumstances; and according as one or the other obtains, there is what surgeons call "healing by the first intention," or by "adhesion," or "healing by the second intention," or by "granulation and suppuration."

247. The stagnation and exudation, and therefore the redness and swelling of the part, do not cease on the occurrence of either of these processes. They continue until the healing process is accomplished, the stagnation, or at least a slow circulation in the part, being the necessary condition of exudation; the exudation, again, that of the supply of material wherewith regeneration is effected.

248. The cornea has been above referred to as a part which, from its non-vascularity, forms a good subject for observing, in a manner uncomplicated by the presence of the vessels in which the blood is stagnant, the development and disposition of the exuded matter in the healing process. The matter exuded into the substance of the cornea from the vessels of the adjacent conjunctiva and sclerotica may (as far as examination with the naked eye, or the eye assisted merely by a magnifying glass goes), be seen to undergo the different modes of development above described.

249. It may be seen that pustules form, and that, in the healing of incisions and ulcers of the cornea, adhesion and granulation, and lastly, cicatrization, may take place without the development of new vessels—a convincing proof that neither

suppuration nor "organization" necessarily implies the development of new vessels.

250. But, as above hinted, new vessels may be formed in the matter exuded into the cornea, and this again affords a very interesting and readily observable example of the development of new vessels, uncomplicated by the previous existence of other vessels in the part.

251. The new vessels, having served their purpose, shrink and disappear, and it is usually not until this that cicatrization is completed.

252. *Healing by the first intention, or adhesion.*—In this case the matter exuded on the cut surfaces becomes forthwith, and all of it, converted into tissues—cellular tissue and capillaries—by which the divided parts are reunited. An epithelium or epidermis is then formed on the surface in the ordinary way, and cicatrization is completed.

253. *Healing by the second intention, or granulation.*—This is a slower process than adhesion. The inflammatory congestion persisting, matter continues to be exuded. One part of it is converted into cellular tissue and capillaries—granulations are composed of these new tissues in process of development; another part is converted into pus, which serves as a sort of epithelium to the granulations.

254. As the healing approaches completion, the quantity of exuded matter converted into pus becomes less and less in comparison with that expended in the formation of tissues. At last, no more pus being formed, the exuded matter is developed into epithelium or epidermis, and cicatrization is in this case also completed. As this takes place, the granulations contract and become less vascular by the shrinking and disappearance of many of the vessels which existed in them, as is often so distinctly observable in the case of the cornea, in regard to all the vessels.

255. That the tissue of cicatrice is not quite homologous with the old tissue, is very evident in the case of the cornea by the resulting opacity.

256. The newly-formed tissues—whether their formation be by the adhesive process or by granulation—besides effecting union of divided parts, or supplying the place of lost parts (regeneration), may be formed in excess. In this case *hypertrophy* is the result. If the new tissues are heterologous, they constitute *tumours* of different kinds, *induration*, &c.*

* For more detailed observations on Inflammation, and its events, see my Reports in the Brit. and For. Med. Rev., Nos. xxxiv.-v.

b. Nature of mortification.

257. Mortification is the death of the part affected, together with the blood stagnant in it, and the matter which may have been exuded.

258. The proximate cause or the condition on which mortification immediately depends, is complete stoppage of the circulation; either from all the vessels of the part being the seat of the inflammatory stagnation, or sometimes together with pressure exerted by the exuded matter, the operation of the pressure being favoured by the mechanical conformation of the part.

259. The dead part being the same as a foreign body, the organization tends to throw it off. The separation is effected by softening of the dead part at its junction with the living.

a. Ulceration.

260. The process going on in an ulcerating sore is the opposite of that going on in a granulating sore. For whereas, in the latter, the exuded matter is developed partly into tissues, partly into pus, in the former the exuded matter is not only not organized into tissues, but those at the surface of the part lose their vitality, and are thrown off in minute portions with the discharge, which is either a mere sanies, or at the most an imperfectly developed pus. This death of the ulcerating surface is not owing to any destructive action of the exuded matter which constitutes the discharge, but is owing to the same condition which determines the death of the exuded matter itself. From this it is seen that *ulceration* belongs to the head of *mortification*.

C. VARIETIES OF INFLAMMATION.

a. Distinction of inflammation into ACUTE *and* CHRONIC.

261. Acute and chronic inflammations are so named from the most striking parts of their character,—the former being distinguished by severity of symptoms, the latter by long continuance. In the acute form of inflammation, with severity of symptoms, there is combined rapidity of progress; and in the chronic form, long continuance is tempered by mildness of symptoms.

262. These differences, it will be observed, are merely differences in degree and continuance. There does not appear to be any essential difference in nature between the acute and chronic forms of inflammation. In both there is congestion, in both exudation, and in both the exuded matter undergoes

analogous changes. Moreover, it is to be observed, that between well-marked acute, and well-marked chronic inflammation, all intermediate forms are met with.

263. The conditions on which the striking parts of the character of acute and chronic inflammation appear to depend, are respectively the following:—

In acute inflammation, the congestion is greater; and if resolution, to which there is a tendency, does not soon ensue, exudation of lymph takes place more or less copiously, the result of which is adhesion, or abscess, or thick puriform discharge, as the case may be, after which the circulation may gradually become re-established, and so there is an end of the inflammation.

In chronic inflammation, on the contrary, the congestion is less complete—there is but little tendency to resolution—and exudation is either not so copious within a given time, or it is more watery. Moreover, the congestion persists, and the exudation still goes on, the result of which is hypertrophies, gleet, &c., as the case may be.

264. The cause of these differences of conditions is, perhaps, that in chronic inflammation, the suspension of nervous influence from the walls of the vessels is less complete, and that the dilatation of the vessels is more of the nature of organic enlargement, than dilatation from simple relaxation and distension, as in acute inflammation.

265. Chronic inflammation may either succeed to acute inflammation, or come on slowly of itself, unpreceded by any acute stage. Acute inflammation may supervene on chronic inflammation.

266. The *tissue affected*, the *nature of the exciting cause*, the *state of the constitution*, the *existence of constitutional disease*, &c., are circumstances which exert a modifying influence on the characters of inflammation, and of its events.

267. This is well exemplified in the inflammations of the eye, especially as regards *modifications of inflammation according to the tissue affected*. Composed, indeed, as the eye is, of different tissues, and these, for the most part, open to direct inspection, it affords, when affected with inflammation, an especially favourable opportunity for observing, and often for comparing, the modifications of the phenomena of inflammation dependent on difference of structure. This circumstance, at the same time that it facilitates the diagnosis of ophthalmic inflammation, assists the study of inflammation in general.

b. Modifications of the phenomena of inflammation according to the tissue affected, as exemplified in the inflammations of the eye.

268. *Objective phenomena.*—The more vascular conjunctiva, when inflamed, is redder than the less vascular sclerotica; and the non-vascular cornea is not red at all; but the congestion, and consequently the redness attending inflammation of it, are seated in adjacent parts. Redness of the cornea itself, however, may be subsequently superadded by the development of new vessels in it. Lastly, in the coloured iris, the congestion is not manifested by redness, but by a colour a compound of the yellowish redness of a thin stratum of blood and the natural colour of the inflamed structure.

269. Exudation takes place more copiously from the conjunctiva and iris than from the less vascular sclerotica, and, *cæteris paribus*, the exudation is in proportion to the degree of inflammatory congestion. The exuded matter is for the most part poured out from the surfaces of the conjunctiva and iris, and there are little swelling and thickening, manifesting interstitial exudation, in comparison with the whole quantity of matter exuded; whereas in parenchymatous structures, the exuded matter being received into their interstices, exudation is manifested by more or less considerable swelling. Exudation may give rise to phlyctenulæ and pustules on the surface of the cornea,—to aphthæ on that of the conjunctiva; a difference which is owing to the difference in the resistance of the epithelium investing the two surfaces. Exudation may take place into the cellular tissue underneath the conjunctiva in inflammation of that membrane, in which case a swelling forms, called chemosis. Lastly, in congestion of the sclerotica, there is comparatively little disposition to exudation, and when it does take place, it is often rather into the neighbouring cornea than into the substance of the sclerotica itself—a peculiarity which seems to hold in the case of other fibrous structures, for example, those around joints in rheumatic gout.

270. From the surface of the conjunctiva, when it is the seat of intense inflammatory congestion, slight hemorrhage readily occurs; but in less intense inflammation, extravasation of blood occurs in the form of patches of ecchymosis into the loose cellular tissue underneath the sclerotic conjunctiva. Effusion of blood may take place from the surface of the inflamed iris, analogous to the hemorrhagic exudations of inflamed serous membranes — and extravasation may also occur into its sub-

stance. But in the latter case, as also in that of extravasation into the substance of the cornea, the spots of ecchymosis are small in comparison with those which present themselves in the loose subconjunctival tissue. The readiness with which bleeding takes place from the surface of the conjunctiva, when the seat of intense congestion, is explicable by the exposure to foreign contact of its delicate superficial capillary network in a state of great distension.

271. A modification of the phenomena of the events of inflammation might *à priori* be presumed to occur in different structures, in consequence of that physiological difference which determines the mode of assimilation peculiar to each structure. That such a modification holds to a certain extent only, and is readily broken through by modifying influences, is shown by the formation of pus in very different structures, and by the circumstance, that a kind of cellular tissue and blood-vessels are the new structures most commonly regenerated, whatever the original structure may be.

272. An influence which manifestly modifies the manner in which the exuded matter is disposed of, consists in the exposure or non-exposure of it to the contact of foreign bodies, including the external air. The matter exuded on the surface of the conjunctiva in contact with the external air, tends to be converted into pus or puriform matter, whilst that exuded on the surface of the iris out of contact with air, is more disposed to be converted into tissue, forming bands of adhesion.

273. The mode in which exposure to the contact of foreign bodies operates in determining suppuration, is probably by their irritation keeping up the congestion, and thus causing exudation in large quantity and of a certain quality. In the cases in which the exuded matter is converted into pus, though not in contact with foreign bodies, the exuded matter has been deposited in large quantity, in consequence of the greatness of the congestion from other causes.

274. In the cornea, there may be observed what will perhaps be admitted as an exemplification of the influence of comparative quantity of exuded matter, in the disposal of it. When exudation takes place slowly and in small quantity, it is developed into tissues; but when exudation takes place, rapidly and in large quantity, suppuration results.

275. The disposition of the iris to form adhesions with the capsule of the lens, as in the case of serous surfaces, presents a remarkable contrast to the indisposition, which, in common with other mucous surfaces, those of the inflamed conjunctiva

have to adhere, even when in close apposition, except when abraded, and therefore no longer mucous surfaces. This appears to point to some peculiarity in the matter, considered as a blastema, exuded from mucous surfaces. Sometimes, indeed, the matter exuded on mucous surfaces presents itself in the form of pseudo-membranes; these, however, do not become organized, like the pseudo-membranes of serous surfaces, but are eventually separated and thrown off like dead parts.

276. In regard to the formation of adhesions between the iris and capsule of the lens, (*synechia posterior*,) it has been contended, that the condition for their formation is not exudation of plastic lymph from an inflamed iris alone, but that the capsule, as well as the iris, must be in a state of inflammation at the same time.

277. However this may be as regards serous membranes generally, it is to be observed of the case under notice, that since inflammation of the anterior wall of the capsule of the lens consists at first merely in exudation into or on it, the exuded matter having its source in congestion of neighbouring parts, there can scarcely be any difference whether the lymph is exuded from the pupillary margin of the iris, or from the same source as in those cases which are considered to come properly under the head of anterior capsulitis (s. 389). It must be admitted, that synechia posterior occurs in cases in which it would be rather too much to say, that in addition to the iritis, there was anterior capsulitis also.

278. On the other hand, there is great indisposition to the formation of synechia anterior, even when the corresponding surfaces of both iris and cornea are inflamed and in contact, except when there is abrasion of the corneal surface.

279. Of the different structures of the eye, the cornea is that most prone to mortification and ulceration, though perhaps the changes which sometimes take place in the lens and vitreous body might properly be referred to this head.

280. *Subjective phenomena.*—The most striking modification of these, perhaps, is the difference of pain. Thus the pain which attends inflammation of the conjunctiva, is like that produced by a foreign body in the eye, whilst the pain in inflammatory congestion of the sclerotica is of a rheumatic character, and seated around the orbit, in the temples, &c. Dimness of vision attends inflammation of the retina. The various morbid visual sensations are the result of the pressure, irritation, &c., to which the retina is subjected in inflammation of other structures of the eye.

c. Modifications of inflammation according to the exciting cause.

281. The influence of the exciting cause in modifying inflammation, appears to consist, sometimes in merely determining inflammation in a particular tissue, as when exposure to cold causes a catarrhal ophthalmia; sometimes, also, in the circumstance that the exciting cause exerts a specific action, as in the case of the primary action of the syphilitic or variolous poison.

d. Modifications of inflammation according to the state of constitution, or the existence of constitutional disease.

282. The influence of the state of the constitution or of constitutional disease, appears to consist in modifying the influence of the exciting cause, as regards its operation in determining inflammation in a particular tissue, at the same time that it may impart peculiar characters to the inflammation,—thus, in particular states of constitution, exposure to cold will determine phlyctenular rather than simple catarrhal ophthalmia; or in a constitution tainted with syphilis, for example, it will determine parenchymatous iritis rather than any other form of ophthalmic inflammation.

283. It would, however, be endless, if not impossible, to trace the innumerable combinations of influences modifying inflammation.

D. MODE OF ACTION OF REMEDIES IN INFLAMMATION.

a. General remedies.

284. From the view of the nature of inflammation, and of the mode of action of its exciting causes, above laid down, it might be inferred, that the remedies which have a direct effect in subduing inflammation, act by determining the vessels to contract, and that through the medium of the ganglionic system.

285. This, indeed, appears to be the action at least of some remedies. As these, at the same time that they promote contraction of vessels, call forth contraction of other organic contractile parts, so it may be inferred, that other antiphlogistic remedies, which are certainly known to promote the contraction of various organic contractile parts, promote the contraction of vessels also; and this, it may be inferred, is the action by virtue of which they exert their antiphlogistic effects.

286. The depression of the animal vital powers which some

remedies occasion for the time, might be looked upon rather as a concomitant effect of their action, than as the means through which their antiphlogistic effects are essentially produced.

287. The Italian therapeutists, influenced by the erroneous opinion, that inflammation is a state of increased action of all the parts concerned—that it is an absolute hypersthenia—exalted dynamism—describe antiphlogistics as absolutely contra-stimulant or hyposthenisant, reducing the powers of the vessels, as well as of the whole system, by diminishing the force of the ganglionic nerves; whereas they would appear to be hyposthenisant of the animal vital powers only, being, in fact, excitants of the contractile fibres of the vessels, and of the organic contractile fibres generally, probably through the medium of the ganglionic system.

288. What has just been said of the mode of action of antiphlogistics, it will be perceived is in the main what is more usually considered to be the action of tonics. The only difference, indeed, between antiphlogistics, properly so called, and tonics, appears to be, that tonics either do not act, or act less energetically in primarily depressing the animal vital powers than antiphlogistics, commonly so called, and more slowly, though more permanently, in increasing the tone of the organic contractile fibre. This shows how that tonics are not incompatible with antiphlogistics.

b. Local remedies.

289. The first effect of irritating applications opportunely made to an inflamed surface—the conjunctiva, for example—is a temporary aggravation of the inflammatory state; but by and by this is succeeded by an abatement of the symptoms.

290. The first effect appears to be produced in the same way that inflammation is itself originally occasioned by any local exciting cause. But the mode in which the healthy reaction is thus subsequently promoted, it is not easy to explain. It may be, that the secondary effect of the irritating application on the sensitive nerves is sedative, and that this restores *antagonistically* the action of the nerves governing the contractions of the walls of the vessels. It is, perhaps, primarily as sedatives of the sensitive nerves, that soothing applications, and also that some general remedies useful in inflammation, act.

Section II.—OPHTHALMIC INFLAMMATION IN GENERAL.

291. Ophthalmic inflammations, considered as a class, may be divided into four orders, viz.:—

1. OPHTHALMIA EXTERNA.
2. OPHTHALMIA INTERNA ANTERIOR.
3. OPHTHALMIA INTERNA POSTERIOR.
4. PANOPHTHALMITIS.

292. The genera of these orders are distinguished and designated according to the particular structure which is the chief seat of the inflammation—I say the chief seat, for the inflammation is seldom confined altogether to a single structure.

293. Ophthalmia externa thus comprehends, according as the conjunctiva, sclerotica, or cornea is the chief seat of the inflammation, the genera

Conjunctivitis,
Sclerotitis,
Corneitis.

294. Ophthalmia interna anterior, on the same principle, comprehends the genera

Aquo-capsulitis,
Iritis,
Crystallino-capsulitis anterior.

295. Ophthalmia interna posterior, again, comprehends the genera

Choroiditis,
Retinitis,
Vitreo-capsulitis,
Crystallino-capsulitis posterior.

296. Panophthalmitis is both order and genus.

297. The circumstances which principally distinguish and give name to the species and varieties of the ophthalmiæ, are—1, the particular part affected of the structure, which is the chief seat of the inflammation—2, the structures which are co-affected—3, the nature of the exciting cause—4, the state of the constitution, or the constitutional disease by which the in-

flammation appears to be modified—5, the nature of the event of the inflammation.

298. As inflammation is seldom or never altogether confined to a single structure of the eye, but generally involves several at the same time, so a description of inflammation in individual structures would be, as Dr. Mackenzie remarks, a description of a state which seldom or never presents itself separately in nature. Notwithstanding this, it will be useful to premise an account of the characters of inflammation in the individual structures, preparatory to entering upon the description of the varied combinations which present themselves in the ophthalmiæ as they occur in nature. The descriptions will thus admit of being made both clearer and shorter.

A. INFLAMMATION AS IT OCCURS IN THE DIFFERENT TISSUES OF THE EYE.

299. In discussing this subject, I will first consider the objective phenomena of inflammation of the different structures of the eye, and then the subjective phenomena.

a. Conjunctivitis, or inflammation of the conjunctiva.

300. The principal forms of inflammation, of which the conjunctiva may be the seat—are puromucous, erysipelatous, and pustular or aphthous.

301. *Puromucous inflammation of the conjunctiva.*—The conjunctiva of the eyelids and of the palpebral sinuses, is deep red. The conjunctiva is also deep red where it is reflected upon the eyeball; but towards the cornea the redness is, at the commencement of the inflammation, gradually shaded off. When, however, the inflammation is fully developed, the redness extends even to the margin of the cornea.

302. The injection of the highly-developed capillary network of the palpebral conjunctiva gives rise to a uniform and intense redness, concealing from view the larger subjacent vessels. Except in a very high degree of inflammation, the injection of the less-developed capillary network of the sclerotic conjunctiva does not conceal the larger subjacent vessels. Indeed, what most strikes the observer, is the network with large meshes formed by the intercrossing and inosculation of comparatively large and tortuous vessels, the ramifications of which tend towards the margin of the cornea—the arteries and veins which carry the blood to and from the superficial capillary network.

303. In consequence of the accumulation of blood in its ves-

sels, the conjunctiva is thickened. The papillæ of the palpebral conjunctiva, being for the same reason swollen and erect, the inner surface of the eyelids has a velvety appearance.

304. The conjunctiva covering the caruncula lachrymalis, and forming the semilunar fold, is deep red like the palpebral conjunctiva, and being at the same time thickened by the accumulation of blood in its vessels, both the lachrymal caruncle and semilunar fold appear much enlarged.

305. At the commencement of the inflammation a serous exudation takes place from the surface of the conjunctiva. By and by, a puro-mucous or purulent discharge, the presence of which is an important character of the inflammation, is established.

306. There is necessarily some exudation into the substance of the conjunctiva itself, producing thickening of it, and enlargement of the papillæ of its palpebral portion.

307. In some cases phlyctenulæ like pins' heads are observed on the palpebral conjunctiva, and on the conjunctiva of the sinuses. These are produced by small collections of exuded matter, raising up the epithelium.

308. The eyelids, besides being somewhat red, may be more or less swollen, from exudation into their cellular tissue. There may also be exudation into the cellular tissue underneath the sclerotic conjunctiva, raising it up like a wall round the cornea, constituting *chemosis*. Tumefaction of the eyelids and chemosis are analogous, in their nature and mode of production, to that swelling which takes place in the neighbourhood of any active inflammation.

309. Ecchymotic spots sometimes present themselves, especially over the sclerotica, in consequence of extravasation of blood into the substance of the sclerotic conjunctiva, or into the cellular tissue underneath. When the inflammation is intense, there may be actual discharge of blood from the surface of the conjunctiva. This more readily takes place from the palpebral portion.

310. From the description now given of puro-mucous inflammation of the conjunctiva, it appears that the matter which is exuded from the inflamed surface is converted into puriform mucus or actual pus, though the surface is not ulcerated. On the other hand, the lymph which may have been exuded into the substance of the membrane is developed into tissue, which is the cause of that thickening of the conjunctiva, and enlargement of its papillæ, which remain for a greater or less length

of time, or even permanently, after the inflammation has subsided.

311. *Healing process in puro-mucous inflammation of conjunctiva.*—Before a puriform or purulent discharge is established, and before thickening of the conjunctiva and hypertrophy of its papillæ have taken place, consequently, before exudation has been anything more than serous, resolution of the inflammation may occur. In the contrary case, the return to the healthy state proceeds thus: As vascular congestion, or in other words, the redness diminishes, the sero-mucous or puro-mucous discharge becomes less and less, and any accompanying chemosis and swelling of the eyelids subside. It is to be remarked, that the vascular congestion of the palpebral conjunctiva disappears less quickly than that of the ocular conjunctiva. The papillæ of the palpebral conjunctiva, moreover, are extremely apt to be left in a state of hypertrophy, constituting what are generally called *granulations* of the conjunctiva.

312. *Erysipelatous inflammation of the conjunctiva.*—Like inflammation of other mucous membranes, inflammation of the conjunctiva sometimes presents itself with characters between inflammation and œdema. There is considerable infiltration of serum into the substance of the membrane itself as well as into the subjacent cellular tissue. The disease is known by the name of *erysipelatous ophthalmia.*

313. The most remarkable appearance in this ophthalmia is the watery exudation under the sclerotic conjunctiva, whereby the latter is raised up in folds which protrude like vesicles between the eyelids. The conjunctiva is of a light red color, inclining to yellow, and presents here and there spots of ecchymosis, but individual vessels are not readily discernible. The mucous secretion of the conjunctiva is somewhat increased in quantity.

314. *Pustular or aphthous inflammation of the conjunctiva.*—The sclerotic conjunctiva presents one or several small scarlet spots, produced by the convergence of vessels. At the spots mentioned the vessels are large and evident, but as they recede from the spots, they cease to be distinguished by the naked eye; hence the vessels of the red spots appear as if isolated from all connection with any other. By and by, however, the continuity of some of the vessels of the red spots, with those of the rest of the conjunctiva, comes to be distinctly seen.

315. The exuded matter first distinctly manifests itself, whilst

in process of metamorphosis into pus, as a small yellow flake in the centre of the vascular spots.

316. In consequence of the little density and cohesion of the epithelium of the conjunctiva scleroticæ, it does not, like the epidermis of the skin, retain the exuded matter, but gives way, so that a proper pustule is not formed, but an aphthous spot or small abrasion covered with the exuded matter, becomes pus or puriform, with fragments of epithelium.

317. Pustules often present themselves close to the margin of the cornea. In this case the vessels do not converge from all points to the pustules, but come from the side of the sclerotic conjunctiva only, as indeed was to be expected, seeing that none could come from the cornea on account of its being non-vascular. The thick epithelium of the cornea is at the part opaque and slightly raised by the exuded matter which, with the softened epithelium of the sclerotic conjunctiva of the spot affected, forms, as in the preceding case, the small yellow flake. This form of pustule thus presents a character intermediate between the phlyctenula or pustule of the cornea and the aphthous spot of the sclerotic conjunctiva above described.

318. Besides the red spots from vascular congestion, there may be patches of ecchymosis.

319. *Healing process in aphthous inflammation of conjunctiva.*—Pustules or aphthæ of the conjunctiva may run into ulceration, but in general the spots of vascular congestion disappear, and the abrasion produced by the separation of the epithelium quickly heals, the spot becoming covered with a new epithelium, whilst the coating of puriform matter and fragments of old epithelium are thrown off.

320. *Mortification and ulceration of the conjunctiva.*—Mortification of the conjunctiva, as a consequence of inflammation, does not appear to have been met with, but sloughing of parts of the conjunctiva, in consequence of chemical injury, sometimes occurs. Ulceration, except from a specific cause, seldom takes place.

321. *Healing of wounds of the conjunctiva.*—Wounds of the conjunctiva gape much, but readily heal. The conjunctiva becomes injected at the edge of the wound, and lymph is exuded, which becomes organized in the manner already explained, according as the union is by the first or second intention, one or the other event being in general determined by the apposition or non-apposition of the edges of the wound as in the skin.

322. The palpebral and ocular surfaces of the conjunctiva have no tendency to form adhesions even while kept in close

apposition, unless previously made raw. When abrasion of the surfaces has been produced, especially by burns and escharotics, there is then great tendency to the formation of adhesions.

b. Sclerotitis, or inflammation of the sclerotica.

323. The redness is in the form of a pink or lake colored zone, encircling the cornea; the injected vessels of the sclerotica being very minute, and disposed in straight radiating lines, as if from the margin of the cornea, where the tint is deeper, whilst it is shaded off, and disappears towards the orbit—the converse of what occurs in the injection attending conjunctival inflammation.

324. If the vascular congestion be alone taken as inflammation, then it must be said that the part of the sclerotica visible during life through the conjunctiva, is often inflamed; but if exudation, and the changes which the exuded matter undergoes, be rather assumed to be indicative of inflammation, then it must be admitted that the sclerotica is comparatively rarely the seat of inflammation.

325. Fibrous tissues in general do not appear to be more frequently the seat of the effects of inflammation than the sclerotica, but are they not as frequently the seat of vascular congestion? Is rheumatism anything more in most cases than vascular congestion in fibrous tissues, with, perhaps, serous exudation into neighbouring parts? What is called rheumatic ophthalmia appears to be at least nothing more than inflammatory congestion of the sclerotica, usually, with more or less implication of the cornea and iris.

326. Rheumatism, or inflammatory congestion in fibrous structures, may at last lead to exudation of lymph either into the substance or on the surface of the part affected,—in the one case giving rise to the thickening and induration of the fibrous structures, in the other, to effusions into the joints or adhesions, such as are met with in pericarditis. By repeated congestions, the sclerotica is indeed left in a somewhat altered state, but it is the cornea or iris which is principally the seat of exudation of lymph and the changes consequent on it, as the joints are in articular rheumatism.

327. The most marked example, perhaps, of the tissue of the sclerotica becoming the seat of changes from inflammation occurs in sclerotico-choroiditis. The first change is a thickened and fleshy appearance of the sclerotica, but its texture becoming at the same time softened, it by and by yields to the distension from within the eye, protrudes and becomes attenuated, and of

a dark color (*sclerotic staphyloma*). In some cases, however, instead of becoming attenuated and dark, the affected part of the sclerotica actually becomes thickened, and of a dense white pearly appearance.

c. Corneitis, or inflammation of the cornea.

328. On account of the non-vascularity of the cornea, there is at first no redness of it from vascular congestion. Congestion is not, however, wanting, but is seated in the adjoining conjunctiva and sclerotica, as already explained.

329. That the cornea is the seat of exudation is manifested by opacities of various kinds, phlyctenulæ, and abscesses. When new vessels are developed in the exuded matter, the cornea then becomes the seat of more or less redness. This, however, is to be distinguished from that which may result from effused blood. When effusion of blood occurs, it appears usually in a patch near the edge of the cornea.

330. One or other of the three principal layers of the cornea may be more particularly the seat of the exuded matter; hence are distinguished inflammation of the proper substance of the cornea, of the conjunctiva corneæ, and of the membrane of Descemet.

331. *Inflammation of the proper substance of the cornea.* In inflammation of the proper substance of the cornea, the vascular congestion is seated in the sclerotica in the form of the sclerotic circumcorneal zone, but sometimes the redness is very slightly marked. There is generally also congestion of the circumcorneal network of the conjunctiva.

332. The exuded matter is deposited either in the interstices of the tissue or on its surface, raising the epithelium in the form of a phlyctenula, or even a blister.

333. The exudation into the interstices of the proper substance of the cornea, may produce map-like patches of dimness, and nothing more. Or the exudation being in greater quantity, a general grayish or yellowish white opacity results, denser at some points than others, and intermixed with red from the presence of new vessels. In this case, the cornea presents a peculiar opalescent appearance.

334. In certain cases there are less exudation and development of vessels; the cornea still retains a degree of transparency, but is of a dirty yellowish green colour, and rough like ground glass, owing to minute vesicles on its surface, or minute points of ulceration, resulting from the bursting of the vesicles. There is softening of the cornea in all these cases.

335. When exudation into the proper substance of the cornea, or under the epithelium, takes place rapidly and copiously, the exuded matter is generally formed into pus or puriform matter, and the result is an abscess or a pustule. In such cases the inflammation is more of an acute character than in the preceding. There is more vascular congestion in the conjunctiva and sclerotica, so much so, that the cases in question are commonly viewed as examples of corneitis supervening on inflammation of the conjunctiva and sclerotica, while the preceding cases are, on account of the slight appearance of congestion in the conjunctiva and sclerotica, viewed as examples of primary corneitis. But from what has been above said of inflammation of the cornea, there is no *primary corneitis* in the sense here implied, *i. e.*, with vascular congestion first in the cornea.

336. The depositions of yellow matter which occur in the interstices of the cornea at its lower part, and which, on account of their presenting the form of the lunular spot at the root of the nails, are called *unguis* or *onyx*, and which are in general rapidly absorbed as the attendant inflammation is subdued, have not the character of abscesses like the circumscribed collections of matter which form in the centre of the cornea.—They result from matter exuded into the interstices of the proper substance of the cornea, subsiding to the most depending part like the water in anasarca, whilst true abscesses make their appearance as a densely opaque spot, first white, then yellow, around which the rest of the cornea is more or less opaque from exuded lymph, in which there may be new vessels, as in the walls of abscesses elsewhere.

337. Most frequently the exuded matter is deposited on the surface of the proper substance of the cornea, raising the epithelium in the form of a phlyctenula or blister. The epithelium of the cornea being denser, thicker, and more coherent than that of the sclerotic conjunctiva, confines the matter which is exuded, in much the same way that the epidermis of the skin does. The matter being at first a transparent fluid, there is a phlyctenula: subsequently becoming puriform or purulent, there is a pustule. Often the process does not proceed so far as the formation of a pustule.

338. A phlyctenula or pustule of the cornea having burst, a small ulcer covered with puro-lymph is left, which may be compared to the aphthous spot on the sclerotic conjunctiva. A fasciculus of new vessels, extending to this ulcer from the conjunctival circumcorneal network, may make its appearance.

339. *Healing process in inflammation of proper substance of the cornea.*—When the congestion around the cornea subsides, the matter exuded into its substance may gradually be absorbed. And this even when development of it has gone on to the formation of new vessels, though tardily, for the more the exuded matter has been developed, the less readily does it dissolve and become fitted for absorption. The new vessels first disappear, leaving a grayish-white opacity, which clears away from the circumference towards the centre of the cornea, where often more or less opacity remains.

340. A pustule on the surface of the cornea, or an abscess in its proper substance, may disappear by absorption of its contents, leaving, however, more or less opacity; but these collections of matter usually burst, and leave a sore, which may either commence to heal by granulation, or run into ulceration.

341. *Inflammation of the conjunctiva cornea.*—This usually accompanies acute inflammation of the proper substance of the cornea, or is an extension of inflammation of the sclerotic conjunctiva.

342. In consequence of the exudation, the conjunctiva cornea becomes at some point opaque and thickened, and here new vessels are soon formed, which, connecting themselves with the conjunctival circumcorneal network—which at the place is in a state of congestion—appear as a mere extension of a fasciculus of vessels from it. The opacity and vascularity may gradually spread across the cornea.

343. In some cases of what may be called inflammation of the conjunctiva corneæ, there are fewer new vessels and less opacity, but there is superficial spreading ulceration. In certain cases the cornea presents here and there on its surface vascular fungous granulations.

344. The changes which the conjunctiva cornea undergoes in inflammation, the thickening and vascularity, are very apt to remain in the forms of pannus, vascular cornea, &c.; but often they disappear entirely, and the cornea resumes its natural appearance.

345. The coagulation and exfoliation of the epithelium of the cornea, in consequence of chemical injuries, have been mistaken for pseudo-membranous formations.

346. *Inflammation of the membrane of Descemet.*—In this inflammation, the vascular congestion is in the sclerotic zone. The exuded matter is deposited between the proper substance of the cornea and the membrane, and generally presents itself

in the form of scattered punctiform opacities. Here also new vessels, when formed, make their appearance.

347. As the inflammatory congestion subsides, the exuded matter is removed by absorption.

348. *Ulceration of the cornea.*—The cornea is extremely prone to ulceration. The ulceration may be limited to a mere abrasion or exfoliation of the epithelium, or it may affect the proper substance of the cornea also. The membrane of Descemet does not appear to be liable to ulceration; but when exposed and deprived of support by penetrating ulceration of the proper substance of the cornea, it eventually bursts.

349. *Abrasion of the epithelium* presents itself either in that form, in which its surface looks like ground glass, or in a form like what is presented after death, when the epithelium begins to soften, and portions of it are detached by wiping the surface. The first form occurs in inflammation of the proper substance of the cornea. The second is rather a result of inflammation of the conjunctiva corneæ; there is superficial vascularity, and the abrasion, like ulceration, has a great tendency to spread; but while it spreads on one side, cicatrization may be seen taking place on another. The cicatrization gives rise to slight opacity.

350. *Ulceration of the proper substance of the cornea* generally commences by the bursting of an abscess or phlyctenula. Both the bottom and edges of the ulcer may be clear, and the cornea around scarcely, if at all, nebulous. In other cases the bottom of the ulcer is filled with a grayish sloughy-looking matter, which is thrown off to be succeeded by the same thing, whilst the ulcer goes on increasing in depth, and may at last completely perforate the cornea.

351. *Hernia of the cornea—(Keratocele).*—When an ulcer has penetrated through the proper substance of the cornea, the membrane of Descemet, unable to withstand the pressure from within, is protruded at the bottom of the ulcer, in the form of a small vesicle filled with aqueous humour. This hernia of the cornea usually bursts ere long; the aqueous humour is thus allowed to escape, whereupon the iris falls forward into contact with the cornea, and perhaps a prolapse of it takes place through the ulcerated opening in the cornea.

352. If now a remission of the attending inflammation take place, which is apt to happen, in consequence of the relief of tension produced by the evacuation of the aqueous humour, the ulcerated opening in the cornea heals, the aqueous humour

again accumulates, and the iris returns to its natural position, provided no prolapse of it had taken place.

353. In some cases, when ulceration of the cornea is both broad and deep, but not penetrating entirely through the proper substance, the hernia of the cornea which takes place is large, but still invested with some of the corneal substance. In consequence of this it does not so readily burst, but may remain permanent as a thinned and projecting part of the cornea, with impaired transparency, resembling somewhat conical cornea, from which, however, it is to be distinguished. From partial staphyloma it differs in not being connected with the iris, and never being so opaque.

354. By the bursting of an abscess or onyx of the cornea inwards into the anterior chamber, the membrane of Descemet, and the inner part of the corneal substance, are destroyed; the outer part, then, incapable of withstanding the pressure from within, sometimes yields, and forms a prominence of a conical shape.

355. *Mortification of the cornea.*—The complete death of the cornea and the separation of it in the form of a well-marked leathery slough, are of rare occurrence. The destruction of the cornea, which is so common in the purulent ophthalmiæ, takes place in a different manner.

356. The cornea, overlapped all round its margin by the chemosed conjunctiva, may be observed to continue for some time unaffected; but within a short interval it will be found to have become quite opaque and softened. To this succeeds the process of destruction, which consists in that form of mortification, with small sloughs, which constitutes ulceration. The destruction may involve the whole cornea in its whole thickness, or a part only in its whole thickness; or it may involve a superficial portion only, and this of greater or less size.

357. The immediate cause of all this mischief appears to be the infiltration of the substance of the cornea with exuded matter, and the mechanical pressure exerted by the chemosed conjunctiva, whereby the nutritive movements are more or less completely arrested.

358. *Healing of wounds and ulcers of the cornea—by the first intention.*—A simple incision of the cornea, in general heals readily. From the vessels of the conjunctiva and sclerotica, which are congested on that side of the cornea next the wound, lymph is exuded into the cornea at the seat of the wound, producing opacity to a greater or less extent, and of more or less intensity. The cut edges are agglutinated by the

exuded lymph, and by its organization continuity of structure is restored. What of exuded matter remains in the substance of the cornea, producing opacity, is gradually absorbed, and the cornea clears in proportion as the injection of the conjunctival and sclerotic vessels subsides; a small speck, perhaps, the cicatrice, merely remaining. No new vessels may have been formed in the cornea.

359. *By the second intention.*—Loss of substance of the cornea, whether produced by ulceration or otherwise, is restored by granulation. The granulations may be non-vascular, or they may be vascular, from new vessels which have been developed in the exuded matter, and which have formed a connection with those of the neighbouring conjunctiva and sclerotica. These new vessels generally disappear when the process of granulation is completed, and preparatory to cicatrization. Thus, when an ulcer has filled up by vascular granulations, one vessel after another disappears, until all are gone, leaving an opaque streak where their course in the cornea had been.

360. At first the sore may be swollen, and more or less nebulous at the edges, and discharge a tough, yellow, purolymphy matter, which sometimes adheres to it, and hangs down from it in flakes. But when the ulcer begins to heal, its edges become decidedly gray and opaque, and in proportion as it becomes filled with granulations, the quantity of purolymphy matter discharged from it becomes less, until none at all is formed. At last cicatrization takes place, and the surrounding nebulosity diminishes until it disappears altogether.

361. The cicatrice is either a permanently opaque spot (*leucoma*) or it is a clear facet, presenting the appearance as if a small piece had been sliced from the convex surface of the cornea.

362. *Effects of penetration of the cornea.*—When the cornea is freely penetrated by wound, ulceration, or sloughing, prolapsus iridis takes place.

363. According to the size and position of the opening in the cornea, so is the extent of the prolapse of the iris, and so is the pupil more or less involved. The different degrees of prolapsus iridis have received different names; thus, when small it is called *myocephalon*, from its forming a small black point like the head of a fly;—when it is a little larger, and flattened down by the pressure of the eyelids, it has been compared to the head of a nail, whence the name *clavus*;—when larger and more prominent, it has been called *melon*, or apple-shaped

prolapse. When the iris is protruded at several openings, the appearance is somewhat like that of a bunch of grapes, whence the name *staphyloma racemosum*. When prolapsus iridis has taken place, all the symptoms of the attending inflammation are apt to be aggravated. But if the inflammation subsides, and if the opening in the cornea and prolapse of the iris be within certain limits, the latter gradually contracts and flattens as the ulcer of the cornea closes, and nothing at last remains but the cicatrice in the cornea, and adhesion between this and the iris—*synechia anterior*—with more or less deformed and contracted pupil. If in consequence of a more extensive destruction of the cornea, whether by ulceration or sloughing, the prolapse of the iris have exceeded the limits alluded to, it never collapses, but, as will be by and by shown, lays the ground for the formation of a staphyloma of the cornea and iris, partial or complete.

d. Iritis, or inflammation of the iris.

364. In consequence of the coloration of the iris, it does not, like the conjunctiva, for example, when inflamed, appear red, but of a colour which is a compound of its own natural colour and that of the stagnant blood. Thus a blue iris becomes green, a brown iris reddish brown. The brilliancy of the iris is at the same time impaired or lost. Subsequent changes in the colour of the iris are owing to exuded matter and to changes in the pigment.

365. The injected vessels are individually not very evident. Such may sometimes be seen, however, and are to be distinguished from those of new formation which make their appearance at a later stage of the inflammation.

366. The sclerotic circumcorneal red zone is well marked. The conjunctiva may be little or very much injected—so much sometimes as to hide the sclerotic injection.

367. The aqueous humour is at first somewhat increased in quantity by exudation of serum. Exudation of lymph afterwards takes place. Lymph may be exuded on the surface or into the substance of the iris. The exudation from the anterior surface and from the pupillary margin may be directly seen. Most commonly the exudation takes place first from the pupillary margin obstructing the pupil. On the anterior surface the lymph presents itself in drops, and fine flakes of it may often be seen in the aqueous humour, rendering it turbid.

368. The lymph exuded at the pupillary margin soon becomes consolidated and organized, forming bands of adhesion between the margin of the pupil and the capsule of the lens (*synechia*

posterior)—distorting the pupil, and sometimes contracting it to a point.

369. The mode in which closure of the pupil takes place appears to be this: the pupil having been in a state of contraction when the lymph was exuded, the lymph, in consolidating, contracts and draws together more closely the margin of the pupil from which it has been exuded, and to which it is adherent.

370. New vessels may make their appearance in the lymph forming the bands of adhesion, in that exuded on the anterior surface of the iris, and also in that filling up the pupil.

371. The lymph poured out at the pupil, forming bands of adhesion, becomes of a brown or yellow colour from the deposition of pigment in it. Small red or brown excrescences are also sometimes seen on the inner circle of the iris, or at the margin of the pupil.

372. Though no distinct serous membrane can be demonstrated on the anterior surface of the iris, it thus, like the surface of inflamed organs, which are covered with serous membranes, pours out lymph, which gives rise to adhesions; but what is peculiar is, that the adhesion which takes place is generally between the iris and capsule of the lens, rarely, if ever, between the iris and the cornea.

373. *Parenchymatous inflammation of the iris* may be looked upon merely as a more intense degree of inflammation, in which, to exudation on the surface of the iris, there is added exudation into its substance, and that quickly and in large quantity.

374. There is, in acute parenchymatous inflammation of the iris, greater vascular congestion both of the conjunctiva and sclerotica, together with congestion of the choroid, as may be inferred from the accompanying photopsia during life, and from its having been found on dissection after death that there was lymph on the inner surface of the choroid.

375. Exudation into the substance of the iris takes place principally at the pupillary circle, or at the ciliary part, less frequently in the middle. It is manifested by the iris losing much of its natural appearance of structure, and becoming swollen, with its pupillary edge retracted, and its middle bolstered forward.

376. Abscess is apt to form in such cases when acute. It appears as a small reddish-yellow tubercle on the surface of the iris, generally near its pupillary or ciliary edge, which bursting into the anterior chamber, gives rise to a small hypopyon.

The place where the abscess was becomes filled with a black matter, in which case it looks as if the iris were perforated by a false pupil. When the abscess is quite at the ciliary margin, it may evacuate itself externally through the sclerotica, close to the place of its junction with the cornea.

377. Hemorrhagic exudation also occurs in inflammation of the iris. The blood is usually in small quantity, forming a patch of greater or less size on the anterior surface of the iris, and tinging the exuded lymph.

378. *Healing process in inflammation of the iris.*—As the congestion in iritis subsides, the progress of the absorption of the exuded matter is beautifully seen. Matter which has been recently exuded rapidly disappears; that which has become already organized into adhesions, having to undergo solution by a retrogressive metamorphosis, in order to be fitted for absorption, disappears more slowly; and in many cases the organization is so complete, that no process of removal takes place. Thickening and change of structure of the iris from exudation into its substance, together with contraction of the pupil and obstruction of it with lymph, are very often permanent.

379. Effused blood is in general readily absorbed, but after repeated effusions some remains unabsorbed, in the form of brown or black masses and patches, at the bottom of the anterior chamber and on the surface of the iris.

380. *Inflammation of the lining membrane of the posterior chamber or uveitis.*—Lymph may be exuded in large quantity into the posterior chamber, on the posterior surface of the iris, and on the anterior wall of the capsule of the lens. The source of this exudation is probably the vessels of the ciliary processes. See further on this head, infra s. 389.

e. Choroiditis and retinitis, or inflammation of the choroid and retina.

381. The anatomical characters of the inflammations of the choroid and retina cannot be directly observed during life; even the external redness of congestion proper to them cannot be seen, for, different from the structures hitherto considered, the blood-vessels of those under notice enter the eyeball at its posterior part. The cases, moreover, in which there has been opportunity for examination of the eye after death, have in general been such as presented the effects of past inflammation rather than the manifestations of inflammation in progress. But from analogy with what has been seen in inflammation of

the other structures of the eye, and from what has been observed in the *post-mortem* examinations referred to, the anatomical characters of inflammation of the choroid and retina may be inferred with some degree of probability.

382. *Inflammation of the choroid.*—The capillary network on the inner surface of the choroid will be more or less injected, and the larger vessels proceeding to or from it, and which are principally seated on its exterior, will be enlarged, so that the choroid will be much increased in thickness, and will press inwards upon the retina and outwards upon the sclerotica. There will be much redness at the posterior part of the sclerotica, from the injection of the choroidal or short ciliary vessels.

383. Exuded matter will be deposited between the choroid and membrane of the pigment, raising and breaking up the latter, together with the delicate stratum bacillosum of the retina, or producing adhesions between the choroid and retina, with alteration of their texture. That something like what is here supposed does really occur is evidenced by what has been found in the few cases in which there has been opportunity for examining the eyes after death. Exudation and adhesion may also take place between the choroid and sclerotica.

384. If there be intense congestion, such as is presented by the conjunctiva in purulent ophthalmia, a large quantity of matter will be exuded, and suppuration will be the result, with breaking up and disorganization of the whole interior of the eye. But before this, the other internal structures will have become implicated. The case will thus now be one of general ophthalmitis or ocular phlegmon.

385. *Inflammation of the retina.*—There will be redness of the inner surface of the retina from injection of the ramifications of the central artery of the retina.

386. Exudation will take place between the retina and vitreous body, and also into the substance of the vitreous body, and into that of the retina itself. The effect of this is degeneration of the retina, the vitreous body, and subsequently of the posterior capsule of the lens.

f. Inflammation of the lenses of the eye.

387. These bodies being, like the cornea, non-vascular in the fully developed state, inflammation of them consists at first merely in exudation into or on them; the vascular congestion having its seat in adjacent parts.

388. *Inflammation of the crystaline body.*—Inflammation of the crystaline body is first evidenced by opacity of the capsule,

resulting from exudation into or on it. In the exuded matter new vessels may be developed. But where is the seat of the primary congestion? This appears to be different according as it is the anterior or the posterior wall of the capsule which is affected.

389. In uveitis, s. 380, the anterior wall of the capsule has often exuded matter deposited on it, in which new vessels are sometimes developed. This is the kind of case described as inflammation of the anterior wall of the capsule.

390. Whilst inflammation of the anterior wall of the capsule belongs to the head of inflammation of the anterior segment of the eye, what has been viewed as inflammation of the posterior wall of the capsule comes under the head of inflammation of the posterior segment.

391. The vessels described by Walther in the posterior wall of the capsule, radiating from the centre, as indicative of inflammation of the part, cannot be, as has been supposed, the enlarged ramifications of the central artery of the vitreous humour, for these have become in the developed eye entirely obliterated. When vessels exist, they must be new formations, developed in exuded lymph. I have not seen any case in which red vessels were actually visible; but I have seen radiating streaks of opacity in the situation of the posterior wall of the capsule somewhat similar in arrangement to that of the vessels represented in Professor Walther's figure of inflammation of the posterior wall of the capsule.

392. When the capsule of the lens is affected, as above described, the lens itself becomes more or less altered in consequence. It becomes opaque, dissolved, or is even the seat of suppuration. Vessels, it is alleged, have been observed shooting into it from the inflamed capsule.

393. *Healing process in the crystaline body.*—Wounds of the crystaline body, it is well known, are in the human eye very generally followed by opacity of the lens. In experiments on brutes this result has occurred in some cases only. As to the capsule, it becomes opaque in the seat of the wound, from exudation depending on the inflammatory congestion which has been occasioned in neighbouring structures by the wound, of which that of the crystaline is necessarily a part only. The wound of the capsule may thus unite. If the wound of the capsule is large, and does not unite, the opaque lens dissolves and disappears.

394. *Regeneration of the lens.*—Pauli, Lowenhardt and Textor have repeated the experiments on regeneration of the

lens in animals with success. Textor communicates some new cases of regeneration of the lens in man after operations for cataract. The proof that the newly-formed substance possesses the same intimate structure as the lens has at last been supplied by Valentin's microscopical investigation of the subject.

395. *Inflammation of the vitreous body.*—This does not appear to take place without the posterior wall of the capsule of the lens also becoming affected. Again, though in the fully formed eye there may still exist hyaloid vessels, as described by Arnold and Van der Kolk, the inflammatory changes of the vitreous body, such as deep-seated deposits of lymph, principally depend on congestion of the vascular layer of the retina, (s. 385.)

396. Increased or suppressed lachrymation, increased or diminished Meibomian secretion, are objective phenomena, sympathetic with inflammation of different tissues of the eye.

397. The subjective phenomena of inflammation of the different structures of the eye now come to be considered. In entering on this part of the subject, it is, in the first place, necessary to distinguish between the morbid sensations depending on perversion of common sensibility and those depending on perversion of special sensibility.

a. Morbid sensations depending on perversion of common sensibility, accompanying inflammation of the different tissues.

398. *Conjunctiva.*—Like other mucous membranes close to the natural apertures of the body, the conjunctiva is endowed with a high degree of common sensibility; but being loose in texture, the pain which attends inflammation of it is not very severe. There is, however, considerable heat.

399. The most characteristic pain is like that produced by a foreign body in the eye—a sensation which attends inflammation of other mucous membranes near the surface of the body. The sensation as if a foreign body were in the eye is owing to enlargement of the vessels on the one hand, and to increased sensibility of the conjunctiva on the other.

400. Attendant on inflammation of the conjunctiva there are also itchiness and smarting at the edges of the eyelids, with occasional stitches of pain shooting from them.

401. *Sclerotica.*—Very severe pain of a rheumatic character around the orbit, in the temples, &c., is a characteristic of sclero-

tic inflammation or congestion, owing either to accompanying congestion in the parts mentioned, or to nervous irradiation.

402. *Cornea.*—The sensation in the cornea itself is one of pressure. But as inflammation of the cornea is attended with injection of the conjunctiva and sclerotica, there may be also the sensation of a foreign body in the eye peculiar to the former, and the rheumatic pain peculiar to the latter.

403. *Iris.*—When the iris is inflamed, there is necessarily more or less sclerotic congestion, hence the sclerotic rheumatic pain which so often accompanies iritis. As to the pain within the eyeball itself, it may be accounted for as much perhaps by the distension to which the exterior tunics are subjected by the increased accumulation of blood and fluids in the interior of the eye, as by supposing it to be seated in the iris, which indeed does not appear to possess much sensibility.

404. *Choroid.*—The choroid itself does not appear to be endowed with any sensibility. The pain which attends inflammation of it being probably owing to the distension of the eyeball, and to attending congestion of other parts.

405. *Retina.*—The morbid sensations depending on perversion of common sensibility, which may attend inflammation of the retina, have not their seat in the retina, but are merely owing to distension of the eyeball, and accompanying congestion of other parts.

b. Morbid sensations depending on perversion of the special sensibility of the retina.

406. When nervous structures endowed with special sensation are irritated, the sensation produced is not pain, but various modifications of the sensation peculiar to the structure, and this whatever be the irritating agent. Thus when the retina is in a morbidly sensible state, irritation of it by light gives rise to a dazzling glare, which is so distressing, that the patient seeks to protect the eye against light: this constitutes intolerance of light, or photophobia. But even in the dark the same dazzling glare, or various kinds of luminous spectra, may be produced by pressure, &c., and that in a degree more or less distressing, according to the morbid sensibility of the retina, and the intensity of the pressure or other irritating cause: this constitutes photopsia.

407. The appearance of a gauze or mist, or "a skin with veins in it," appears to be the proper subjective effect of the congestion and exudation in inflammation of the vascular layer of the retina.

408. The other special morbid sensations, photopsia, a morbid sensibility to common impressions, and photophobia, occur rather as accompaniments of inflammation of other structures of the eye than of the retina itself. Thus the morbid sensibility of the retina on which intolerance of light depends, is an accompaniment of those acute inflammations in which the cornea is especially involved. Luminous spectra again appear to be especially occasioned in inflammation of the choroid, by the pressure arising from the congestion and exudation. This is illustrated by the well-known effect of pressure with the point of the finger on the exterior of the eyeball.

B. CAUSES OF OPHTHALMIC INFLAMMATION.

409. The practical advantage of being acquainted with the causes of ophthalmic inflammation is to know how to avoid them, and thus to prevent the inflammation, or, if they have already produced inflammation, to know how to remove them if still in operation and removable.

410. The causes of ophthalmic inflammation may be referred to three heads,—viz.—1st. Those which operate directly on the eyes. 2d. Diseases of other parts with which the eyes sympathize, or which spread to the eyes. 3d. States of constitution and constitutional diseases which, though they do not necessarily determine inflammation of the eyes, at least predispose them to be affected by other causes.

411. To the first head belong:—Direct injuries—direct influence of cold—the direct action of very strong light, or of this and strong heat together—the irritation of reflected light—over-exertion of the sight, especially in bad light, either too weak or too strong, with much stooping of the head—the direct influence of acrid vapours,—epidemic or endemic influences—the direct application of contagious matters. These are all exciting causes; but some of them require to be assisted by other causes, so that they operate partly as predisposing causes also.

412. To the second head belong diseases of the skin, especially the exanthematous diseases.

413. To the third head belong the scrofulous, rheumatic or gouty diathesis, and constitutional syphilis.

414. Under the influence of these causes, different forms of ophthalmic inflammation are produced.

C. TREATMENT OF OPHTHALMIC INFLAMMATION.

415. In consequence of the peculiarity of the structure and functions of the eye, its usefulness is apt to be interfered with by such effects of inflammation as in most other organs would be of little or no moment. Hence, though the treatment of ophthalmic inflammation must be conducted on the same general principles as that of inflammation of any other part of the body, it is necessary, *cæteris paribus*, to push it with more activity, and at the same time to attend to numerous special details. Thus in iritis, blood-letting and mercurialization require to be pushed to a greater extent than might in another organ be thought advisable for the same kind and degree of inflammation. But supposing blood-letting and mercurialization thus pushed have been successful in subduing the inflammation, the neglect of such details as the application of belladonna to keep the pupil dilated, may have allowed it to become closed, or the lens spotted over with depositions of lymph, in which case vision will be lost or greatly impaired.

416. In the treatment of ophthalmic inflammation, the first points to be attended to (besides, as a matter of course, the removal of the exciting cause, if still in operation and removable), are the protection of the eyes from everything which can cause or keep up irritation—such as using them or exposing them to strong light—and the avoidance of whatever is calculated to operate injuriously on the system in general, such as exposure to the weather, corporeal exertion, errors of diet, &c.

417. When ophthalmic inflammation is sympathetically connected with disease of some other organ, as the exanthematous ophthalmiæ are with the inflammation of the skin, or symptomatically connected with some general diathesis, as scrofula, or disease, as syphilis, the treatment of the ophthalmic inflammation ought not to be delayed until the removal of the disease with which it is sympathetic, or of which it is symptomatic.

418. It is true that the local disease cannot always be cured or alleviated until the removal of the general disease, and that the removal of the general disease, will, of itself, often determine the subsidence of the local. This, however, ought not to prevent us from at least attempting to relieve the eyes as quickly as possible.

419. For the cure of ophthalmic inflammation, as for that of

inflammation generally, different plans of treatment are required according to the structure or structures affected, the degree and stage of the inflammation, &c.

420. The treatment of ophthalmic inflammation is divided into general and local, of each of which there are two principal plans. The two principal plans of general treatment are—the antiphlogistic, properly so called, including mercurialization,—and the tonic and alterative. These two plans may be variously modified and combined, according to the circumstances of the case. The two principal plans of local treatment are—the antiphlogistic and soothing,—and the irritating or stimulant. These again may be variously modified or even alternately employed according to the circumstances of the case.

a. General.—α. Antiphlogistic treatment.

421. *General bleeding.*—This is often required in acute ophthalmia, whether external or internal. Incompressibility of pulse, hot skin, and white tongue, are the general indications of the propriety of bleeding. The objective and subjective states of the eye will often of themselves furnish indications irrespective of those just mentioned. Circumorbital pain, for example, is a good indication; for when an ophthalmia is attended by it, venesection in general soon gives relief and promotes the operation of other remedies.

422. It is to be remarked that when circumorbital pain is severe, and has already continued some time, there may be a state of depression. This, however, ought not to forbid the abstraction of blood: on the contrary, venesection, by relieving the pain, removes the state of apparent depression.

423. The quantity of blood abstracted must depend on the nature of the inflammation and the strength of the patient—from ten to twenty ounces may in general be safely taken. Nor need a repetition of the abstraction of the same quantity be dreaded. In severe inflammation, the system in general tolerates a greater abstraction of blood as it does larger doses of tartar emetic, &c.

424. Cupping may sometimes be employed to supersede venesection, but in general, cupping is more applicable in chronic internal ophthalmia—cases in which the tonic and alterative plan of treatment is indicated.

425. In acute internal inflammation, by trusting to cupping, the system may be drained of blood without any advantage to the eye; but, on the contrary, the cure will be protracted, and the vessels of the organ left weak and relaxed, so that they will

be for a long time liable to become congested from the slightest cause.

426. The advantage obtained from bleeding is not so much the mere depletion as the impression made on the nervous system. This venesection effects more decidedly than cupping.

427. *Mercurialization.*—In the internal ophthalmiæ, mercury is an indispensable remedy. In acute iritis, for example, when the system is brought under the influence of mercury, the inflammation is in general observed to abate, and as this abatement goes on, the effused lymph becomes absorbed. The operation of the mercury is promoted by combination with opium, and by the preceding venesection.

428. The action of mercury is commonly described as simply sorbefacient; but it appears to be sorbefacient merely because it subdues the inflammation, which has caused the exudation or the congestion which prevents the absorption.

429. Mercury is both antiphlogistic and tonic, contra-stimulant, or hyposthenisant, as the Italian therapeutists affirm; but how does it act—primarily on the organic contractile fibre, or primarily on the blood, or on both at the same time?

430. *Turpentine* has been employed with considerable success in iritis and some forms of corneitis, but it is not so certain a remedy as mercury.

431. *Emetics, purgatives, diaphoretics.*—The antiphlogistic powers of tartar emetic are not, perhaps, so strikingly displayed in ophthalmic as in pulmonary inflammation; considerable advantage is, however, often obtained from it. The treatment of the phlyctenular ophthalmia of children, for example, is often very materially assisted by tartar emetic, first in emetic, and afterwards in nauseating doses.

432. As regards the use of purgatives in ophthalmic inflammation, it is to be observed, that it is sometimes only after a free action on the bowels that a decided abatement of the inflammation takes place.

433. In general, however, it may be said, that emetics and purgatives are not to be trusted to as a principal means of cure in ophthalmic inflammation. This is still more applicable to diaphoretics.

434. *Nitre* is a favourite remedy in inflammation, generally. It has been of late highly recommended in ophthalmic inflammation, sometimes, even, in preference to mercury and tartar emetic; not affecting the gums like the former, nor causing vomiting like the latter.*

* Rognetta, Traité philosophique et clinique d'ophthalmologie basé sur les principes de la thérapeutique dynamique. Paris, 1844.

435. *Belladonna.*—This is a most important medicine in the treatment of ophthalmic inflammation. It is employed to keep the iris contracted in iritis, and thus to oppose the tendency to closure of the pupil, and to prevent depositions of lymph on the middle part of the anterior capsule and synechia posterior. Against intolerance of light, and especially that which is so distressing a symptom in phlyctenular ophthalmia, it sometimes acts like a charm.

436. But besides these effects, belladonna appears to exert an influence in subduing the inflammation itself. Indeed, in respect of antiphlogistic powers, the Italian therapeutists have compared it to bleeding, tartar emetic, &c., though from neglect of the important distinction above laid down, (s. 287,) they appear to me to describe its mode of action inaccurately, not only in inflammation, but also in dilating the pupil.

437. As to the mode of action of belladonna in dilating the pupil, seeing that the state of relaxation of the iris is that in which the pupil is neither much contracted nor much dilated, and that contraction and dilatation of the pupil are manifestations of an active state, the former of the circular, the latter of the radiating fibres of the iris, it is to be inferred, that the action of belladonna, in producing dilatation of the pupil, consists in calling forth, through the medium of the ganglionic system, the contraction of the radiating fibres. These fibres, it is to be remarked, are, different from the circular fibres, immediately under the influence of the ganglionic system.

438. If such be the action of belladonna in dilating the pupil, it is more than probable that its power as an antiphlogistic, consists in determining contraction of the vessels, they being, like the radiating fibres of the iris, under the influence of the ganglionic system.

439. The action of belladonna, in producing dilatation of the pupil, probably consists in exciting, through antagonistic reflex action, the nerves of the radiating fibres of the iris, by exerting a sedative influence on the retina. The contraction of vessels, which I suppose to be called forth by belladonna in inflammation, may be due to a similar sedative influence on sensitive nerves,—in consequence of which, the action of the nerves governing the contraction of the vessels, is by *antagonism* restored. The relief of intolerance of light by belladonna, appears to be produced by its sedative influence on the retina.

β. *Tonic and alterative treatment.*

440. *Tonics* are of extensive use in ophthalmic inflammation

—sometimes to promote convalescence, after inflammation has been subdued by depletion and mercurialization—sometimes even in the height of the inflammation; thus in the scrofulous ophthalmia, quina has been shown by Dr. Mackenzie to be scarcely less efficacious than mercury is in iritis. Iron, zinc, and the mineral acids, are also useful in various cases, complicated with anæmia, dyspepsia, &c.

441. In chronic internal ophthalmia, mercury, as an alterative, given in conjunction or not with sarsaparilla, quina, &c., is a most useful remedy—also arsenic.

b. Local.—a. Antiphlogistic and soothing treatment.

442. *Local bleeding—Leeches.*—Though in acute internal ophthalmia, leeches would not produce a very decided effect, they may often be usefully made to follow up venesection. Leeches alone are applicable in ordinary cases of conjunctivitis, corneitis, &c.

443. *Scarification* is very beneficial when the vessels of the palpebral conjunctiva are much gorged with blood, as in the purulent ophthalmiæ. When chemosis is present, incisions are made in the elevated conjunctiva, or folds of it are snipped off, as above directed, (s. 152;) but as much for the sake of relieving tension as for the abstraction of blood.

444. *Evacuation of the aqueous humour.*—This has been recommended as a remedy in ophthalmic inflammation. It operates, by relieving distension of the eyeball from increased accumulation of aqueous humour—a state attended by suffusion of the cornea, and the cause at once of considerable distress, and of a continuance of the inflammatory action. The practice is certainly sometimes advantageous, but the aggregate results have been on the whole not very favourable; moreover, the operation is too nice a one to warrant its adoption, except on particular occasions, (see s. 176.)

445. *Counter irritation* is of much use in ophthalmic inflammation, after the acute symptoms have been subdued, and in chronic inflammations.

446. *Cold and warm applications.*—The cases in which cold applications are adapted, are conjunctivitis in its earlier stages, and injuries of the eye, in order to ward off or moderate the traumatic inflammation. In most other cases of ophthalmic inflammation, warm applications are preferable. But it is to be observed, that the choice of cold or warm applications may be in general best determined by the feelings of the patient.

β. *Irritating applications.*

447. It may be laid down as an axiom, that (to use the words of Dr. Mackenzie) in the internal ophthalmiæ, and especially in the acute stage, the application of stimulants is useless or destructive; while in conjunctival inflammations, more is effected by their means than by almost any other kind of remedy. Indeed the plan of treatment adapted for acute iritis, if trusted to in severe conjunctivitis, would expose the eye to almost certain destruction.

448. But in regard even to conjunctival inflammations, it is to be observed, that as they are frequently dependent on the state of the constitution, or on an affection of some other organ, he who in treating them should direct his attention exclusively to the eye affected, might often exhaust his whole ophthalmic formulary in vain. On the other hand, however, it is not to be denied, that in many cases the inflammation is either purely local, or though connected with constitutional causes, can have its cure effected only by local treatment. This must not be overlooked; for though it has been more usually the error to treat ophthalmic inflammations as mere local affections, still some practitioners have run into the opposite extreme of neglecting local treatment entirely.

449. For observations regarding the mode of action of local remedies, see ss. 289, 290.

Section III.—THE OPHTHALMIÆ.

A. Order I.—OPHTHALMIA EXTERNA.

450. The order of ophthalmia externa comprehends the genera conjunctivitis, sclerotitis, and corneitis. Each of these, as has been shown, may be more or less complicated with some degree of the other; but when the conjunctiva and sclerotica, or conjunctiva and cornea, or the conjunctiva, sclerotica, and cornea, are equally affected at the same time, then the case must be considered as coming under the head of a fourth genus, viz., compound external ophthalmia.

a. Genus I.—CONJUNCTIVITIS.

451. The species of conjunctival ophthalmia are:—*puro-mucous ophthalmia—erysipelatous ophthalmia*—and *pustular* or *aphthous ophthalmia.*

452. *Puro-mucous ophthalmia.*—The different forms or varieties of puro-mucous ophthalmia are:—catarrhal ophthalmia—Egyptian or contagious ophthalmia—ophthalmia neonatorum—gonorrhœal ophthalmia,—to which may be added the ophthalmia sometimes met with in female children in connection with puro-mucous vaginal discharge.

Catarrhal ophthalmia.

(Blepharophthalmo-Conjunctivitis catarrhalis—Ophthalmia purulenta mitior.)

453. The form of inflammation comprehended under this name, is usually considered the type of conjunctival inflammation; for it is the form which inflammation of the conjunctiva, excited by other causes besides atmospherical influence—injury, for example—is most prone to assume.

454. *Objective symptoms.*—The eyelids are somewhat red and swollen, especially at their edges—the upper eyelid may be so much swollen as to overlap the edge of the lower. The white of the eye is bloodshot, and on examination, this is found to be owing to the reticular vascular injection above described as characteristic of inflammatory congestion in the conjunctiva, (ss. 301-302.) Besides the vascular injection, there are sometimes interspersed spots of ecchymosis, (s. 309.)

455. On everting the lower eyelid, it is seen, that towards the palpebral sinus, the redness of the sclerotic conjunctiva is more intense, and that the palpebral conjunctiva, at the same time that it is very red, is thickened and velvety-looking. The semilunar fold and lachrymal caruncle are red and swollen.

456. In the severer cases, in which the vascular injection of the sclerotic conjunctiva extends to the very margin of the cornea, there may be some degree of chemotic elevation of the conjunctiva, especially at the lower margin of the cornea.

457. The cornea may remain quite clear, and the colour and activity of the iris unchanged.

458. There is at first watering of the eye, the result, partly, of the serous exudation from the conjunctiva, above mentioned, (s. 305,) but by and by a puro-muculent discharge takes place. The matter accumulates in greater or less quantity at the inner

corner of the eye, and in flakes in the palpebral sinuses. Films of this matter getting on the surface of the cornea every now and then, occasion momentary dimness and iridescence of vision. The eyelashes, also, are besmeared with the secretion; but another source of the matter, which is found incrusting them, and gluing the eyelids together over night, is the secretion of the Meibomian glands, which is poured out in increased quantity.

459. The watering of the eye at the commencement, as has been hinted, does not appear to be wholly the result of lachrymation, but partly of serous exudation from the congested vessels of the conjunctiva. A flood of tears, however, occasionally takes place.

460. *Subjective symptoms.*—Itchiness and smarting at the borders and angles of the eyelids, heat, and the sensation as if a foreign body were in the eye, are the subjective symptoms which usually usher in an attack of catarrhal ophthalmia.

461. There is not much intolerance of light, though there is a greater or less desire to shade the eye, and a feeling of weakness of it. The eyelids feel stiff, heavy, and tense. When the upper overlaps the lower, a very disagreeable sensation is experienced.

462. The discharge of tears which occasionally takes place, is followed by temporary relief; and when the puro-muculent secretion is established, the itchiness and smarting of the edges of the eyelids, and the sensation as if a foreign body were in the eye, are relieved.

463. There may be pain across the forehead, and in the region of the frontal and maxillary sinuses, but there is no pain like rheumatism around the orbit nor in the temples.

464. An exacerbation of the symptoms takes place towards evening; but the sensation as if a foreign body were in the eye, is felt much on first moving the eye in the morning.

465. *Constitutional symptoms.*—In general, there is not much or any constitutional disturbance; but the patient may be at the same time affected with a general catarrh.

466. *Predisposing causes.*—The patient may be of any age, of either sex, and otherwise healthy; but it is often the case that he has been for some time out of health, or has been overexerting the eyes.

467. *Exciting causes.*—This form of inflammation, though conventionally called catarrhal, may be excited, as above mentioned, by irritation or injury of the conjunctiva. It is in the

majority of cases, however, excited by atmospheric influence. In this case it may occur epidemically. In some places it is so common, that it might be considered endemic. Under these circumstances, it is usually of a very severe form, partaking more of the characters of Egyptian ophthalmia in its milder degrees—like which, also, it sometimes appears to spread by contagion.

468. Very generally both eyes are affected, but one is usually more so than the other.

469. *Diagnosis.*—Simple catarrhal ophthalmia is, in general, distinguished from the other forms of puro-mucous ophthalmia, in not presenting such a degree of redness and swelling of conjunctiva, copiousness of the puriform discharge, nor swelling of the eyelids, and by the circumstances under which it occurs.

470. The ophthalmiæ from which catarrhal ophthalmia requires to be principally distinguished, are phlyctenular and catarrho-rheumatic,* the former occurring in young persons, the latter in adults.

471. In phlyctenular ophthalmia, the conjunctival vessels which are injected are few in number, and ramify singly or in detached fasciculi towards the conjunctival circumcorneal network, (s. 625,) which may be completely, or partially injected. There is also some sclerotic circumcorneal injection. The general expression of the redness in phlyctenular ophthalmia is thus different from what obtains in catarrhal ophthalmia, a faint blush on one side or all round the cornea, shaded off towards the circumference of the eyeball, together with a fasciculus of vessels, perhaps, proceeding to some point on the cornea where there is an ulcer.

472. In phlyctenular ophthalmia, the cornea, which is the essential seat of the disease, early becomes suffused, or presents phlyctenulæ, which, bursting, leave ulcers. In catarrhal ophthalmia, although ulceration of the cornea may eventually take place, the cornea is quite unaffected at first.

473. In phlyctenular ophthalmia there is little or no increase of the Meibomian secretion, or of the mucous secretion of the conjunctiva, which are such prominent characters in catarrhal ophthalmia. But in phlyctenular ophthalmia there are great lachrymation and intolerance of light; whereas in

* Catarrhal ophthalmia is not likely to be confounded with rheumatic ophthalmia or sclerotitis. The difference in the seat and character of the vascular injection has been above pointed out, (ss. 63, 323,) and the difference in the accompanying pain, (ss. 2, 394-395.)

catarrhal ophthalmia, these symptoms are slight or altogether absent.

474. But it is to be remarked, that phlyctenular and catarrhal ophthalmiæ may occur in combination, constituting scrofulo-catarrhal ophthalmia. Catarrhal may also occur in combination with pustular or aphthous ophthalmia. Cases even occur of a combination of catarrhal, aphthous, and phlyctenular ophthalmia.

475. The differences between catarrhal and catarrho-rheumatic ophthalmiæ are:—In catarrhal ophthalmia, there is simply conjunctival injection—in catarrho-rheumatic, both conjunctival and sclerotic. Hence, while in catarrhal ophthalmia, the sclerotica is observed white under the vascular network of the conjunctiva, it is pink in catarrho-rheumatic ophthalmia.

476. While in catarrhal ophthalmia, unless severe and of long continuance, the cornea is clear, and the colour and motions of the iris natural, in catarrho-rheumatic ophthalmia, the cornea appears muddy, and not unfrequently presents a phlyctenula or ulcer, and the iris is discoloured, and pupil sluggish. There is considerable intolerance of light in catarrho-rheumatic ophthalmia; and instead of the pain across the forehead, or in the frontal sinuses, which may exist in catarrhal ophthalmia, there is more or less severe circumorbital or temporal pain, aggravated when the patient is warm in bed.

477. *Prognosis.*—Catarrhal ophthalmia, in its simpler forms, is in general readily subdued. In its severer forms, if neglected or improperly treated, ulceration of the cornea may take place, and, above all, the palpebral conjunctiva is extremely apt to be left in a state of chronic inflammation—itself thickened, and its papillæ enlarged—a state which keeps up irritation of the eye, and which may lead to vascularity and opacity of the conjunctiva corneæ. In this, as also in the other puro-mucous ophthalmiæ, entropium and ectropium are not unfrequent results.

478. *Treatment.*—In the simpler forms of this ophthalmia, if the case is seen at the very commencement, an attempt should be made to subdue the inflammation by soothing treatment. For this purpose, rest, quiet, and restricted diet should be enjoined, and a purgative of calomel and jalap, for example, prescribed; or an emeto-cathartic, especially if there is more than usual sensibility to the light,—two grains of tartar emetic, and an ounce of Epsom salts, may be dissolved in half a pint of water, and two or three tablespoonfuls of the solution taken

every half hour until vomiting; after which the same dose every four or six hours only.

479. As applications to the eye, lotions of tepid water three or four times a day, or, if more agreeable, the continued application of cold. The continued application of cold lotions, however, it is to be remarked, is apt, in middle-aged persons particularly, to excite sclerotic inflammation, and thus convert a catarrhal into a catarrho-rheumatic ophthalmia. As an occasional application, cold water is not well adapted. When used as such, an uncomfortable sensation of heat in the eye is felt soon after; whereas, when tepid water has been used, the eye for a time feels pleasantly cool. At bed-time, the borders of the eyelids are to be anointed with simple ointment.

480. Under this soothing treatment, the inflammation will sometimes subside without anything further being required; but if it does not begin to do so within twenty-four hours or so, irritating collyria will require to be used. The nitrate of silver solution, for example, may be dropped into the eye once a day, and the alum, bichloride of mercury, or lapis divinus lotion, without addition of vinum opii, (s. 124,) used tepid, to bathe the eye three times a day. At bed-time, the borders of the eyelids may be anointed with the weak red precipitate salve, (s. 136).

481. If, notwithstanding this treatment, the inflammation persists, it will be proper to apply leeches—from six to twelve around the eye, or each eye, if both be affected.

482. In the severer forms of the complaint, blood should be at once abstracted, either by leeches as above, or if the patient be robust, by venesection, followed up, if necessary, by leeches. This treatment will save much subsequent inconvenience from a thickened state of the palpebral conjunctiva. After the bleeding, a pediluvium, and some diaphoretic, such as Dover's powder, at bed-time, are to be prescribed, and a purgative draught in the morning. After that, nitre in doses of gr. v every two or three hours, in barley-water. Locally, the same treatment as above indicated.

483. As the inflammation remits, the redness of the sclerotic conjunctiva becomes less and less until it has quite disappeared; but though this has taken place, considerable congestion may still be presented by the palpebral conjunctiva, with enlargement of its papillæ. If this state of the palpebral conjunctiva continue obstinate, blisters behind the ears, scarification of the palpebral conjunctiva, and the penciling of it with the strong red precipitate or nitrate of silver ointment, will be useful. When

the palpebral conjunctiva is merely left relaxed and thickened, penciling it a few times, at intervals of two or three days, with vinum opii, pure, or diluted with one or two waters, or with the lapis divinus drops, will do good. A return to generous diet, and the use of tonics, are at the same time to be enjoined.

Egyptian ophthalmia.

Ophthalmia vel conjunctivitis puromucosa contagiosa—Ophthalmia purulenta gravior—Ophthalmo-blennorrhœa—Ophthalmia bellica, &c.

484. This is the disease of the eyes which so severely affected the English and French armies in Egypt, and also after their return thence, and which has since raged in the armies of almost all the states of Europe.

485. The palpebral conjunctiva is especially the focus of the disease ; being the part which is from the first, and which continues to the last affected, whatever other parts may be also involved. But though the inflammation may thus remain almost entirely confined to the palpebral conjunctiva, it is peculiarly disposed to extend, and that with great violence, to the ocular conjunctiva, and even to the proper tunics of the eyeball itself. On this extension of the inflammation depends the rapid destructiveness to the eye, which has so lamentably characterized the disease.

486. Different degrees of the ophthalmia—a first, a second, and a third degree—are accordingly recognized.

487. In the first degree, the inflammation is still in a great measure confined to the palpebral conjunctiva, and, though there is some puro-mucous secretion, there is no decided blennorrhœa.

488. In the second degree, the inflammation has extended to the ocular conjunctiva, which is loosened and raised up into chemotic folds at the lower edge of the cornea, and there is more or less blennorrhœa.

489. In the third degree, the chemosis is complete, the eyelids are enormously swollen, there is profuse discharge of mucopurulent matter, and the proper tunics of the eyeball are either already involved, or in imminent danger of becoming so.

490. The disease may not advance beyond the first degree, but become chronic, or it may at once pass into the severer degrees. In its chronic state, it is still ready, on the application of any exciting cause, to pass into the severer degrees.

491. The second degree may arise at once as such, or be developed from the first degree.

492. The second degree has a great tendency either to become chronic or to pass into the third degree, and this especially if neglected or improperly treated. The third degree, indeed, generally, if not always, arises by a sudden aggravation of all the symptoms from the milder degrees, especially the second.

493. The morbid development on the surface of the palpebral conjunctiva of what are called *granulations*, is an early and important effect of the inflammation.

494. Besides granulations, phlyctenulæ, in some cases, present themselves, in the beginning of the disease, on the palpebral conjunctiva, and on the conjunctiva of the sinuses. The nature of these phlyctenulæ, as well as that of the granulations, has been above pointed out, (ss. 303-6-7-10-11.) From what is there said, it appears that there are two principal stages in the development of granulations:—The first stage consists simply in enlargement of the papillæ from inflammatory congestion; the second in hypertrophy of the papillæ.

495. According to the degree of development of the granulations, which, it is to be remarked, does not always depend on the degree of the inflammation, the surface of the palpebral conjunctiva appears, when the eyelids are everted, like red velvet—the enlarged papillæ being separated into groups by furrows or fissures; or tuberculated and sarcomatous looking like a mulberry. I have seen granulations like small pedunculated polypi.

496. The development of a granular state of the palpebral conjunctiva is often the result of long-continued but slight congestion—so slight as scarcely to have attracted the patient's attention. Hence it has been maintained, that the formation of granulations takes place independently of inflammation; and when, in such cases, ophthalmia declares itself in a decided form, it has been alleged to be an effect or symptom of the granular state of the palpebral conjunctiva. But this is incorrect.

497. Both eyes, commonly, are affected, though one, and that the right generally, it has been said, may suffer more than the other. When both eyes become affected, there is often an interval of some days between their first invasion.

498. The lower eyelid is usually first affected, but the upper soon becomes so and suffers more than the lower—it, indeed, remains the nest of the disease.

499. *Local symptoms in first and second degrees.*—The *first* and *second* degrees of Egyptian ophthalmia do not essen-

tially differ in their symptoms, either objective or subjective, from the milder and severer forms of catarrhal ophthalmia, except in the granular state of the conjunctiva, which, though it does in some degree exist in inveterate cases of catarrhal ophthalmia, presents itself in Epyptian ophthalmia even from the first, and remains to the last, so that it is justly considered the peculiar characteristic of the disease.

500. *Constitutional symptoms in first and second degrees.*—In general, there is no constitutional disturbance—no fever—no loss of appetite. When such do occur, they depend rather on the idiosyncrasy of the patient than on the disease.

501. *Objective symptoms in the third degree.*—In the third degree, the eyelids, especially the upper, are very much swollen sometimes enormously so, tense, livid, and hot. The upper eyelid hangs down over the lower.

502. If an attempt be made to open the eyelids, or even when the patient makes any effort whatever, protrusion of the conjunctiva of the palpebral sinuses, and eversion of the eyelids, are apt to take place, in consequence of the swollen and sarcomatous state of the conjunctiva, as well as the effusion beneath it. The eversion of the eyelids is at first reducible, but by and by it may cease to be so.

503. The semilunar fold and lachrymal caruncle are so red and swollen, as to look like sarcomatous excrescences rather than natural structures.

504. The sclerotic conjunctiva, likewise red and swollen, is raised up like a wall all round the cornea, which thus appears half buried, (*chemosis.*) The cornea may be as yet unaffected.

505. After some hours, the secretion of the conjunctiva, which was sero-muculent, becomes muco-purulent, and is poured out in such quantity, that it is constantly flowing down the cheek. If the eyelids are suddenly opened, the matter bursts out in a torrent.

506. An oozing of blood readily takes place from the conjunctival surface.

507. The inflammation does not remain confined to the conjunctiva, but extends to the proper tunics of the eyeball, the sclerotica, the cornea, and even the internal tunics. When the eyelids admit of being opened, the implication of the cornea can be seen, but that of the other parts is inferred from the subjective symptoms. When the eyelids cannot be opened, and the cornea seen, something may be inferred as to the degree to which it has suffered from the state of the discharge; if ill-conditioned, there is reason to dread mischief to it.

508. The cornea, though it sometimes escapes immediate material injury, is the part most subject to the destructive effects of the inflammation. It becomes more or less opaque from exudation into its substance. Its conjunctival layer may become thickened, opaque, vascular, and covered with fungous excrescences,—or phlyctenulæ form, burst, and run into perforating ulceration, which is followed by prolapsus iridis. In the worst cases, the cornea becomes wholly infiltrated with exudation, and is rapidly and completely destroyed by ulceration, or by mortification and sloughing. Sometimes it bursts, but probably not before being thinned by ulceration. Even if it should have escaped these destructive effects, an ulcerated trench will probably be found, when the swelling of the parts subsides, at the place where it was pressed on by the chemosed conjunctiva.

509. *Subjective symptoms in the third degree.*—The severity of the subjective symptoms in this degree of the disease, is principally owing to implication of the proper tunics of the eyeball—the sclerotica, the cornea, and even the internal tunics.

510. There is burning hot pain in the eyelids, aggravated by the slightest touch, deep distending pain in the eyeball, and pain around the orbit, in the temple, or all over the side of the head. There is great intolerance of light, and often photopsy.

511. The pain around the orbits and in the temples occurs in nocturnal paroxysms, during one of which the cornea bursts. On the bursting of the cornea, the pain immediately remits, but returns again in another form, or passes to the opposite eye.

512. *Constitutional symptoms in the third degree.*—Even in the third degree, the constitutional symptoms are not severe. In some exceptional cases, indeed, before the disease has reached its greatest height, a symptomatic inflammatory fever arises, but is, notwithstanding the severity of the local affection, very moderate, and does not continue long. In the progress of the disease, however, the patient is apt to become much sunk both in strength and spirits.

513. *Causes.*—The cause of this disease was at one time supposed to be a peculiar contagion, first imported into Europe from Egypt (hence the epithet Egyptian) by the English and French armies. It is now, however, pretty generally conceded, that the disease does not depend upon any such peculiar contagion, but that it may arise from occasional atmospherical influences, sometimes sporadically, sometimes epidemically.

There are also local influences which render it endemic, in many other places besides Egypt.

514. In whatever way it arises, it may, under favouring circumstances, as when large bodies of people are crowded together, become infectious. This is the explanation of its propagation in armies, schools, and prisons.

515. It has been supposed that propagation takes place principally by infection *per contactum;* but experience appears to show, that infection *in distans* is the more common way,* the air being the vehicle by which the infecting principle is conveyed in the latter case, the discharge from the eye in the former. Piringer† has made a number of attempts to reproduce the disease, by the application of matter from an affected eye, for the purpose of curing pannus, as will be explained in the proper place, and the results he has come to in regard to the contagion of the disease, are the following:—The contagion is fixed, its vehicle the muciform secretion of the conjunctiva. The mucus of the second and third degree of the disease only is absolutely infectious; as the secretion becomes thinner, it loses its infectious power. Eyes which have been already diseased, appear to be less readily infected than perfectly sound eyes. The activity of the mucus is not retained beyond the third day after its removal from the body; the reaction takes place in from six to twenty-four hours, usually at night. The degree of the disease excited by the infection, depends on the quality of the contagion. Mucus from the first degree of the disease, or thin secretion from the second and third, occasions the first degree of the disease. Secretion from the second degree of the disease excites the third degree. The application of ice-cold water, and cleansing the eye, within three minutes after the matter has been applied, prevent the operation of the infection.

516. Though the disease has prevailed in the most opposite climates, and in all seasons, still it appears that a very warm, or a warm and damp climate or season, is peculiarly favourable to its development and propagation.

517. As causes predisposing the individual to be attacked, may be mentioned fatigue, exposure, want of cleanliness, improper food, abuse of spirituous liquors, &c. The heavy caps and high tight collars of infantry soldiers in Prussia, Belgium, &c., have been supposed by Dr. Vleminckx to be a predispos-

* Eble, Die so-genannte contagiöse oder ägyptische Augenkrankheit. Stuttgardt. 1839.

† Die Blennorhoë am Menschenauge. Gratz, 1841.

ing cause, operating by straining the body during exercise, and impeding the free return of blood from the head.

518. *Diagnosis.*—It has been above shown, that the principal difference between catarrhal ophthalmia and the milder forms of Egyptian ophthalmia, consists in the great degree in which the papillary body of the palpebral conjunctiva is affected with hypertrophy in the latter,—a morbid state, which is very inveterate, and by its presence keeps up irritation and a tendency to relapse.

519. The severest degree of Egyptian ophthalmia is to be distinguished from the other forms of purulent ophthalmia, gonorrhœal, for example, principally by the circumstances of the case—and by this, that in gonorrhœal ophthalmia, the ocular conjunctiva is perhaps more swollen, the eyelids less so, and that there is an absence of phlyctenulæ and granulations of the palpebral conjunctiva.

520. *Prognosis in general.*—When the inflammation is of an active character, and not modified by any constitutional peculiarity, early and proper treatment promises success. When the inflammation is of a torpid character, and when the constitution is scrofulous, it less readily yields to treatment, subsides less quickly and perfectly, and fixing itself in the structures of the eye, is apt to produce degeneration of it. In erethitic irritable cases, the prognosis is also unfavourable, but less so than in torpid cases.

521. Sporadic cases are usually of middling severity. In an epidemic, the disease is at first mild, then increases in severity, and again becomes milder towards the end. When the disease is endemic, the cases, without being of the severest character, are in general very inveterate, if neglected.

522. The disease arising from contagion is more dangerous than when otherwise produced.

523. *Prognosis in the first degree.*—The disease in the first degree, especially if properly and timely treated, may in general be readily subdued. If not timely and properly treated, the disease may pass at once into the severer degree, or fall into a chronic state. In this state, however, it is still ready, on the application of any exciting cause, to rise into the severer degree.

524. *Prognosis in the second degree.*—The disease in the second degree, if taken in time and properly treated, may still be cured in three or four weeks. But if the inflammation has already been going on for a week or so, even if the cornea is still unaffected, though the inflammation may be readily re-

moved from the sclerotic conjunctiva, the palpebral conjunctiva will remain long in a thickened and granulated state.

525. When the disease has become fully developed before medical assistance is called for, vascularization and ulceration of the cornea may have taken place. This affection of the cornea is kept up, if not aggravated, by the morbid state of the palpebral conjunctiva; hence the prognosis is very unfavourable, as opacity and permanent vascularity of the cornea may result. The ulceration may penetrate the cornea.

526.—*Prognosis in the third degree.*—In the third degree of the disease, a perfect cure is seldom effected. If the eye is not disorganized, which it may be in 24—36 hours, by destruction of the cornea, it may be very much injured by perforating ulceration and its consequences. Besides this, the morbid state in which the conjunctiva is left is long of being recovered from, perhaps never perfectly, and is a constant source of irritation.

527. *Treatment.*—In the first degree, leeches around the eye, and opening medicine, are to be first prescribed. Then lotions of tepid water, or the constant application of cold, and pencilling the palpebral conjunctiva once a day with the nitrate of silver drops, (s. 128,) or with the strong red precipitate ointment (s. 136).

528. In the severer degrees of the disease, if the patient be of good strength, venesection to ℥xij—xvj—xx, followed at bed-time with Dover's powder, gr. x—xx, and calomel, gr. iij—v, and a black draught next morning. In some cases, leeches around the eye may be required to follow up the venesection, or it may be necessary to repeat the latter.

529. After the bleeding, &c., the application to the conjunctiva of strong irritants should be made, as nitrate of silver in substance, salve, or solution, or the strong red precipitate salve once or twice a day, and the eye bathed and cleansed frequently with tepid water, or the tepid solution of alum, or of bichloride of mercury, (s. 124.)

530. If chemosis exists, and if the cornea appear much buried and pressed on by it, incision, or excision of small pieces of the chemosed ocular conjunctiva ought to be had recourse to without delay, (ss. 152, 443.) Incision or excision of the chemosed conjunctiva relieves the eyeball, and especially the cornea, from the pressure which is considered, as above mentioned, (s. 357,) to be one great cause of its destruction.

531. When the iris and other internal structures of the eyeball become affected, as is indicated by change of colour of iris and contraction of pupil, provided these can be seen, and by

pulsative pain in and around the eye, with inflammatory fever, the propriety of abstraction of blood, either by venesection, cupping or leeches, will again come under consideration. It will, in any case, be proper to give calomel, gr. ij and opium, gr. ss every four hours, until the gums are affected, and to apply belladonna around the eye.

532. When the violence of the inflammation has subsided, it will be advantageous to improve the diet and give tonics,—quinine or bark, especially if there be periodical pains in or around the eye. Also to make counter-irritation behind the ears or on the nape of the neck.

533. The special treatment of granular conjunctiva, of pannus, of ulceration of the cornea, prolapsus iridis, &c., which may present themselves as the effects of the inflammation, will be treated of under the proper heads.

Ophthalmia of new-born infants.

(Ophthalmia neonatorum—Purulent ophthalmia of infants.)

534. It is generally within a week after birth that this ophthalmia makes its attack. Sometimes it is observed immediately after birth, sometimes, again, as late as three or four weeks.

535. *Objective symptoms.*—It is first noticed, that the infant keeps the eyes shut, that the edges of the eyelids are slightly œdematous and red, and that they are glued together after sleep with an inspissated yellow matter, which is the Meibomian secretion increased in quantity. On softening this, and separating and everting the eyelids for examination, the palpebral conjunctiva is found red and spongy; and sclerotic conjunctiva but little injected.

536. In this way, first one eye, and in a day or two the other becomes affected. That first affected generally suffers most in the course of the disease.

537. The swelling and redness, which were at first confined to the edges, by and by extend to the whole eyelids, especially the upper. The palpebral conjunctiva becomes still more red, swollen, and velvety. The lachrymal caruncle and semilunar fold are red and swollen, and the sclerotic conjunctiva is now more or less injected, even to the margin of the cornea. A whitish sero-muculent discharge is at the same time established. This will perhaps flow out in some quantity when the eye is opened for examination, having been pent up and accumulated in the conjunctival space, in consequence of the gluing together of the edges of the eyelids.

538. As the disease approaches its height, the swelling of the eyelids increases, and their skin becomes of a brownish-red colour, tense, and shining. The upper eyelid, which is always the more swollen, overlaps the edge of the lower.

539. On separating the eyelids, a quantity of thick puriform matter escapes, and the eyelids perhaps become everted, and the conjunctiva of the palpebral sinuses protrudes, so great is the swelling of the conjunctiva. Eversion of the eyelids, and protrusion of the conjunctiva of the palpebral sinuses, may take place even by the contraction of the muscles when the infant cries. The lachrymal caruncle and semilunar fold are very much swollen, and the sclerotic conjunctiva is in the state of chemosis. In this stage of the inflammation, discharge of blood readily takes place from the conjunctival surface.

540. Hitherto the cornea may have continued unaffected, or at the most may have been hazy; but chemosis has usually not existed long, before it suffers more or less injury, becoming the seat of ulceration, abscess, or destructive purulent infiltration. When such mischief as this occurs, the discharge becomes ichorous, and a diminution of the swelling and tension of the eyelids takes place.

541. *Constitutional symptoms.*—As the disease proceeds, the infant becomes fretful and uneasy, does not suck, nor sleep, and its mouth becomes aphthous.

542. *Causes.*—The infants, the subjects of this ophthalmia, are generally weakly, often twins, or prematurely born.

543. Sometimes the disease can be attributed to no other exciting cause than such as gives rise to catarrhal ophthalmia. In many cases, exposure of the eyes to heat and light, or the direct intrusion of irritants, such as the soap or spirits used in washing the infant, appears to be the exciting cause. Inoculation with leucorrhœal matter from the vagina of the mother during parturition, there is reason to believe is a very common cause. Inoculation with gonorrhœal matter is, for obvious reasons, a less frequent cause. Dr. Cederschjöld of Stockholm, found ophthalmia neonatorum occur in 20 out of 137, or 1 in 7 infants the mothers of whom were affected with vaginal discharge; and in 10 out of 181, or 1 in 18, the mothers of whom were not so affected.

544. The disease may be propagated by infection *per contactum*. Adults having had the discharge from the infant's eyes accidentally applied to theirs, purulent ophthalmia has been produced, and that so severe as to destroy the eyes.

545. When there is a number of infants labouring under this

disease collected together, as in lying-in and foundling hospitals, infection appears to be propagated *in distans*.

546. *Prognosis, and course.*—In whatever stage of the disease the medical man be called in, he may in general pronounce a favourable prognosis, if he finds the cornea still clear, or even though hazy, still free from ulceration or abscess. If ulceration or abscess have taken place, the extent to which the cornea will be preserved clear, whether it may not be perforated and prolapsus iridis take place, and this whether to the extent of constituting the condition for the formation of partial staphyloma, can only be doubtfully prognosticated until a decided stop is put to the inflammation. The prognosis may then be regulated by the degree and extent to which the cornea has suffered, (ss. 359-363.) If the cornea have become completely infiltrated with matter, it is destroyed; it will be thrown off by ulceration or sloughing, the iris will protrude, and the condition be laid for a total staphyloma.

547. Though the eye may have otherwise escaped, it may be left affected with central capsular cataract, strabismus, or incomplete amaurosis.

548. The disease yielding, the swelling of the eyelids diminishes. From being tense and shining red, the skin becomes wrinkled and pale livid. The chemosis and redness of the sclerotic conjunctiva subside; but although the swelling of the palpebral conjunctiva becomes much diminished, its redness and the enlarged state of its papillæ more slowly disappear. The purulent discharge becomes less and less. All this, and the course to a cure, proceed rapidly if the cornea have remained unaffected; but the existence of ulceration, &c., of the cornea necessarily retards the cure of the other parts, which, in fact, proceeds only in proportion as the cornea heals.

549. *Treatment.*—The disease may be successively treated from the first by such applications as nitrate of silver drops or ointment, or strong red precipitate ointment, (ss. 128, 126.) These remedies must be applied by the surgeon himself once a day. Before the application, the eye is to be cleansed from discharge.

550. The nurse should use the alum, or bichloride of mercury collyrium tepid, three times a day, for bathing and cleansing the eye; and the weak red or white precipitate ointment, for anointing the edges of the eyelids, to prevent them from being glued together.

551. If the disease has come to a height before the surgeon is called in, it will often be necessary to have recourse, in the

first place, to the application of a leech to the swollen upper eyelid, or what is better, perhaps, to scarification of the red, swollen, and spongy palpebral conjunctiva before applying the strong drops or ointment. The scarification of the palpebral conjunctiva may be required to be repeated more than once; and if the chemosis be great, and the cornea much buried and becoming dim, it will be advisable to make some deep scarifications in the chemosed sclerotic conjunctiva also.

552. Small blisters behind the ear in severe cases promote the action of the preceding treatment.

553. Internally, a little castor-oil, or rhubarb and magnesia, is to be given as occasion requires; and when the cornea is threatened, small doses of calomel and quina, gr. $\frac{1}{4}$ of the former, and gr. ss of the latter, rubbed up with sugar twice a day.

554. The diet of the nurse is to be carefully regulated. During the height of the disease, she should abstain from animal food and strong drinks.

555. When the puriform discharge has ceased, but the conjunctiva remains relaxed, drops of vinum opii, diluted with an equal part of water, or the lapis divinus drops, (s. 128,) are to be applied to the conjunctiva once a day, or once every second day; and the nurse may now take besides animal food and wine or porter, tincture of iron.

556. Whenever the eyelids become everted, they should be immediately restored to their proper position, which is done by seizing the eyelid between the finger and thumb, drawing it a little from the eyeball, and then turning it down. Should the eversion have been allowed to continue some time, and the eyelid cannot be restored to its proper position, the everted conjunctiva is to be scarified; and when it has thus been somewhat emptied of blood, it will admit of being returned more readily.

Gonorrhœal ophthalmia.

(Ophthalmia gonorrhoica vera—Acute gonorrhœal inflammation of the conjunctiva.)

557. *Diagnosis.*—This ophthalmia resembles very much the severest form of Egyptian ophthalmia. If there is any difference, it is this:—In gonorrhœal ophthalmia, the sclerotic conjunctiva is affected from the very first, and great and inveterate chemosis rapidly forms; whereas in Egyptian ophthalmia, the sclerotic conjunctiva becomes affected subsequently to the palpebral conjunctiva, the chemosis does not form so rapidly, nor is it so inveterate. In gonorrhœal ophthalmia, though the inflammation of the palpebral conjunctiva and swelling of the

eyelids may be very great, it is in general not so considerable as in Egyptian ophthalmia; and, at any rate, the papillæ of the palpebral conjunctiva do not become affected in the same way; hence granulated conjunctiva does not occur in, or is not so marked a result of gonorrhœal as of Egyptian ophthalmia.

558. In consequence of the greater severity of the inflammation of the sclerotic conjunctiva, the cornea is still more liable to suffer and be destroyed in gonorrhœal than in Egyptian ophthalmia. Indeed, gonorrhœal ophthalmia is the most rapidly destructive disease the eye is subject to.

559. Males are oftener affected with this disease than females; but it is of comparatively rare occurrence in either sex.

560. In general one eye only is affected in gonorrhœal ophthalmia; whereas in Egyptian ophthalmia, it is extremely rare to meet with a case in which the disease remains confined to one eye.

561. The differences, it will be observed, are not sufficiently strict to serve as a practical ground of diagnosis. The history of the disease forms the best ground of diagnosis.

562. *Cause.*—Inoculation with gonorrhœal matter.

563. *Prognosis.*—Until, with a cornea safe, or at least not much ulcerated, the disease is on the decline, which is known by the subsidence of the swelling of the eyelids and of the chemosis, with diminution of the discharge, the prognosis must be extremely unfavourable. The eye may be destroyed in forty-eight hours from the commencement of the disease.

564. *Treatment.*—The treatment must be the same as in the severest form of Egyptian ophthalmia, only, if possible, more active. No delay of treatment can be admitted. Incision or excision of the chemosed conjunctiva should be early had recourse to, and counter-irritation by blisters to the nape of the neck, behind the ear, or even on the eyelids themselves.

Mild gonorrhœal ophthalmia.

565. A milder form of ophthalmia is met with in persons labouring under gonorrhœa, which, however, does not appear to differ from common catarrhal ophthalmia. The cases of the kind which I have seen have not appeared to me in any other way dependent on gonorrhœa, than that at the time the system was in consequence of it more susceptible to cold. The exposure to which, at the same time that it excited the ophthalmia, operated in checking the discharge from the urethra.* They

* Iritis, in connection with gonorrhœa, will be considered farther on, under the head of *Iritis*.

readily yielded to the same treatment as is above indicated for catarrhal ophthalmia.

Puro-mucous ophthalmia occurring in female children, in connection with puro-mucous discharge from the vagina.

566. This ophthalmia, though sometimes severe, is usually of a mild character.

567. *Symptoms.*—In a case of two or three days standing, the eyelids were red and swollen, but not tense, and admitted of being readily opened. The conjunctiva was red but not intensely so—the palpebral conjunctiva spongy—the sclerotic conjunctiva raised up over the lower margin of the cornea in a state of slight chemosis. The cornea was still quite clear. There was a serous discharge, mixed with considerable flakes of thick whitish yellow matter. No pain, and little or no intolerance of light.

568. *Treatment.*—Scarification of the palpebral conjunctiva—the nitrate of silver drops once a day—the alum lotion two or three times a day for cleansing the eye—the red precipitate ointment at bed-time and some laxative medicine—checked the inflammation in a few days. The healing process was then promoted by a blister behind the ear, penciling the conjunctiva with lapis divinus drops, and the exhibition of quina.

569. When the chemosis subsided, superficial ulcer of the cornea was discovered where it had been pressed on by the fold of conjunctiva. This readily healed, leaving a slight opacity, but was the cause of retarding somewhat the recovery.

570. The vaginal discharge subsided under the use of a sulphate of zinc injection.

Erysipelatous ophthalmia.

(Conjunctivitis erysipelatosa idiopathica.)

571. The conjunctiva is always more or less affected in erysipelas of the eyelids, but idiopathic erysipelatous ophthalmia is not of frequent occurrence.

572. *Objective symptoms.*—To the anatomical description of erysipelatous inflammation of the conjunctiva above given, it only remains to add under this head, that in consequence of the gravitation of the fluid, the serous chemosis is greater below than above—that the cornea appears half buried by it—that there are occasional lachrymation and increased Meibomian secretion.

573. *Subjective symptoms.*—There is an uneasy sensation

of pressure and tension about the eye when it is moved, with itching and smarting pain, and some impatience of light.

574. *Constitutional symptoms.*—The subjects of this ophthalmia are most commonly persons of weakly constitution, advanced in life, or labouring under gastric derangement: but these conditions are to be viewed rather as the predisposing causes than as the symptoms of the ophthalmia.

575. *Causes.*—The predisposing causes have been just referred to.—*Exciting causes.* Exposure to cold and wet. Injuries, chemical or mechanical, of the conjunctiva; it sometimes occurs after needle operations for cataract. In an old man affected with small irritable ulcers on his legs, with surrounding erythema, I once saw it occur as if by metastasis on the application of warm fomentations to the legs.

576. *Diagnosis.*—The nature of the conjunctival inflammation is at once perceived; but in forming the diagnosis, it should be determined whether there be any complication—such as sclerotitis.

577. *Prognosis and course.*—The prognosis is good. The disease usually begins to subside in a few days—the watery effusion is gradually absorbed—and the conjunctiva becomes again applied to the sclerotica, but continues for some time in a loose flaccid state. During this process, the injection of the conjunctiva disappears, but the spots of extravasated blood are some time of being absorbed. The lachrymal, Meibomian, and conjunctival secretions return to their natural quantity and quality.

578. *Treatment.*—Three grains of mercurial chalk, with watery extract of aloes, and extract of hyoscyamus, of each one grain at bed-time, followed by a purgative draught in the morning; and as a collyrium, the solution of the bichloride of mercury, with vinum opii, (s. 124,) will in general suffice to check the disease. Good diet, cordials, and tonics, may be afterwards given.

579. Instead of a lotion, some prefer dry warmth, by means of medicated bags, (s. 116,) hung over the eye. If more agreeable to the patient, this may be adopted; but in either case it will be necessary afterwards to drop in vinum opii to give tone to the relaxed membrane.

Pustular or aphthous ophthalmia.

(Aphthous inflammation of the conjunctiva.)

580. This name is confined to the case in which the pustules or aphthæ are situated on the sclerotic conjunctiva—a

tenth or a twentieth of an inch from the margin of the cornea, or close to the margin of the cornea, but not on the cornea.

581. *Objective symptoms.*—To the objective description of pustular inflammation of the conjunctiva above given, (ss. 314-318,) all that requires to be added here, is that the cornea is quite clear—that there is no decided lachrymation, though a flow of tears is readily excited by the movements of the eye—and that there is an increased Meibomian discharge, sufficient, perhaps, to cause gluing together of the eyelashes over night.

582. *Subjective symptoms.*—There is not the slightest intolerance of light, or perhaps any other local inconvenience, except a sensation like that from a foreign body in the eye, which is excited by the pustule and its enlarged vessels. It is not, however, distressing, in consequence of the general sensibility of the conjunctiva not being exalted.

583. *Constitutional symptoms.*—There is little or no constitutional disturbance.

584. When pustules present themselves close to the margin of the cornea, (s. 317,) the subjective symptoms may be as slight as above described; but the case in which this occurs is apt to pass into, if it is not already, one of scrofulo-catarrhal, or of phlyctenular corneitis, or common scrofulous ophthalmia, which is attended with great intolerance of light and lachrymation.

585. *Causes.*—Pustular ophthalmia occurs in children and young adults, especially females. It is usually excited by exposure of the eye to a draught of air. In a little boy, for example, it was brought on by looking through the keyhole of a door and receiving on the eye the current of air passing through.

586. *Diagnosis and prognosis.*—Practically, it is of importance not to confound pustular ophthalmia with phlyctenular. In the former, the application, two or three times repeated, of nitrate of silver drops, or strong red precipitate ointment, will seldom fail to cure; whereas in the latter, the curability is entirely different. Seeing that when the pustules are at the margin of the cornea, the case is apt to be mixed up with phlyctenular ophthalmia, the curability is under such circumstances modified. The combination with catarrhal or scrofulo-catarrhal ophthalmia, has not so great a modifying influence.

587. *Treatment.*—Any application, such as the nitrate of silver drops, (s. 128,) or salve, or red precipitate salve, (s. 136,) &c., applied two or three times to the eye, will in general suffice for the cure. The vascular congestion speedily disap-

pears, and this is followed by the healing of the aphthæ. All the general treatment that may be necessary, is a dose of hydrargyrum cum creta, followed by a purgative and afterwards a tonic.

588. The above treatment is applicable, though not so rapidly effectual, when pustular is combined with catarrhal or scrofulo-catarrhal ophthalmia. When pustular is complicated with phlyctenular ophthalmia, the treatment is that applicable to the latter.

b. Genus II.—SCLEROTITIS.

589. The only species of this genus admitted, is rheumatic ophthalmia.

Rheumatic ophthalmia.

(Sclerotitis rheumatica vel idiopathica.)

590. In rheumatic ophthalmia, the sclerotica is the principal seat of the vascular congestion; but, as above shown, (s. 325,) there is usually some degree of implication of the cornea and iris in the inflammation, the former from exudation, the latter from both congestion and exudation. Rheumatic ophthalmia, considered as a pure sclerotitis, or a sclerotitis with the slight complications mentioned, is of rare occurrence, in consequence of its tendency to merge into catarrho-rheumatic ophthalmia, aquo-capsulitis, or decided iritis.

591. *Objective symptoms.—Redness.*—At the commencement, the only redness is from the sclerotic injection, the characters of which have been above described. By and by there is added some injection of the conjunctiva, especially of its circumcorneal zone.

592. *State of the cornea.*—The cornea becomes dim from exudation into it; and over its margin, at some side, or even all round, vessels may be seen shooting to the extent of one-twentieth or one-tenth of an inch, and then suddenly stopping.

593. *State of the iris.*—The iris becomes discoloured, the pupil contracted, sluggish in its motions, and perhaps hazy from slight exudation.

594. There is lachrymation, but no increased conjunctival, nor Meibomian secretion.

595. *Subjective symptoms.*—The most striking subjective symptom is the rheumatic pain around the orbit, in the temples, face, &c., becoming exacerbated at night when the patient gets warm in bed, and remitting only towards morning. Be-

sides this rheumatic pain, there is deep-seated, distending, and pulsative pain of the eyeball.

596. There is intolerance of light accompanying the lachrymation, usually in proportion to the degree of implication of the cornea and iris.

597. The vision is dim in proportion to the dimness of the cornea and haziness of the pupil.

598. *Constitutional symptoms.*—Resembling rheumatism in accompanying pain and exacerbations, this disease resembles it also in the constitutional symptoms, inflammatory fever, derangement of digestive organs, &c.

599. *Causes.*—This disease resembles rheumatism in respect of its causes, predisposing as well as exciting; but the subjects of it, who are always adults, may never have suffered from rheumatism in any other part of the body.

600. Both eyes are seldom affected together. When they are so, one is much less severely affected than the other.

601. *Diagnosis.*—This disease is readily distinguished from catarrhal ophthalmia by the seat and character of the vascular injection, (ss. 63, 323,) by the absence of any mucous secretion from the conjunctiva in the former, and especially by the difference in the character of the pain. Catarrho-rheumatic ophthalmia is attended by all the symptoms of rheumatic ophthalmia, with the superaddition of those of catarrhal, and a greater tendency to mischief in the cornea than in either. From aquo-capsulitis or iritis, rheumatic ophthalmia is distinguished by the slight degree, if not absence, of affection of the membrane of the aqueous humour or iris.

602. *Prognosis.*—This ophthalmia may prove slight and soon go off, but even when not so slight, the prognosis is in general good. The degree to which the cornea or iris may have become affected, however, will, of course, modify the prognosis. A person having once suffered from it is very liable to renewed attacks. Sometimes it occurs in a chronic state, and proves obstinate without being severe.

603. *Treatment.*—In incipient or slight cases the following treatment will sometimes check the disease—calomel, gr. v, and Dover's powder, gr. x, with a pediluvium at bed-time, and a purgative draught in the morning. Then nitre three or four times in the course of the day, in doses of gr. v—x in barley water.

604. If the disease is not immediately checked, no time should be lost in having recourse to venesection. When the rheumatic pain is severe, and the cornea and iris threatened,

blood should be at once abstracted. According to the strength of the patient, the venesection should be carried to ℥xij—xvj —xx.

605. On the night after the bleeding, calomel and Dover's powder, or calomel and James's powder, are to be given at bed-time, and a purgative draught in the morning; the nitre in the course of the day, and calomel and opium (gr. ij—g. ss), every night at bed-time, until the gums are just touched. During this time the bowels are to be kept open by a solution of Epsom salts, ℥j, and tartar emetic, gr. ij in water, ℥viij, in doses of two tablespoonfuls in the morning.

606. When the calomel is omitted, Dover's powder, gr. v —x, with extract of hyoscyamus, gr. iij, may be given at bed-time.

607. *Colchicum*, though uncertain, is sometimes useful. If it is thought advisable to try it, it should be after the bleeding and purging, and if the tongue is clean, half a drachm of the wine, in combination with an alkali or magnesia, may be given twice a day; but if no decided effect is produced after the third or fourth dose, its use should not be persisted in. Nitre may be advantageously given in combination with colchicum—five grains of the former with fifteen to twenty-five drops of the wine, twice or thrice a day.

[The *hydriodate of potash*, in solution, five grains three times a day, is often very efficacious.]

608. The eye is to be bathed occasionally with the belladonna collyrium tepid, and in the intervals kept lightly covered with a dry compress. As a means, though only subsidiary to the venesection, and calomel and Dover's powder, of moderating the rheumatic pain around the orbit, or in the temples, &c., friction over the seat of pain with mercurial ointment, combined with an equal part of extract of belladonna, with a tincture of tobacco,* with morphia dissolved in almond oil, or with laudanum combined with extract of belladonna, in the proportion of ℥j of the latter to ℥j of the former, may be employed at bed-time. The belladonna applications will at the same time serve to keep the pupil dilated, which is a point to be attended to when there is implication of the iris.

609. Counter-irritation, by blisters or tartar-emetic ointment to the nape of the neck or scalp, is useful.

610. When by the above treatment the disease has been

* ℞—Tabaci fol. concis. ℥jss—Camphoræ pulv. ℥j—Alcohol. fort.—aq. distillat. āā ℥jv. Digere perdies octo et cola.—Sig. ℥ss—℥ij to be used at a time.

checked, tonics promote convalescence. Bark and carbonate of soda, in doses of five grains each, two or three times a day, are a favourite tonic; quina also is useful.

611. In the decline of the disease, vinum opii, diluted with one or two waters, may be dropped into the eye with advantage.

612. In chronic cases, the bichloride of mercury, in doses of one-thirtieth to one-sixteenth of a grain in a drachm of tincture of bark, may be given two or three times a day, or Fowler's solution, in doses of from eight to twelve drops, thrice a day, and counter-irritation kept up on the nape of the neck by blisters or seton.

c. Genus III.—CORNEITIS.

(Keratitis.)

613. Whilst congestion was taken as the characteristic of sclerotitis, exudation, for the reasons above given, (s. 206, et seq.,) must be taken as the characteristic of corneitis.

614. As species of corneitis, I rank, 1st, common scrofulous or phlyctenular ophthalmia, and 2d, corneitis, commonly so called, or scrofulous corneitis.

615. Scrofulous or phlyctenular ophthalmia is usually ranked as a conjunctival inflammation, but with no good reason, seeing that although the conjunctiva is the seat of injection, the redness is neither great nor uniform, the vessels being few in number, and running singly or in detached fasciculi towards the cornea—an injection of the conjunctiva which is the consequence merely of the afflux of blood towards the primarily affected cornea; and seeing that it is the cornea which is the seat of the exudation—of phlyctenulæ, of ulcers, and of new vessels into which those of the conjunctive are continued. Moreover, besides conjunctival, there is some degree of sclerotic injection.

616. Corneitis, commonly so called, or scrofulous corneitis, is an inflammation of the "adhesive" character, involving principally the proper substance of the cornea; hence it has been also named *parenchymatous* corneitis, though the conjunctiva corneæ, on the one hand, and the membrane of Descemet, on the other, may also become affected.

617. Though in phlyctenular ophthalmia and corneitis, commonly so called, the iris is apt to become involved, it is always more or less so in inflammation of the membrane of Descemet. Indeed, affection of the iris constitutes a part of this ophthalmia,

which has hence been named *kerato-iritis*, and also *aquo-capsulitis*, under the impression that the membrane of Descemet extends over the anterior surface of the iris, and thus constitutes the investing membrane of the anterior chamber of the aqueous humour. The inflammation in question will thus be best treated of under the head of *ophthalmia interna anterior*.

618. The other ophthalmiæ, in which the cornea, whether its proper substance, or its conjunctival layer, is implicated, belong to the genus of compound external ophthalmia, (s. 696.)

Scrofulous or phlyctenular ophthalmia.

(Conjunctivitis scrofulosa vel strumosa—Erethitic form of scrofulous ophthalmia.)

619. This is the most common form of ophthalmia in children of from one to twelve years of age. Out of 100 cases of ophthalmia at that time of life, it has been estimated that 90 are cases of this kind. Although the subjects of it often present the scrofulous diathesis in a well-marked manner, and not unfrequently are labouring at the same time under scrofulous affections of other parts, it is to be remembered that cases frequently occur in which there are no such evidences of scrofula. Unless, therefore, we choose to view, as some do, this form of ophthalmia itself as a manifestation of a scrofulous constitution, the term "scrofulous ophthalmia" must be received rather in a conventional than in a literal sense.

620. *Objective symptoms.*—When the little patient is brought into the light to be examined, the eyelids are found spasmodically closed, the eyebrows drawn down, and the cheeks drawn up, the child endeavouring at the same time to cover the eyes with his hands in order to protect them from the light.

621. In consequence of the very forced closure of the eyelids, their borders are sometimes found so much inverted, that their cutaneous surfaces are in contact; and if this has been of long continuance, these surfaces will be moist and soft like mucous membrane.

622. There are greater or less redness and excoriation of the cheeks, and not unfrequently a pustular eruption, extending over the face, forehead, and temples.

623. As it is in general impossible for the child to open the eyelids, even if disposed, in consequence of the great intolerance of light and involuntary spasmodic closure of the eyelids, it is necessary for the surgeon to do so in order to examine the eyes. For the mode of doing this, see s. 55.

624. On opening the eyelids, which are probably somewhat

red and tumid at their margins, a gush of hot tears takes place, which had been pent up in the oculo-palpebral space in consequence of the continued closure of the eyelids.

625. On examination now, there will probably not be seen much vascular injection of the sclerotic conjunctiva, and some of what there is, even, may have been caused by the irritation of opening the eyelids. There may be merely a fine circumcorneal reticular blush, fed by some small pink scattered vessels running towards it, such as is seen when the eye is congested from the irritation of a foreign particle which has got into it. Some larger vessels, however, will perhaps be seen collected into fasciculi, running from the angles towards the cornea. In addition to the conjunctival injection, there is also circumcorneal zonular redness of the sclerotica.

626. The palpebral conjunctiva is usually the seat of considerable congestion.

627. The cornea, though suffused, may be as yet free from any circumscribed speck; but ere long, one or more *phlyctenulæ* are met with, or small ulcers left by the bursting of phlyctenulæ.

628. The cornea may be still unpervaded by red vessels; or perhaps a single one may be detected running over its margin towards the phlyctenula; or if instead of a phlyctenula, an ulcer already exists, there may or may not be a fasciculus of vessels extending into it, (s. 338.)

629. Sometimes there is onyx.

630. The pupil is usually rather contracted.

631. Whilst the lachrymation is so great, the conjunctival and Meibomian secretions are not much increased.

632. Both eyes are generally affected at the same time, but one is always worse than the other.

633. *Subjective symptoms.*—There is in general not much distress, except from the great intolerance of light; and this is relieved by darkening the room and in the evening. There occur, however, occasional attacks of darting pain in the eye at night; and if phlyctenulæ or ulcers exist, there is the painful sensation as if a foreign body were in the eye, aggravated when the eyelids are moved. The irritation of the excoriated cheek by the tears also causes considerable distress.

634. *Constitution and state of health.*—As above mentioned, the constitution of the subjects of this ophthalmia is in a great number of cases that which is known by the name of scrofulous.

635. Along with the ophthalmia, a disordered state of the health will be found generally to exist. The digestive organs

and skin especially will probably be found out of order—with feverishness and irritability of temper.

636. *Causes.*—The predisposing causes of scrofulous ophthalmia may be referred principally to the age, constitution, and state of health of the patient. That age predisposes, is shown by the circumstance that it is the most common by far of all the inflammations of the eye in children, and that an inflammation originally of a different kind, in childhood is extremely apt to run into it. That the constitution predisposes, may be inferred from the name of the disease being taken from that state of constitution in connection with which the ophthalmia so frequently manifests itself in early age. It is to be observed, that at such age, and in such constitutions, it may in one case be the eye, in another the ear, in a third some other organ which is affected; but in all, the digestive organs are found more or less at fault. Previous attacks, and also exanthematous diseases, predispose to it. See *Exanthematous ophthalmiæ.*

637. *Exciting causes.*—This inflammation may be excited by any of the ordinary exciting causes of ophthalmic inflammation, the age, constitution, and state of health determining its particular character. Any common inflammation of the eye is in such circumstances apt to merge into this. The ophthalmia often appears to be excited and kept up by the irritation of teething.

638. *Diagnosis.*—The symptoms of this ophthalmia are so very striking, that it can scarcely be confounded with any other, especially if the age of the patient be taken into account.

639. In so far as regards the slight degree of redness of the white of the eye and the great intolerance of light, parenchymatous or scrofulous corneitis resembles it; but the changes which take place in the cornea in the two ophthalmiæ are quite different. In scrofulous corneitis, there is no formation of phlyctenulæ, nor ulceration, and rarely onyx or abscess, but opaque adhesive exudation into the substance of the cornea, and development of general deep-seated vascularization, with increased prominence of the cornea.

640. Scrofulo-catarrhal ophthalmia is distinguished from phlyctenular ophthalmia by the greater redness of the white of the eye, and the less degree or absence of intolerance of light.

641. The age of the patient alone, independent of other points of difference, distinguishes between this ophthalmia and catarrho-rheumatic.

642. *Course and prognosis.*—Phlyctenulæ on the cornea

may either recede without being matured, or pass into ulceration. If a phlyctenula on the cornea recede, it will leave a speck called *albugo*—round, smooth, slightly elevated, and densely opaque in its centre, but shaded off at its circumference. Sometimes a vessel or two may be seen running into an albugo, or a nebulous streak indicates where vessels had run.

643. If ulceration has taken place, the ulcer will probably be the point of termination of a fasciculus of vessels as above mentioned, (s. 628;) but when the healing process commences, one vessel after another shrinks and disappears. If the ulcer has penetrated to any depth, an opaque cicatrice or *leucoma* will be left, (s. 361.)

644. There is a circumscribed and rather deep ulcer of the cornea met with in this disease, unpreceded by any phlyctenula. It is circular, with smooth, round edges, quite clear to its bottom, unaccompanied by any extension of vessels into it, and the cornea around is scarcely, if at all, nebulous. The cornea looks simply as if a small piece had been scooped out of it. After this ulcer heals, a small clear facet remains, (s. 361.)

645. The inflammation continuing unchecked, ulcers which may have formed, often go on increasing in depth, until the proper substance of the cornea is perforated, in which case the membrane of Descemet is protruded through the opening at the bottom of the ulcer in the form of a small transparent vesicle, (*hernia of the cornea,*) which soon bursts, and the aqueous humour escapes, the consequences of which have been described above, (s. 351, et seq.)

646. Iritis sometimes supervenes on this form of ophthalmia. Sometimes, also, inflammation of the posterior tunics, by which the eye is left amaurotic, atrophic, or in a state of varicosity.

647. From long continuance of the forced closure of the eyelids, (s. 621,) a tendency to entropium is induced.

648. There is less tendency to ophthalmia tarsi in this than in scrofulo-catarrhal ophthalmia.

649. This is one of the most obstinate of all the acute inflammations of the eye, and one of those most liable to relapse. The tendency to the disease, however, diminishes on the approach of puberty.

650. If the cornea be still free from phlyctenulæ or ulcers, the prognosis is good; but if phlyctenulæ or ulcers exist, the prognosis must be qualified by the likelihood of a speck or specks on the cornea. See above.

651. The state of the constitution, and the circumstances in

which the patient is placed, must greatly influence the prognosis.

652. The dismissal, when cured, should always be accompanied by a warning as to the great tendency of the disease to return, and instructions as to the diet and regimen best calculated to guard against a relapse.

653. *Treatment.*—The treatment is always advantageously commenced with an emetic—and an antimonial emetic is the best. (Vin. antimon. ℥j aq. pur. ℥ij;—a tablespoonful every ten minutes until vomiting.) The emetic may be followed up by a purgative of calomel and scammony or jalap.

654. If after this, much feverishness still continue, small doses of antimonial wine (gtt. xv—xxx) three times a day, to keep up a state of nausea and determination to the skin, with a warm bath at night, will be useful.

655. The above remedies having been premised, small doses of hydrargyrum cum creta, (gr. ij—iij,) in combination with extract of conium or hyoscyamus, (gr. ss—j,) are to be given once a day for a few days, with a dose of calomel and rhubarb or scammony every second or third day.

656. The digestive organs having been by the alteratives and purgatives brought into a better state, and if there are no longer any considerable feverish symptoms, the disulphate of quina, in doses of gr. j—ij, three times a day, will be found, in a large proportion of cases, to act like a specific. Under its use, the inflammation and intolerance of light soon begin to subside, and this is followed by the disappearance of the phlyctenulæ and healing of the ulcers on the cornea.

657. In some cases, iron, or sulphuric acid, and in others, rhubarb with carbonate of soda, will be found useful as tonics.

658. The application of a few leeches around the eye is occasionally required to relieve the congestion, and thus to promote the action of the other remedies.

659. Counter-irritation by blisters, kept open or repeatedly renewed, behind the ears, or behind and below the mastoid process, is always of great service; and afterwards, when the ophthalmia has declined, the application of a warm plaster between the shoulders.

660. As an application to the eye itself, the belladonna lotion may be used from the first. It soothes the eye, and greatly, if not wholly, relieves the intolerance of light. Steaming the eyes with the vapour of hot water impregnated with belladonna, has the same effect, (s. 115.)

661. When the acute symptoms have been overcome by the

vomiting, alteratives and purgatives, at the same time that the use of tonics is commenced, recourse may be had to the application of the nitrate of silver drops to the eye once a day.

662. If under this treatment the case does not improve, but the inflammation, on the contrary, continues active and severe, the iris perhaps becoming discoloured, with the pupil contracted, and ulceration threatening to penetrate the cornea, the following treatment should, without delay, be had recourse to:—Evacuation of the aqueous humour, leeches around the eye, followed by renewed blisters behind the ears, small doses of calomel internally, to the extent of affecting the gums, the quina being still given; and in addition to the continuance of the belladonna fomentation, the drops of belladonna or atropia, to keep the pupil dilated if it is the centre which is threatened to be penetrated by the ulceration, in order, if penetration should take place, prolapsus iridis may be obviated.

663. The eyes are not to be bound up, but may be protected by a large shade like a bonnet front.

664. Good air, moderate light, friction of the skin, the tepid bath, comfortable clothing, and simple nourishing diet, are important dietetic adjuvants in the treatment of this ophthalmia.

665. When there is great tendency to relapse, removal to a milder climate or a more sheltered situation, will often be advantageous.

Corneitis, commonly so called.

(Corneitis scrofulosa—Corneitis parenchymatosa.)

666. There are two distinct forms of this disease, which may be designated acute and chronic.

Acute corneitis.

667. *Objective symptoms.*—There is little redness of the white of the eye, and what does exist is principally sclerotic. The proper substance of the cornea is the seat of exudation, occasioning a grayish-white opacity, denser at some points than others, which by and by becomes intermixed with red, in consequence of the development of vessels in the exuded matter. In this case, the cornea presents a peculiar opalescent appearance.

668. When inflammation of the conjunctiva corneæ is superadded, as is sometimes the case, it is at some part opaque, thickened, and vascular. The vessels are in continuation with those of the corresponding part of the circumcorneal network of the sclerotic conjunctiva. Sometimes this state of the con-

junctiva corneæ extends all round the cornea, in the form of a ring about one-twentieth or one-tenth of an inch broad. In some cases it extends even to the middle of the cornea.

669. In the course of the disease, increased prominence of the cornea takes place, owing to softening of its texture, on the one hand, and distension by increased accumulation of aqueous humour, on the other. The prominent cornea in corneitis is distinguished from conical cornea by its spherical curve.

670. The iris is apt to become affected, but this, on account of the opacity of the cornea, is not readily detected.

671. *Subjective symptoms.*—There is in general little or no pain—a feeling merely of distension or of pressure on the front of the eyeball—the intolerance of light is more or less considerable, and, as usual, accompanied by lachrymation. Of course, there is dimness of vision, in proportion to the opacity of the cornea.

672. *Constitutional symptoms.*—When the local symptoms are most severe, so are the constitutional, viz., general feverishness, dry skin, white tongue, loss of appetite, and headache.

673. Exacerbations and remissions of the disease occur.

674. When the disease occurs in persons about middle age, as it sometimes though not usually does, it is accompanied by rheumatic or arthritic characters, and is designated rheumatic or arthritic corneitis, in contradistinction to the name *scrofulous corneitis*, given to the disease when it occurs in young persons, as is generally the case.

675. *Predisposing causes.*—A weak unhealthy state of constitution, such as the scrofulous diathesis in younger persons, the rheumatic in older, usually exists in the subjects of corneitis parenchymatosa. The disease is more frequent in persons of an age from eight to eighteen than in older persons, and more frequent in females than males. In females, disturbed menstruation often accompanies the complaint.

676. *Exciting causes.*—The disease sometimes supervenes on another ophthalmia. Injury of the cornea, or exposure to cold and wet, often appears to be the exciting cause. Sometimes the inflammation comes on after the retrocession of some disease of the skin. Often the etiology is obscure.

677. *Diagnosis.*—This ophthalmia is distinguished from phlyctenular ophthalmia by the difference in the changes which take place in the cornea; from the compound ophthalmiæ, in which the cornea is implicated, by the slight degree of redness of the white of the eye, and the peculiar changes in the cornea; from the chronic form, by the intolerance of light, and the

greater opacity of the cornea, and the other changes in its appearance, mentioned in their proper places, (ss. 691-2.)

678. When opacity, thickening, and vascularity of the conjunctiva corneæ extend over the whole cornea, it conceals the affection of the proper substance; but the existence of this, and the distinction of such a case from that in which the conjunctiva corneæ alone, and not the proper substance, is affected, as it may be found in scrofulo-catarrhal ophthalmia, are indicated by the great intolerance of light, and by the increased prominence of the cornea, which generally after a time presents itself.

679. *Course and prognosis.*—Inflammation of the proper substance of the cornea is an obstinate disease. It may go on for a long time, alternately getting better and worse. Inflammation of the membrane of Descemet and iritis readily supervene, and the sclerotica, choroid, and ciliary body may also become involved, in which case there is added to the increased prominence of the cornea a conical projection of the whole front of the eyeball, in consequence of an attenuation and yielding of the anterior part of the sclerotica. Under such circumstances, the retina has usually also suffered; and there are consequently more or less amaurotic symptoms.

680. When the inflammation is arrested, the cornea clears sometimes very rapidly, and to an extent not previously expected. The clearing of the cornea takes place from the circumference towards the centre, where opacity usually lingers, and often continues fixed.

681. Increased prominence of the cornea having once taken place, is permanent.

682. Relapses are frequent.

683. *Treatment.*—In young persons, this is to be conducted very much on the same plan as the treatment of phlyctenular ophthalmia. In older persons, a modification of the treatment will be required, by the attending state of health and constitution. If the patient be a grown-up female, attention should be directed to the state of menstruation.

684. The general abstraction of blood is not often required, but the occasional application of leeches around the eye is generally necessary. An emeto-cathartic at the commencement is, as in phlyctenular ophthalmia, an important remedy.

685. After the bowels have been well cleared out, a carefully-conducted course of mercury in small doses, along with or followed by quinine or other tonics, such as iron, baryta, &c., according to the condition of the patient, will prove of

great advantage. Counter-irritation is, at the same time, to be employed.

686. Turpentine, either alone, or in alternation with mercury, has been recommended. The dose is from ʒj to ʒij three or four times a day. It is given floating on some liquid aromatic vehicle, or combined in the form of emulsion.

687. Steaming the eyes with hot water impregnated with belladonna, (s. 115,) and bathing them with the belladonna lotion, are of great use in soothing the eye and mitigating the intolerance of light when present. Belladonna is also sometimes necessary for the purpose of keeping the pupil dilated, (s. 100,) when it is feared the iris has become affected.

688. When the disease has been fairly arrested, the drops of the bichloride of mercury, or lapis divinus, combined with vinum opii, are of great use in promoting the clearing of the cornea.

689. Evacuation of the aqueous humour is sometimes of use, especially in cases with great distension of the cornea.

Chronic corneitis.

690. *Objective symptoms.*—Though there is not much redness of the eye to attract notice, still, on close examination, it will be found that it is pervaded by red vessels, both conjunctival and sclerotic, besides being dull and dirty-looking.

691. There is little exudation into the substance of the cornea—at the most, enough to produce streaks or clouds of opacity; but the most peculiar appearance which the cornea presents, is the roughness of its surface, like ground glass, and a dirty yellowish-green colour, as above mentioned, (s. 334.) The cornea is at the same time unnaturally prominent, sometimes enlarged in diameter, with corresponding enlargement of the anterior chamber.

692. *Subjective symptoms.*—There is merely dimness of vision, without any pain or intolerance of light.

693. *Constitution.*—The subjects of this form of corneitis are usually of a dull, leucophlegmatic, scrofulous habit. They often are at the same time affected with deafness.

694. *Treatment.*—The treatment applicable in this form of corneitis, is what is above laid down in ss. 685, 688, 689.

695. The diet and regimen above recommended for phlyctenular ophthalmia, (ss. 664, 665,) are equally called for in both the forms of corneitis now described.

d. Genus IV.—COMPOUND EXTERNAL OPHTHALMIA.

696. The ophthalmiæ, comprehended as species under this head, are the scrofulo-catarrhal, and catarrho-rheumatic.

Scrofulo-catarrhal ophthalmia.

(Torpid form of scrofulous ophthalmia—Chronic scrofulous ophthalmia.)

697. This is a combination of common scrofulous or phlyctenular ophthalmia and catarrhal; having sometimes more of the characters of the former, sometimes more of the characters of the latter, with occasionally an admixture of pustular ophthalmia.

698. *Objective symptoms.*—This form of ophthalmia not being attended by any great intolerance of light, the eyelids are not spasmodically closed, but usually kept half open. Their borders are red and swollen, and perhaps nodulated, from enlargement of the glandular structures situated there, and the eyelashes are incrusted with dried Meibomian secretion, which is poured out in increased quantity.

699. The vascular injection of the conjunctiva, both palpebral and sclerotic, is very considerable, and though with less uniformity, presents the catarrhal characters. There may be also some sclerotic injection.

700. Pustules or aphthæ may present themselves on the sclerotic conjunctiva, and at the margin of the cornea, but the cornea itself may as yet be clear, or it may be the seat of onyx, or of phlyctenulæ or ulceration. The phlyctenulæ on the cornea usually reach a larger size than those which occur in common phlyctenular ophthalmia—indeed, they mature into pustules, and bursting, leave large ulcers, with flabby, everted, and perhaps red edges, into which large fasciculi of vessels run from the neighbouring conjunctiva and sclerotica.

701. Instead of the cornea suffering in this way, the conjunctiva corneæ may be found in some parts of its extent the seat of exudation—opaque, thickened, and vascular. The vessels are closely arranged side by side, and extend over the margin of the cornea, in continuation from those of the conjunctival circumcorneal zone, and with the opacity and thickening of the conjunctiva corneæ, stop abruptly, (*vascular speck.*)

702. The pupil is natural.

703. Lachrymation is comparatively inconsiderable, but there is a marked puro-mucous secretion from the conjunctiva, together

with the increased discharge from the glands of the borders of the eyelids, above mentioned.

704. *Subjective symptoms.*—There is little intolerance of light or pain.

705.—*Constitutional symptoms.*—There is no acute constitutional disturbance, but the patients are in general out of health—there is, perhaps, disordered digestion; and if a female at the period of puberty, the menstrual function is probably disturbed.

706. One eye alone may be affected, but often both. One is usually worse than the other, or it may be, that whilst one is affected more in the manner of a catarrhal ophthalmia, with the cornea clear, the pupil natural, and no intolerance, the other is affected more in the manner of phlyctenular ophthalmia—the cornea dim, the pupil contracted, and considerable intolerance of light.

707. *Causes.*—Perhaps this form of scrofulous ophthalmia is more disposed to occur in older subjects than common scrofulous or phlyctenular ophthalmia—more frequently about the age of puberty. It may be more generally connected with the torpid form of the scrofulous constitution, but it is to be observed, that in the same person one eye may be suffering from this form, whilst the other is suffering from the other. In females, disturbed menstruation often exists in casual connection with the ophthalmia.

708. *Exciting causes.*—These are the same as the exciting causes of catarrhal, pustular, and phlyctenular ophthalmia. The inflammation may come on first as a catarrhal or pustular ophthalmia.

709. *Diagnosis.*—This ophthalmia differs from catarrhal principally in the early implication of the cornea—from phlyctenular ophthalmia, and from parenchymatous corneitis, in the less degree of intolerance of light, or total absence of it, and in the greater redness of the white of the eye.

710. That form of scrofulo-catarrhal ophthalmia in which there are opacity, thickening, and vascularity of the conjunctiva corneæ to a greater or less extent, and which is sometimes called *inflammation of the conjunctiva corneæ*, is distinguished from those cases of parenchymatous corneitis, in which there is, in addition, the same affection of the conjunctiva corneæ, by the characters above mentioned, (s. 678,) and by what of the proper substance of the cornea, which may be still visible, not being opaque and vascular. Practically, the distinction between the two diseases is important, as the affection of the conjunctiva corneæ in scrofulo-catarrhal ophthalmia may be efficiently treated

by local remedies which would be injurious in parenchymatous corneitis.

711. *Course and prognosis.*—If aphthæ have formed on the sclerotic conjunctiva, a large superficial abrasion is produced if the inflammation goes on unchecked.

712. If ulceration of the cornea has taken place, it may remain superficial, and become covered with small sarcomatous growths or real red granulations, or the ulceration, though rather indolent, may go on to penetrate the cornea, the result of which will be as above described, (362–3.)

713. When opacity, thickening, and vascularity of the conjunctiva corneæ (*vascular specks*) take place, they may gradually spread from several points of the circumference of the cornea, and to such an extent as to cover the whole cornea, forming what is called *pannus*.

714. The papillæ of the palpebral conjunctiva may become hypertrophied, forming granular conjunctiva.

715. Besides onyx, hypopyon may occur. Iritis, also, may supervene, if the cornea be much affected; but there is less tendency to iritis in this than in common scrofulous ophthalmia. When, however, internal inflammation does take place, there is perhaps a greater tendency for it to run into choroiditis and varicosity of the bulb, though this is a rare result in any case.

716. In consequence of the affection of the glandular structures at the borders of the eyelids, ophthalmia tarsi is apt to remain. Small abscesses at the roots of the eyelashes, and styes are also of frequent occurrence.

717. This ophthalmia is in general more easily cured than phlyctenular ophthalmia or parenchymatous corneitis, and the cure depends more on local treatment. General treatment, however, is also of great importance.

718. The prognosis in the course of the disease will depend on the extent to which the cornea is affected. In cases in which there are vascular specks on the cornea—vascularity, thickening, and opacity here and there of the conjunctiva corneæ, it may be prognosticated, that by a well-directed local stimulant treatment, the eye will be quickly freed from vascularity, any superficial ulceration of the cornea healed, and the cornea itself cleared, with the exception of some spots of gray opacity. It is to be kept in mind, however, that relapses are very apt to take place, especially if the state of the palpebral conjunctiva, with its enlarged papillæ, has not been improved.

719. Ulcers, though large and deep, in general heal readily

under treatment, but of course leave *leucomata;* except they be of the transparent non-vascular kind, which leave a facet.

720. If the cornea has been penetrated by the ulceration, then the prognosis is unfavourable. Things will turn out as above mentioned, (ss. 362–3.)

721. Onyx, if not to any great extent, readily disappears as the inflammation subsides.

722. *Treatment—General.*—Emetics are not in this ophthalmia of so much use as in phlyctenular ophthalmia, but the bowels require to be freely acted on, by repeated doses of calomel and jalap. After this, mercurial chalk may be given, in doses of two or three grains once or twice a day for a short time if the liver appear to be inactive.

723. The stomach and bowels having been put into order, tonics may be prescribed in addition to nourishing diet.

724. If the patient be a female about the age of puberty, attention must be directed to the state of the catamenial discharge.

725. *Local treatment.*—If there be much inflammation, a few leeches may be applied to the eyes, and blisters behind the ears; but local stimulants, which may be commenced at once, will be found to act more efficiently in this ophthalmia than in phlyctenular, even when there is ulceration, large, deep, and threatening to penetrate. It is from not having used the local stimulating treatment, that this ophthalmia has been erroneously put down as even more difficult of cure than phlyctenular ophthalmia.

726. The nitrate of silver solution is to be dropped into the eye once a day, or once every second day; the bichloride of mercury eye-water is to be used three times a day, and the red precipitate salve to the edges of the eyelids at bed-time.

727. In the chronic state, into which this ophthalmia is so apt to fall if neglected or not properly treated, the direct application of some strong stimulant, especially the strong red precipitate salve, (s. 136,) will be found to produce very decided results. The salve is to be introduced under the upper eyelid, and diffused over the whole surface of the conjunctiva, by rubbing with the point of the finger over the eyelid. Two or three such applications I have always found sufficient to remove the most marked appearances of the chronic disease, such as the vascularity and red specks of the cornea, and the injection of the sclerotic conjunctiva.

Catarrho-rheumatic ophthalmia.

(Conjunctivo-sclerotitis—Conjunctivo-sclero-keratitis.)

728. In this ophthalmia, there is a combination of the symptoms of catarrhal and rheumatic ophthalmiæ, with a greater tendency for the cornea to become the seat of phlyctenula or abscess and ulcer.

729. Catarrho-rheumatic ophthalmia is of much more frequent occurrence than rheumatic ophthalmia, but not so common as catarrhal. The comparative frequency of the three ophthalmiæ is usually stated thus:—Rheumatic, 1—Catarrho-rheumatic, 6—Catarrhal, 10.

730. *Objective symptoms.*—The edges of the eyelids are red and somewhat swollen. The white of the eye red, from both conjunctival and sclerotic injection. Generally, the sclerotic injection is great—the conjunctival only middling, but the contrary is sometimes the case. There is often some degree of serous chemosis, concealing the sclerotic injection. The redness of the palpebral conjunctiva is very considerable.

731. The disease has not in general existed beyond a few days, before the cornea becomes implicated. The epithelium of the cornea may be raised up, by exudation underneath it, in the form of a large phlyctenula, or even blister, (s. 332,) or the exudation being into the proper substance of the cornea, and the matter being converted into pus or puriform matter, an onyx or abscess is the result, (ss. 335-6.) By the bursting of the phlyctenula or blister, an ulcer is left, which may remain superficial and cicatrize without opacity, but it may also penetrate deep into the substance of the cornea—even through and through it. Ulceration may also take place when there is onyx or abscess; the cornea over the collection of matter ulcerates, the matter is evacuated, and a large deep ulcer is left, which may go on to penetrate the cornea through and through. Instead of thus bursting externally, the onyx or abscess may burst into the anterior chamber, and give rise to what is called false hypopyon.

732. This ophthalmia is attended by lachrymation in proportion to the intolerance of light. The conjunctival mucous secretion is increased, but in general not to a great degree, rarely to such a degree as to constitute blennorrhœa. The Meibomian secretion is poured out in increased quantity, so that the eyelids are glued together over night.

733. The iris and pupil are apt to become affected—the colour of the iris changed—the pupil contracted and sluggish

in its movements, perhaps hazy from exudation. A deposit of matter at the bottom of the anterior chamber sometimes occurs, or a true hypopyon.

734. *Subjective symptoms.*—Along with the feeling as if sand were in the eye, indicative of the conjunctival affection, and which is most troublesome in the morning, there is the severe circumorbital or temporal pain coming on at night, characteristic of the sclerotic part of the ophthalmia, and the intolerance of light, which appears to be dependent on the implication of the cornea.

735. The conjunctival and sclerotic parts of the affection may commence at the same time, or the conjunctival first, or the sclerotic first—in the one case, catarrhal, in the other, rheumatic, merging into catarrho-rheumatic ophthalmia.

736. *Constitutional symptoms.*—Considerable fever, and derangement of digestive organs—pulse generally quick and sharp—tongue white, and mouth ill-tasted—sleep prevented until towards morning by the nocturnal pain.

737. *Causes.*—The predisposing causes are much the same as those of rheumatic ophthalmia, only it is to be remarked, that catarrho-rheumatic ophthalmia is more common in old persons than in the middle-aged, in whom rheumatic ophthalmia is more apt to occur.

738. The exciting cause is most generally cold. The disease is most prevalent during north-easterly winds. A somewhat similar inflammation occurs from traumatic causes, such as abrasion of the cornea. See below.

739. *Diagnosis.*—This ophthalmia is distinguished:—

From catarrhal, by the superaddition of circumcorneal sclerotic injection, severe implication of the cornea, and the circumorbital or temporal pain, above pointed out, (ss. 475-6.)

From rheumatic ophthalmia, by the superaddition of the conjunctivitis, and the greater affection of the cornea, as above pointed out, (s. 601.)

From phlyctenular ophthalmia, by the age of the patient, and the circumorbital or temporal pain.

From corneitis, by the great redness of the white of the eye, and the difference in the kind of affection of the cornea, (s. 677.)

From iritis, by the absence of affection of the iris, or if present, by its comparative slightness, and by the presence of the corneal affection.

740. *Prognosis and course.*—The prognosis is good, when proper treatment is begun before the cornea is much or at all affected. The rheumatic symptoms depending on the sclerotic

part of the disease usually decline first, the conjunctival part of the disease receding more slowly.

741. When the cornea is affected with ulcer or onyx, the prognosis is doubtful until a check has been put to the inflammation. According to the state in which the cornea is, so will be the prognosis, both as regards how soon recovery of the eye is likely to take place, and to what extent the recovery may be —opacities of the cornea, synechia anterior, or partial staphyloma, may be left.

742. *Treatment.*—This comprises the general treatment for rheumatic ophthalmia, and the local treatment for catarrhal ophthalmia, as above laid down. The local applications may be made from the very commencement. Evacuation of the aqueous humour is useful when an ulcer threatens to penetrate the cornea; and if it is the middle of the cornea which is threatened with penetration, the pupil should be kept dilated by belladonna, as above directed in phlyctenular ophthalmia, (s. 662.)

B. Order II.—OPHTHALMIA INTERNA ANTERIOR.

743. As genera of this order, *aquo-capsulitis*, *iritis*, and *crystallino-capsulitis anterior* have been above admitted, (s. 294.)

744. In aquo-capsulitis, the inflammation involves not only the membrane of Descemet, but also the anterior surface of the iris. In crystallino-capsulitis anterior, the seat of the inflammation is not only the anterior wall of the capsule of the lens, but also the uvea.

745. Seeing thus, that in both aquo-capsulitis and crystallino-capsulitis anterior, the iris is superficially affected, some authors admit iritis as the only genus of ophthalmia interna anterior, viewing aquo-capsulitis and crystallino-capsulitis anterior as species of iritis, under the names of *iritis serosa anterior*, and *iritis serosa posterior*, the species of iritis in which the whole substance of the iris is involved, being named *iritis parenchymatosa.*

746. Iritis serosa, however, does not comprehend all the cases which may be referred to the head of aquo-capsulitis and crystallino-capsulitis; whilst there are, on the other hand, cases of iritis serosa which cannot be considered as coming under the head of aquo-capsulitis or crystallino-capsulitis, but which properly come under the head of iritis only, especially as they are disposed to pass into iritis parenchymatosa.

747. Ophthalmia interna anterior may be acute or chronic. In the latter case, it is to be distinguished into that which has supervened on acute inflammation, and that which has had a chronic character from the first.

748. Ophthalmia interna anterior, in some one of its forms, may occur as a primary affection; but it may become more or less complicated with some degree of external or posterior internal ophthalmia, by extension of inflammation to the external or posterior tunics. On the other hand, it may arise secondarily by extension of inflammation from the external or posterior tunics.

749. To determine how the case stands in these respects, is an important point in the diagnosis, as both prognosis and treatment are much influenced by it.

750. Again, the different forms of anterior internal ophthalmia may occur as primary affections, or arise secondarily as extensions from each other. Indeed, it seldom happens but that one form is more or less complicated with some degree of another.

751. As the iris is always involved, either primarily and principally, or secondarily and to a greater or less degree, and as the affection of it constitutes the point on which the treatment especially hinges, the general observations which remain to be made on ophthalmia interna anterior have reference to iritis.

752. The *objective characters of iritis* in general have been above pointed out, (s. 364, et seq.)

753. Of the *subjective symptoms*, the kinds of pain have been also referred to. Here it is farther to be remarked, that the pain of rheumatic character around the orbit, in the temples, &c., though usually severe and considerable, is sometimes absent. The same may be said of the intolerance of light. As to the disturbance of vision, it is in proportion to the obstruction of the pupil, unless the posterior segment of the eyeball be at the same time involved, when, with photopsy, &c., there may be great diminution of vision.

754. The *constitutional symptoms* consist in those of pretty smart inflammatory fever,—sometimes, however, there is little or no constitutional disturbance.

755. *Causes.*—Scrofula, rheumatism, gonorrhœa, syphilis, gout, &c., act as predisposing, modifying, or even exciting causes of iritis. The disease is most frequent in adult age, less so before puberty and in old age. In young persons, it is usually connected with the scrofulous diathesis—in adults, with rheumatism—common or gonorrhœal—or with syphilis—in old

persons, with gout. Males are more frequently the subjects of iritis than females. The left eye, it is said, is more prone to be affected—when the cause, of course, is of a general nature—than the right, and when both are affected, it usually suffers more.

756. *Occasional causes.*—Injuries. Over-exertion of the eyes may act both as a predisposing and exciting cause; also exposure of them to too strong light and heat. Exposure to cold is a common exciting cause. Iritis is apt to be occasioned by the spread of inflammation from other parts of the eye—to supervene on external ophthalmia, or on posterior internal ophthalmia. One eye being affected, the opposite usually becomes affected also—and this even in traumatic cases.

757. *Diagnosis.*—In the diagnosis of iritis, attention is to be paid principally to the changes in the iris and pupil. The external redness, pain, &c., are not at all pathognomonic, inasmuch as the same may occur in other ophthalmiæ, such as rheumatic, catarrho-rheumatic, &c. In these ophthalmiæ, however, as also in choroiditis, retinitis, &c., an extension of inflammation to the iris is prone to take place. When there is dilated pupil, it will probably be found that the iritis has arisen by extension of inflammation from the posterior tunics.

758. There are certain cases commonly described as chronic iritis, in which the disease proceeds to diminution or destruction of vision of one eye so insidiously, that the patient perhaps becomes aware of his malady only by accidentally discovering the defect of vision. On examination, the iris is found more or less altered in structure, and its pupillary margin adherent by bands of lymph to the capsule of the lens, which is perhaps the seat of some opacity, or even vascularity, but the pupil may not be much, if at all, obstructed with lymph. The defect of vision, therefore, is not owing to the iritis, but is the result of chronic inflammation of the posterior segment of the eyeball, on which the affection of the iris has supervened. Such cases, therefore, properly come under the head of ophthalmia interna posterior. The other eye is apt, sooner or later, to become affected.

759. *Prognosis.*—The great danger of iritis is, that it may leave the pupil obstructed with lymph, contracted, or actually closed, or the anterior capsule of the lens opaque. Another danger of iritis is, that the inflammation is apt to spread to the deeper parts of the eye, the ultimate result of which may be more or less complete disorganization of the organ—such as

atrophy, dissolution of the vitreous body, hydrophthalmus, staphyloma scleroticæ, &c., with loss of vision.

760. *Treatment.*—The chief indication is to put a stop to the inflammation; in other words, to remove the inflammatory congestion as quickly as possible. It is by this only that a stop can be put to the exudation, and the condition established for the absorption of what matter has been exuded. It is by this, also, that the pain is most quickly and decidedly relieved. Bleeding and mercurialization are the principal means by which this indication is in general most effectually fulfilled. In some cases, however, as when the patient has had repeated relapses, and has been exhausted by the treatment, they are either not admissible, or a modification requires to be made in their employment.

761. Another indication, is to guard the pupil from being contracted or closed by the exuded lymph. This is accomplished by keeping it, throughout the disease, under the influence of belladonna.

762. The treatment in chronic iritis consists chiefly in tonics and alteratives, such as bichloride of mercury, in doses of from one-sixteenth to one-thirtieth of a grain three times a day, with bark and sarsaparilla, or arseniate of potass, in doses of one-thirtieth of a grain, three times a day; counter-irritation being at the same time used.

a. Genus I.—AQUO-CAPSULITIS.

(Inflammation of the membrane of the anterior chamber of the aqueous humour—Keratitis serosa—Iritis serosa anterior—Kerato-iritis.)

Aquo-capsulitis.

763. In the disease to which this name has been given, the inflammation involves the membrane of Descemet on the one hand, and the anterior surface of the iris on the other—sometimes the one, sometimes the other being the part first or most affected—sometimes both at the same time, and equally. The disease occurs either in an acute or chronic form.

764. The external redness, which is slight, is owing principally to sclerotic circumcorneal, with more or less scattered conjunctival injection. Between the redness and the margin of the cornea, there sometimes intervenes the narrow bluish-white ring, usually called the *arthritic ring*, (ss. 68—71.)

765. The affection of the membrane of Descemet is manifested by deep-seated dimness, interspersed with grayish or yellowish-white specks from the size of a pin's head, to micro-

scopical minuteness, of the cornea, produced, as above mentioned, (s. 346,) by exudation between the proper substance of the cornea, and the membrane of Descemet. There are at first no vessels in this situation, and when subsequently vessels make their appearance, they are of new formation.

766. The affection of the iris is manifested first by the usual loss of brilliancy and change of colour, by contraction and sluggishness, or immobility of the pupil, and subsequently by exudation of lymph into the pupil, and on the surface of the iris, where new vessels may make their appearance.

767. Along with these changes in the membrane of Descemet and iris, there is increased accumulation of aqueous humour, causing abnormal distension, if not prominence, of the cornea—an effect of which distension is dimness or suffusion of the corneal substance, superadded to the mottled opacity from exudation between it and the membrane of Descemet.

768. When the opacity of the cornea is not so great as to conceal the parts behind, flakes of lymph may be observed in the aqueous humour. Sometimes there is hypopyon.

769. *Subjective symptoms.*—A feeling of distension and fullness in the eyeball, with a dull aching pain in the forehead, sometimes extending to the occiput, annoys the patient. In acute cases, circumorbital or temporal pain occurs in nocturnal paroxysms, as in rheumatic ophthalmia and iritis.

770. Intolerance of light and lachrymation exist, but not to great degree.

771. Vision is disturbed in proportion to the opacity from exudation both between the substance of the cornea and the membrane of Descemet, and into the pupil.

772. *Constitutional symptoms.*—In acute cases there is some febrile disturbance. The scrofulous constitution, or other disordered state of health which usually exists, belongs to the head of predisposing cause.

773. *Causes.*—The disease is sometimes of traumatic origin. In the disordered state of health just alluded to, such causes as over-exertion of the eyes, and suppressed perspiration, have been found to excite the disease. It most usually occurs in persons below middle age.

774. *Diagnosis.*—Aquo-capsulitis requires to be distinguished from common corneitis on the one hand, and from common iritis on the other. From common corneitis, it is distinguished by the deep situation, and the peculiar mottled appearance of the opacity of the cornea; and the presence of this opacity, in

addition to the changes in the iris, distinguishes the disease from simple iritis.

775. *Prognosis.*—The disease, especially the chronic form of it, is sometimes obstinate. Relapses are liable to occur.

776. *Treatment.*—This should be much the same as is above recommended for corneitis, with the addition of a more decided use of mercury for the accompanying iritis—and also the moderate abstraction of blood. When abstraction of blood is not called for or not admissible, the treatment may be commenced with an emeto-cathartic, (s. 478,) after which the use of mercury should be commenced and pushed so as to affect the gums slightly. Quinine may be given at the same time, or afterwards, according to circumstances.

777. Turpentine is sometimes efficacious, as above mentioned in corneitis, (s. 686.)

778. Dr. Ammon of Dresden strongly recommends the hydrochlorate of baryta. It may be given in doses of gr. ss—gr. iij, dissolved in aromatic water, three or four times a day, or combined with cicuta, thus :—℞—Baryt. hydrochlorat. ℥ss, solve in aquæ laurocerasi ℥j, et adde extr. cicutæ gr. x.—Sig. —Eight drops twice a day at first, and then the dose to increase one drop daily.

779. Counter-irritation is of great use. Evacuation of the aqueous humour, by relieving tension, is sometimes of advantage ; but such a measure should only be had recourse to in obstinate cases.

780. The iris should be kept under the influence of belladonna, and as a fomentation to the eye, the belladonna lotion (s. 124) may be used.

781. No irritating drop or salve to the eye is admissible until after the decline of the disease, when diluted vinum opii, or the drops of lapis divinus, with vinum opii, (s. 128,) may be used occasionally.

b. Genus II.—IRITIS.

782. The species or varieties of iritis to be considered here, are such cases as are primary, or at most occur only as extensions from the external tunics. Those cases of iritis which occur as extensions of posterior internal inflammation, will be considered under the head of ophthalmia interna posterior.

783. The varieties of primary iritis are—scrofulous, rheumatic, syphilitic, and arthritic,—the two former coming under the head of *iritis serosa*, the two latter under that of *iritis*

parenchymatosa. In many cases, certain of these varieties of iritis are variously mixed up or complicated with each other—a circumstance which requires to be taken into consideration in forming a diagnosis, delivering a prognosis, and planning the treatment.

Scrofulous iritis.

(Ophthalmia scrofulosa interna anterior.)

784. In phlyctenular ophthalmia, and in corneitis, the inflammation, as above mentioned, (ss. 646, 670,) is apt to extend to the anterior surface of the iris. In some cases, the anterior surface of the iris appears to be primarily affected. These cases, spoken of as cases of scrofulous iritis, usually occur in persons about the age of puberty.

785. In addition to the treatment above indicated for the phlyctenular ophthalmia, or for the corneitis, it is necessary to give mercury so as to affect the gums, with the precautions which the constitution of the patient requires; or, instead of mercury, the hydrochlorate of baryta, as above indicated, for aquo-capsulitis, may be employed. The pupil should be kept under the influence of belladonna.

786. A chronic form of scrofulous iritis is also met with, usually in connection with chronic corneitis—sometimes with inflammation of the posterior tunics. A tonic and alterative treatment is indicated in such cases.

Rheumatic iritis.

787. In rheumatic and catarrho-rheumatic ophthalmiæ, it has been above seen, (ss. 593, 733,) that the iris is apt to be somewhat involved in the inflammation. When in an ophthalmia occurring under the same circumstances as rheumatic or catarrho-rheumatic ophthalmia usually does, the iris is the principal seat of the inflammation, the case is conventionally said to be one of *rheumatic iritis*—and this whether the patient has been subject to rheumatism in any other part of the body or not.

788. Rheumatic iritis constitutes what is called an *iritis serosa anterior*, as the inflammation principally affects the anterior surface of the iris. It may, however, also extend to the proper substance of the membrane.

789. *Symptoms at the commencement.*—Slight superficial pain of the eye, with increased sensibility to light and lachrymation, first attracts the attention of the patient. On examination,

the white of the eye may be found but slightly red, and this principally from scattered conjunctival vessels. No change may be perceptible in the iris, except, perhaps, that it is dull looking, and its pupillary margin not so sharply defined as natural. As regards the pupil, its motions may be as yet natural.

790. Sclerotic circumcorneal zonular injection now becoming well marked, the colour of the iris changes—first in its lesser circle—the pupil becomes dim, contracted, and sluggish, the pain in the eye increases, and after a nocturnal paroxysm of circumorbital or temporal pain, exudation of lymph is discovered to have taken place. The disease is thus fully formed.

791. *Symptoms in the fully-formed state.—Objective symptoms.*—As has been above more particularly described, (s. 364, *et seq.*,) the white of the eye is red from sclerotic circumcorneal, and more or less conjunctival injection. The colour of the iris, if naturally blue, is now green, if naturally hazel, reddish brown. Exuded lymph is seen in the now fixed pupil, perhaps, also, on the surface of the iris, and sometimes in flakes suspended in the aqueous humour. If exudation has taken place into the substance of the iris, it is known by the iris having lost the striated appearance of its surface, being swollen, and inclined towards the cornea. Abscess is a rare occurrence as a consequence of exudation into the substance of the iris in rheumatic iritis.

792. Besides these changes, the cornea is distended from increase in the quantity of aqueous humour (s. 367); it is more or less dim; and if the inflammation has involved the membrane of Descemet, the deep punctiform opacities indicative of this, are presented.

793. The palpebral conjunctiva is injected, and the eyelids towards their tarsal borders are somewhat red and swollen.

794. *Subjective symptoms.*—Besides the nocturnal paroxysms of circumorbital or temporal rheumatic pain, such as occur in rheumatic or catarrho-rheumatic ophthalmia, there is a painful feeling of distension in the eyeball, and a dull pain extending from the forehead to the occiput.

795. There is much intolerance of light, accompanied by lachrymation.

796. Vision is very considerably disturbed.

797. *Constitutional symptoms.*—Rheumatic iritis, like rheumatic ophthalmia, is attended by inflammatory fever, manifested by the usual symptoms of full strong pulse, white and dry tongue, costiveness, thirst, loss of appetite, and want of sleep.

The want of sleep is in part due to the severity of the nocturnal pain.

798. *The causes*, predisposing and exciting, of rheumatic iritis, are the same as those of rheumatic ophthalmia, (s. 599.) Rheumatic iritis, along with rheumatic inflammation of the joints, sometimes occurs as a consequence of gonorrhœa. A similar iritis is apt to occur during or after the use of mercury, the mercury rendering the system more susceptible to the action of cold. The iritis having once occurred, leaves a predisposition to subsequent attacks.

799. One eye only, or both, may be affected. In the latter case, the inflammation is usually more severe in the one than in the other.

800. *Diagnosis.*—The diagnosis of the disease, in its fully formed state, as an iritis, being made, (s. 757,) its rheumatic nature is determined, as above said, principally by the circumstances under which the attack has come on, taken in conjunction with the character of the symptoms.

801. *Prognosis.*—The prognosis is in general good if the disease is taken in time, before much exudation has occurred, and properly treated. In this case it may be cured in three or four weeks. A tendency to relapse, however, remains.

802. Left to itself, or improperly treated, the inflammation may fall into a chronic state, or it may eventually subside, but perhaps not until by exudation of lymph the pupil is obstructed or actually closed, or the anterior capsule opaque, and the eye is rendered more or less completely unfit for vision. The progress of the healing process of iritis, in general, as described in ss. 378, 379, is quite applicable to rheumatic iritis.

803. *Treatment.*—Venesection is the first remedy to be had recourse to, and it may be repeated. After blood-letting, three or four grains of calomel, and ten or fifteen grains of Dover's powder, are to be given at bed-time, and next morning a purgative draught. The calomel and opium are then to be continued in smaller doses, (gr. ij—gr. ss,) every four or six hours, with nitre and barley-water in the intervals, until the gums are sore.

804. If, under this treatment, the gums do not soon become sore, and if the inflammation does not show indications of subsiding, the venesection should be repeated, after which, probably, the gums will quickly become affected, and an evident diminution of the severity of the disease take place.

805. Low diet is to be enjoined, and the bowels kept open with castor oil, or an emeto-cathartic. Rest and quiet, and

protection of the eyes from strong light, are important parts of the treatment.

806. The eye may be occasionally bathed with tepid water, after which it is to be carefully dried, and covered lightly with a fold of linen. The eyebrow is to be constantly kept smeared with belladonna.

807. To assist in warding off nocturnal pain, inunction over the pained part is to be made with mercurial ointment and belladonna, opium, tincture of tobacco, &c., as above indicated for rheumatic ophthalmia.

808. When the inflammation begins to yield, counter-irritation repeated occasionally will promote the cure.

809. The violence of the disease having now subsided, absorption of exuded matter commences. Improved diet, bark or quinine, and a collyrium of lapis divinus, with vinum opii to the eye, may now be had recourse to with advantage.

810. When circumstances forbid the use of mercury, turpentine, as above recommended, may be tried as a substitute, or tartar emetic, so as not to cause vomiting, to the amount of two or three grains, in divided doses, in the course of the day.

Syphilitic iritis.

811. In syphilitic iritis, the inflammation involves the whole substance of the iris, (*parenchymatous iritis,*) and is very apt to spread to other parts of the eye.

812. *Objective symptoms.*—In the fully-formed state of the disease, there is well-marked external redness, not only from the usual sclerotic circumcorneal injection, which is great, but also from considerable conjunctival injection—the brick red colour of which may obscure the rose tint of the sclerotic injection. Through the dim and muddy-looking cornea, and aqueous humour, the iris is seen dull, and changed in colour, but more intensely so than usual on account of the greater vascular congestion, especially at its inner circle, where the colour is reddish-brown or tawny. The surface of the iris may present small points of extravasation of blood.

813. The pupillary margin is retracted, whilst the swollen iris, no longer presenting its fibrous structure, is bolstered forward. The pupil is itself fixed, contracted, angularly distorted, displaced upwards and inwards, and more or less filled with lymph.

814. Besides these changes, there are formed on the surface of the iris, especially towards the pupillary or ciliary margin, reddish-brown tubercular excrescences, and sometimes yellow

abscesses, as above described, (ss. 371–376,) the latter of which bursting, give rise to hypopyon.

815. *Subjective symptoms.*—During the day, there is in general not much pain, but at night, the paroxysms of circumorbital or temporal pain are peculiarly severe. There are intolerance of light and lachrymation. Vision is considerably diminished in consequence of the great obstruction of the pupil, but it is still more disturbed if the posterior tunics have become implicated, in which case there is, moreover, photopsy.

816. *State of health and general symptoms.*—Besides the iritis, there are usually, though not always, other secondary symptoms present, such as eruptions, papular, scaly, tubercular, or pustular, ulceration of the throat and mouth, periosteal swellings, and pains in the limbs.

817. *Constitutional symptoms attendant on the iritis.*—There is usually inflammatory fever.

818. Both eyes generally suffer—one eye becoming affected after the other.

819. The disease is often insidious in its attack, commencing with slight symptoms. It may then assume an acute character, or, with symptoms still mild, continue to observe a chronic but not less destructive course.

820. *Causes.*—The constitutional disease appears to be, in some cases, both predisposing and exciting cause, but in other cases, the disease is excited by some occasional cause, such as exposure to cold, over-use of the eyes, a slight injury, &c.

821. *Diagnosis.*—Though the tawny colour of the smaller ring of the iris, the angular distortion and displacement upwards and inwards of the pupil, and the presence of the tubercular excrescences, may some of them be met with in cases of iritis, not syphilitic, and may some of them be absent in syphilitic cases, they, nevertheless, are of such frequent occurrence in syphilitic iritis, that their presence alone constitutes strong ground for suspecting the nature of the case, and for inquiring as to whether or not other secondary symptoms exist. If such do exist, the nature of the case can no longer be doubtful.

822. *Prognosis.*—This is a very dangerous form of iritis. Left to itself, or inefficiently treated, it may spread to other parts, such as the choroid, retina, vitreous body, &c., and occasion disorganization of the whole eye, with consequent loss of vision.

823. In otherwise healthy persons, if timely and properly treated, the disease may be perfectly cured. It often, however, happens, especially when the health has been much pulled

down by the general disease, that even when the iritis has been subdued, the eye remains for a long time weak, and relapses are liable, from slight causes, to be excited.

824. *Treatment.*—Bleeding and mercurialization are the great remedies in this as in rheumatic iritis—the mercurialization, however, not solely because the disease is syphilitic. The venesection may require to be repeated more than once, and the mercury (calomel and opium) must be pushed until decided salivation. After this the mercury may still be required to be continued in smaller doses, to promote the removal both of the effects of the iritis and of the constitutional disease.

825. Besides belladonna, to oppose the contraction of the pupil, anodyne frictions are made, as above prescribed in rheumatic ophthalmia and iritis, around the orbit or on the temple, to assist in mitigating the nocturnal pain.

826. When the disease has been checked by the bleeding and mercury, blisters are useful.

827. When, as sometimes happens, it is not advisable to push mercury to the necessary extent, or when mercury does not exert its usual curative effects, turpentine, in drachm doses, three times a day, is the next remedy on which most dependence can be placed in subduing the iritis.

828. Iodide of potassium may be also tried under such circumstances. It may be given in doses of three or four grains, in compound decoction of sarsaparilla, three times a day.

Arthritic iritis.

(Ophthalmia arthritica interna anterior.)

829. In this, as in syphilitic iritis, the inflammation involves the substance of the iris, (*parenchymatous iritis.*)

830. *Objective symptoms.*—The redness of the white of the eye, which is owing not to sclerotic only, but also to considerable conjunctival injection, inclines to a livid tint. This arises partly from the sclerotica being, in such cases, attenuated, and of a bluish-black tinge around the cornea, and partly to the venous character of the conjunctival congestion, including the varicose enlargement of the rectal veins.

831. Between the margin of the cornea and the redness of the white of the eye, there usually intervenes, either at the nasal and temporal sides only, or all round, a narrow bluish-white space, forming a more or less perfect ring round the cornea. Under the impression that this appearance is peculiar to arthritic inflammations of the eye, it has been named *arthritic ring*, but improperly, as above shown, (ss. 68-71.)

832. This disease being a parenchymatous iritis, the iris is not only dull and discoloured as usual, but also swollen, especially at the pupillary margin, which becomes retracted and adherent to the capsule of the lens, while the middle part of the iris is bolstered forward towards the cornea. The natural structure of the iris is at the same time lost, and the membrane is seen to have become pervaded by new vessels, which run from the ciliary towards the pupillary margin. By and by, the condition of the pigment being altered, the iris may present a dirty slate colour.

833. The pupil, at first contracted, may become filled with lymph, mixed, perhaps, with blood, and angularly distorted—sometimes wholly closed—but it still remains central.

834. The inflammation does not readily at first extend to the choroid, &c.

835. In consequence of the considerable degree of conjunctival congestion, there is some increased mucous secretion, and in consequence of the affection of the borders of the eyelids, which are red and swollen, there is increased Meibomian discharge. These matters, by the movements of the eyelids, collect towards the angles of the eyes, in the form of a whitish foam, which has been named *arthritic foam*, as if the appearance were peculiar to arthritic inflammation of the eye ; but it is not, for the same appearance may present itself in other cases of ophthalmic inflammation.

836. *Subjective symptoms.*—Sometimes an attack of the disease is preceded by a feeling of formication in the skin of the face, and a tingling sensation about the eye. Dependent on the conjunctival injection, there may be the sensation of a foreign body in the eye. There is also a feeling of fullness and distension of the eyeball ; but the most distressing symptom is the racking pain, not only around the orbit and in the temple, but over the whole side of the head and face. It is most severe at night, but may not be wholly absent even during the day.

837. Intolerance of light exists to a greater or less degree, accompanied by lachrymation.

838. Vision is impaired only in proportion to the exudation into the pupil, except when the posterior tunics are involved, (see below.)

839. Usually one eye only is affected.

840. *Constitution, state of health, and constitutional symptoms.*—The persons who become affected with this disease are usually middle-aged, and may or may not have been the sub-

jects of regular gout. The disease when formed is attended by considerable inflammatory fever.

841. *Causes.*—The state of constitution just described may be viewed as the predisposing cause, and sometimes as exciting cause also, seeing that the disease may come on without any evident external exciting cause. More frequently, an inflammation of the eye being called forth by some exciting cause, such as over-exertion of the sight, damp and cold, &c., the state of the constitution causes it to assume the arthritic character.

842. *Diagnosis.*—The local symptoms, and the state of the constitution, point to the arthritic character of the disease; but the form of arthritic iritis under consideration requires to be distinguished from that which is a radiation or extension of *arthritic inflammation of the posterior tunics.* The principal ground of diagnosis is, that in the latter case, along with irregular gout, the primary symptoms indicate posterior internal ophthalmia, such as sclerotic redness at the circumference of the eyeball, diminishing towards the cornea, photopsy, and rapid diminution of vision. Consequently the pupil, when the disease extends from the posterior tunics, instead of being contracted, is dilated, (and this generally more in the transverse direction, so that it presents an oval shape,) and is not the seat of so much, if any, lymphatic exudation; the lens, however, is seen to have become glaucomatous and enlarged, so that it projects through the dilated pupil.

843. *Prognosis.*—This is the most dangerous form of iritis —not only because the pupil is apt to become contracted and obstructed by exuded lymph, but because the inflammation is very obstinate, prone to relapse, or to attack the opposite eye, and after several attacks, to spread to the choroid, retina, &c., and totally destroy vision.

844. *Treatment.*—Though this inflammation is so dangerous to the eye, and is attended by such severe symptoms, the state of the constitution is usually such, that the active treatment, so beneficial in other cases of iritis, requires to be very cautiously employed.

845. If the patient be strong, and if the pulse be full and hard, the skin hot, the tongue loaded, and the paroxysms of pain severe, venesection will be both safe and useful. At any rate, the bowels should be freely moved by calomel and colocynth, followed up by salts and senna. After this, a solution of Epsom salts, with tartar-emetic, should be used to keep the bowels open.

846. The bowels being thus regulated, colchicum may be tried, given as above prescribed, (s. 607,) or turpentine, (s. 827.)

847. Mercury must be given cautiously—the bichloride, in doses of one-sixteenth or one-twentieth of a grain, three times a day, in tincture of bark, with syrup of sarsaparilla, is a useful form. If, however, these remedies fail, and if the inflammation is going on to exudation into the pupil, calomel, with Dover's powder, must be given, gr. ij of the one, and gr. viij of the other, every night at bed-time.

848. Counter-irritation by blisters, or tartar-emetic ointment, behind the ear, or to the nape of the neck, is a very necessary and useful remedy.

849. To relieve the racking pain, friction is to be made with one or other of the substances above mentioned (s. 608).—Sometimes one, sometimes another, will be found more efficacious. The extract of belladonna should be kept smeared on the eyebrow to keep the pupil dilated. No application should be made to the eye itself. It should be merely covered with a fold of linen, a narcotic herb-bag, or the like.

850. The diet should be at first restricted, but when the violence of the inflammation has subsided, it may be improved, though it should still be temperate and carefully regulated. Tonics may also be given—for instance, bark, and carbonate of soda, five grains of each, two or three times a day, or disulphate of quina.

851. Local applications may also now be made to the eye, such as an eye-water of lapis divinus, with vinum opii, and the weak red precipitate salve, to the edges of the eyelids.

c. Genus III.—CRYSTALLINO-CAPSULITIS ANTERIOR.

(Inflammation of the membrane of the posterior chamber of the aqueous humour—Irido-periphakitis.)

Crystallino-capsulitis anterior.

852. In this inflammation, the uvea, as well as the anterior wall of the capsule of the lens, is affected—hence the disease is also named *irido-periphakitis*.

853. From what has been above said (ss. 380 and 389), of the anatomical characters of the disease, it appears never to be, properly speaking, a primary inflammation, but always an extension of inflammation from the iris, ciliary body, or choroid.

854. It in general observes a chronic course, and the symptoms are by no means strongly marked.

855. *Objective symptoms.*—There is not much external

redness. The iris is slightly discoloured and dull, and the pupil, bordered by a fringe of uvea, is somewhat contracted, irregular in form, and either fixed or very sluggish in its movements. On close examination, patches of opacity, some of them tinged of a brown colour, may be seen on the anterior wall of the capsule with minute vessels terminating in them. If belladonna be applied, and the pupil yields to its influence, the few red vessels, which were previously seen coming from behind it, are discovered to be derived from a looping network on the crystalline, forming an interrupted circle concentric with the pupil. This network may appear to the naked eye like mere brownish-red patches, but by the help of a magnifying glass, of one inch, or one half inch focus, these patches are discovered to be vascular. Between these vascular networks on the anterior wall of the capsule, and the membrane on the posterior surface of the iris, vascular bands of adhesion may extend, preventing the free dilatation of the pupil.

856. *Subjective symptoms.*—The dull pain in the eye and head which attends this inflammation is seldom such as to cause much distress; and any intolerance of light is so little, that the examination of the eye is not attended with much uneasiness. Muscæ volitantes, and photopsy, however, sometimes disturb the patient, and the dimness of vision is greater than the mere suffusion of the lens would alone indicate.

857. *Prognosis.*—In the early stage of inflammation of the anterior wall of the capsule, resolution is sometimes brought about; but, when the disease has existed for some time, it remains very obstinate. The iris being involved, becomes much altered in structure.

858. *Treatment.*—The general treatment employed in anterior internal inflammations of the eye, viz., depletion, mercury, counter-irritation, and belladonna, in the early stage, and tonics in the latter stages, are the remedies which suggest themselves; but their employment must be regulated and modified according to the circumstances of the case.

859. Dr. Mackenzie mentions the following circumstances in regard to a case of inflammation of the anterior hemisphere of the capsule, which he treated. On the first day of his being called in, two minute reddish spots were seen projecting from behind the edge of the pupil. Next day there were five. In the course of a week, the symptoms totally disappeared, under the employment of venesection, leeches, calomel with opium, and belladonna. The mouth was made very sore. In the

chronic stage, Dr. Mackenzie confesses, however, that this inflammation has in his hands proved one of the most obstinate.

c. Order III.—OPHTHALMIA INTERNA POSTERIOR.

860. The anatomical characters of ophthalmia interna posterior cannot be seen, and there are no objective symptoms pathognomonic of it. As subjective symptoms, there may be photopsy, dimness of vision, deep distending pain in the eyeball, intolerance of light, and headache. Of all these symptoms, the dimness of vision is the most constant.

861. As shown in s. 758, posterior internal ophthalmia may arise and proceed to diminution or destruction of vision, so insidiously, that the patient perhaps becomes aware of his malady only by accidentally discovering the defect of vision. On the other hand, the disease may run its course with such rapidity and severity, as, amidst great suffering, to destroy the eye in twenty-four or thirty-six hours. Hence the distinction of ophthalmia interna posterior into acute and chronic.

862. Ophthalmia interna posterior may arise primarily or secondarily.

863. In primary ophthalmia interna posterior, an extension of the inflammation usually ere long takes place to the anterior segment of the eyeball. It is of the ophthalmia interna anterior thus supervening that the sclerotic circumcorneal injection which presents itself is symptomatic, not of the posterior internal inflammation. Such cases of ophthalmia interna posterior, with secondary ophthalmia interna anterior, are distinguished from primary ophthalmia interna anterior, by the changes in the anterior segment of the eyeball not being such as to account for the diminution or loss of vision, and by this diminution or loss of vision having occurred, perhaps, before the changes in the anterior segment took place.

864. Secondary ophthalmia interna posterior arises by extension of inflammation in ophthalmia interna anterior.

865. Though genera of posterior internal ophthalmia are above admitted, it must be confessed, that in practice there is considerable uncertainty as to their diagnosis, especially at the commencement.

866. There are no marked objective symptoms at first, distinguishing choroiditis from retinitis, for example; and though the changes of structure which the eyeball may eventually undergo in consequence of ophthalmia interna posterior, appear to be some of them (sclerotic staphyloma) more connected

with choroiditis, others (the changes visible in the vitreous body and posterior wall of the capsule of the lens, above referred to (ss. 386, 390) as manifestations of vitreo-capsulitis and crystallino-capsulitis posterior) more connected with retinitis, they present themselves only after both choroid and retina, and even the anterior segment of the eyeball, have become implicated, and therefore are of no value as a means of diagnosis.

867. As to subjective symptoms, again, though there is reason to believe that photopsy is occasioned by choroiditis and dimness of vision alone by retinitis, these symptoms can scarcely be admitted as pathognomonic. The absence of photopsy would be no certain indication of absence of choroiditis. Besides, dimness of vision and photopsy often occur together.

868. As to pain, it appears to be dependent rather on the acuteness of the inflammation, and the degree to which other parts besides the choroid and retina may have become implicated, as above observed.

869. From this it appears, that we cannot with precision determine which particular structure in the posterior segment of the eyeball is the chief seat of the inflammation in an ophthalmia interna posterior, and therefore it is in vain to attempt to diagnosticate choroiditis, retinitis, &c., considered as genera of posterior internal ophthalmia. We can only discriminate certain forms of posterior internal ophthalmia, characterized principally by the state of the constitution, or by the constitutional disease with which the ophthalmia appears to be connected, and by the effects of the inflammation. Practically, perhaps, nothing more is required.

870. The principal forms of posterior internal ophthalmia met with are:—1. Those cases of diminution or loss of vision above referred to (s. 758) as being sometimes described as cases of chronic iritis, and which are also sometimes described as retinitis. 2. Those cases which end in sclerotic staphyloma and posterior hydropthalmia, and which are described by Dr. Mackenzie under the name of sclerotico-choroiditis. 3. Those cases which end in glaucoma, and which are described as forms of arthritic ophthalmia.*

871. These forms of ophthalmia, being usually of a chronic character at first, are seldom or never seen by the medical man, until, being already formed, they manifest themselves by their

* The cases in which there are no other than the subjective symptoms of diminution and disturbance of vision are more conveniently referred to the head of amaurosis.

effects, or, becoming acute, by the severity of the subjective symptoms.

872. The two first forms might perhaps be viewed merely as different degrees of the same kind of posterior internal ophthalmia, and this might be named *scrofulous posterior internal ophthalmia.* The third is a form of arthritic ophthalmia, and may be named *arthritic posterior internal ophthalmia* in contradistinction to arthritic iritis or arthritic anterior internal ophthalmia.

Scrofulous Posterior Internal Ophthalmia.

873. Dimness of vision in a greater or less degree is the symptom which generally first seriously attracts attention. Muscæ volitantes, photopsy, headache, intolerance of light, may or may not be precursors or accompaniments.

874. *Objective symptoms.*—When, in consequence of these subjective symptoms, an examination of the eye is made, it will probably be found that the pupil is slightly dilated and sluggish or immovable, and its margin adherent by bands of lymph to the capsule of the lens. It will perhaps also be found that there is some external redness in the form of a sclerotic circumcorneal blush, which, together with the state of the iris and pupil, is a manifestation of the supervention of anterior internal ophthalmia.

875. In addition to these appearances, it will perhaps be observed that the sclerotica is attenuated and dark-coloured, and that the white of the eye is pervaded by enlarged and tortuous recto-muscular vessels, ramifying towards the cornea.

876. The eye may never undergo any farther change than what is above described.

877. In some cases of scrofulous posterior internal ophthalmia, on the contrary, the sclerotica becomes more attenuated and darker coloured, and bulges out here and there, forming sclerotic staphyloma. This is owing to a collection of fluid at the place, either between the sclerotica and choroid, or between the choroid and retina, or within the retina.

878. Towards the side next the sclerotic staphylomatous projection the pupil is displaced, and on the same side patches of opacity frequently form in the cornea.

879. The iris is sometimes little, sometimes much, implicated; in the latter case it is bolstered towards the cornea, and the pupil and posterior chamber are filled with lymph.

880. Degenerated and enlarged, the eyeball protrudes more or less from the orbit.

881. *Subjective symptoms.*—In the course of these changes, in addition to the dimness of vision and photopsy, there may be chroopsia, hemiopia, and diplopia with one eye. Eventually vision becomes dimmer and dimmer until it is entirely lost.

882. In this stage of scrofulous posterior internal ophthalmia, remissions and exacerbations of the inflammation occur. During an exacerbation, the white of the eye is of a purple colour, from the blending of the dark tint of the attenuated sclerotica and the red colour of the injected vessels. There is very seveve pain in the eyeball, in and around the orbits, and over the whole side of the head, with intolerance of light and lachrymation.

883. *Constitutional symptoms.*—To these local symptoms is added considerable constitutional disturbance.

884. *Causes.*—This form of posterior internal ophthalmia is met with principally in young adults of scrofulous constitution, more frequently females than males, and is commonly attributable to overuse of the eyes, with neglect of exercise, derangement of the stomach and bowels, disturbed menstruation, &c. Traumatic inflammation of the eye sometimes takes this form.

885. *Diagnosis.*—This may be inferred from what has been above said.

886. *Prognosis.*—The prognosis, as regards vision, is unfavourable; in the more advanced stage very much so. Still it does sometimes happen that the disorganizing progress of the inflammation is arrested, and some degree of vision preserved or restored.

887. *Treatment.*—If the case be seen early, venesection or cupping, according to the strength of the patient, free action on the bowels, and mercury pushed so as to affect the gums, constitute the proper treatment.

888. In the more advanced stages of the disease, the tonic and alterative treatment—the bichloride of mercury, in doses of one-thirteenth to one-sixteenth of a grain, three times a day, in tincture of bark; or the arseniate of potass, in doses of one-thirty-secondth of a grain, either in the form of Fowler's solution or in that of a pill—with counter-irritation, should be tried. During this course it will be useful to act on the bowels occasionally; for this purpose calomel and colocynth, followed by salts and senna, may be given. The abstraction of blood by leeches may also still be necessary.

889. During an exacerbation of the inflammation, the belladonna lotion (s. 124) is an excellent application to the eye.

Under its use alone I have seen the inflammation diminish and the pain and intolerance of light rapidly relieved.

890. When there is staphylomatous bulging of the sclerotica, the repeated evacuation of the accumulated fluid by puncture is sometimes had recourse to. See *Sclerotic Staphyloma.*

Arthritic Posterior Internal Ophthalmia.

891. This disease occurs both in an acute and in a chronic form. The acute form may supervene on the chronic, or come on all at once. The chronic form usually comes on of itself unpreceded by the acute form.

892. The acute differs from the chronic disease principally in the greater rapidity with which it leads to the organic changes, causing destruction of the function of the eye,—vision being destroyed in the course of a few days, sometimes even in a single night; and in a correspondingly greater severity of the subjective symptoms.

893. Keeping in view the difference in the rapidity of their course, the following description of the objective symptoms is applicable to both the chronic and the acute form; but as regards the subjective symptoms, it will be necessary to give a separate description of them, both as they occur in the chronic, and as they occur in the acute form.

894. *Objective symptoms.*—The most characteristic of these at first is, the state of the pupil, which is sluggish or fixed, and dilated, but instead of being circular, it is of an oval shape. The long diameter of the ovally-dilated pupil may be transverse, or vertical, or diagonal—most commonly transverse. The pupillary margin of the iris is bordered with pigment.

895. A dimness is seen through the dilated pupil, and, on careful examination, this is discovered to be owing to that peculiar deep-seated green opaque appearance called *glaucoma.* See *Glaucoma.*

896. The white of the eye, dark and dirty looking, is at first pervaded merely by large livid tortuous vessels derived from the recto-muscular, but the inflammation spreading to the iris, the white of the eye becomes the seat of vascular injection, conjunctival as well as sclerotic, partially or completely round the cornea, but separated from it by the bluish-white ring above referred to, (ss. 68—71.) The resulting redness is of a livid tint.

897. The iris, which was at first merely dull-looking, becomes changed to a slate colour, pervaded by varicose vessels, its pupillary margin retracted, its middle part inclined towards

the cornea, and eventually loses its striated appearance. There is no exudation of lymph.

898. The cornea may become dim and rough on its surface, like ground glass.

899. The eyeball is hard to the touch.

900. The sclerotica becomes attenuated here and there, and perhaps bulges out, constituting sclerotic staphyloma.

901. The lens may become cataractous (glaucomatous cataract), and protruding through the dilated pupil, press against the cornea.

902. *Subjective symptoms of the chronic form.*—Considerable dimness of vision, with photopsy, attracts the patient's attention, but so far from having intolerance of light, the patient sees best in good light. There may be at first no pain, at the most, uneasiness in the eyes, but in the progress of the disease a feeling of distension in the eyeball and occasional paroxysms of dull supraorbital or circumorbital pain, distress the patient.

903. Bodily exertion or mental excitement or errors of diet, aggravate; rest and mental tranquillity, and moderate nutritious diet, mitigate the symptoms.

904. Diminution of vision goes on, sometimes gradually, sometimes suddenly, the photopsy at the same time increasing, and continuing even after vision is lost. Vision, after being almost lost, is sometimes improved after an attack of gout.

905. *Subjective symptoms in the acute form.*—Severe burning bursting pain in the eyeball, and racking pain in the supraorbital or circumorbital region, in the temples, and thence extending over the whole side of the head. The pains are severest towards midnight.

906. There is much intolerance of light, accompanied by lachrymation and the sensation as if a foreign body were in the eye.

907. With great photopsy, vision rapidly becomes dimmer and dimmer, until all sensibility to external light even is lost, though the photopsy may still continue.

908. *General symptoms.*—In the chronic disease the system does not sympathize much, but in the acute disease there is severe inflammatory fever.

909. *Predisposing causes.*—This disease occurs in persons advanced in life—more frequently females than males, and the dark than the fair complexioned—and who have not been previously quite healthy, having been perhaps the subjects of irregular gout, derangement of the digestive organs, piles, headaches, gutta rosacea, or the like.

910. In such persons the eyes have seldom remained alto-

gether sound; the borders of the eyelids are swoln and pervaded by large vessels; the white of the eye is dark and dirty-looking, and pervaded by large varicose vessels derived from the rectal, filled with dark blood, whilst a sensation of fullness is experienced in the eyeball; muscæ and temporary dimness of vision are apt to be occasioned by stooping, by being heated, &c.

911. *Exciting causes.*—In persons in the state of general health, and with the state of eyes above described, ophthalmic inflammation, induced by any common occasional cause, is prone to assume this form.

912. As more special causes may be mentioned, suppressed gout, anxiety of mental distress, suppression of hæmorrhoidal discharge, in the female the cessation of menstruation, the suppression of any other habitual discharge, continued over-exertion of the eyes, strong light, cold.

913. Both eyes may be attacked at once, but the inflammation is more severe in the one than the other. More usually one is first attacked and destroyed, and afterwards the other. One eye may however be spared.

914. *Diagnosis.*—This disease during its active state is to be distinguished from arthritic anterior internal ophthalmia (ss. 829, et seq.), and the state in which the eye is left by it must be distinguished from cataract and amaurosis properly so called.

915. The *prognosis* is altogether unfavourable. Treatment has little influence on the disease. At the most it can merely mitigate or retard. The eye is sure eventually to be destroyed by a renewed attack.

916. *Treatment.*—The subjects of this disease do not bear much bleeding or mercurialization.

917. In the chronic form the occasional application of leeches may be necessary. The bowels having been freely opened by means of calomel and colocynth, followed by salts and senna, a mercurial alterative course may be commenced: the bichloride of mercury in doses of one-sixteenth to one-twentieth of a grain, three times a day, in tincture of bark and syrup of sarsaparilla. Counter-irritation should be kept up by means of blisters on the nape of the neck. Feet and hip-baths should be often taken. Friction of the skin is useful.

918. When there is much circumorbital or temporal pain, the anodyne frictions above recommended are to be had recourse to, (s. 608.)

919. During this treatment the diet should be mild and nutritious, and care taken to keep the bowels, the kidneys, and skin in good order, whilst rest and quiet should be enjoined.

920. After this treatment, tonics will be useful.

921. In the acute form of the disease, if there is time for treatment, it should be the same as that above recommended for arthritic iritis, but employed with still greater precautions. If fortunately the violence of the disease be subdued before destruction of the eye, the subsequent treatment should be the same as just recommended for the chronic form of the complaint.

D. Order IV.—PANOPHTHALMITIS.

922. Panophthalmitis is inflammation of the whole eye. Primary panophthalmitis, i. e., inflammation invading the whole eye at once, is of rare occurrence. Most commonly, panophthalmitis is secondary, being developed by extension of inflammation from one structure to another, as has been seen may take place in some of the ophthalmiæ above considered, especially the posterior internal.

923. As has been above said, panophthalmitis is genus as well as order.

Genus.—PANOPHTHALMITIS.

924. The species or form of panophthalmitis which it is purposed to consider here is phlegmonous panophthalmitis or ocular phlegmon.

Phlegmonous panophthalmitis.

925. *Objective symptoms.*—There are inflammatory swelling of the cellular tissue of the orbit around the eyeball, or fluid accumulated in the orbital capsule, and chemosis of the conjunctiva, in consequence of which the distended eyeball is immovably fixed and protrudes from the orbit, stretching the upper eyelid and averting the lower, which are red and swollen, especially the upper.

926. If the cornea is still transparent enough to allow the iris to be visible, this is seen to be discoloured and the pupil contracted and fixed.

927. *Subjective symptoms.*—Dimness of vision, independent of changes in the cornea and pupil, and photopsy, are indicative of the retina and choroid being involved in the inflammation.

928. As might be expected from the great distension of the eyeball from within, and the pressure to which it is subjected to from without, the suffering is very severe. Besides the hot burning pain in the eyelids and whole region of the eye, aggra-

vated by the slightest touch or attempt at motion, there is deep distending throbbing pain in the eyeball as if it would burst, pain in the orbit, extending to the back of the head, pain around the orbit, in the temples, or all over the side of the head and face. There is also great intolerance of light, with lachrymation.

929. *Constitutional symptoms.*—Inflammatory fever and sometimes delirium accompany the disease.

930. The disease advancing, all the symptoms become aggravated, and suppuration takes place; being ushered in by a feeling of weight and cold in the eye, and general rigors.

931. In consequence of accumulation of matter in the interior of the eyeball, this becomes much distended and enlarged, so that it protrudes still more from the orbit. The cornea is infiltrated with matter, and projects from the bottom of the fossa formed by the chemosed conjunctiva.

932. With the supervention of suppuration the suffering not only does not abate, but actually increases, in consequence of the strong outer tunics of the eyeball not readily yielding to the distension from the accumulated matter. At last, however, the eyeball bursts by the cornea or sclerotica giving way, and the abscess, together with blood and the humours of the eye, are evacuated. The pain, which before this was of the severest character, is now at once greatly relieved, and afterwards gradually subsides.

933. *Causes.*—This disease of the eye usually occurs in young robust individuals, in consequence of the intense operation of those causes of ophthalmic inflammation in general, which act directly on the eyes as above mentioned, (s. 406,) especially injuries, chemical or mechanical. The disease, as it occurs in connection with phlebitis, is described below under the name of *phlebitic ophthalmitis.*

934. *Prognosis.*—It is only when the disease is early and actively treated, that the eye can be saved as an organ of vision. When the disease has already made some progress, preservation of the form of the eye will perhaps be all that can be hoped for; the retina having been disorganized. When suppuration has taken place, even this can no longer be calculated on. If the eyeball be allowed to burst, the humours will be evacuated along with the matter, the tunics will therefore be permitted to collapse, and after cicatrization nothing of the eyeball will remain but a small stump at the bottom of the orbit.

935. *Treatment.*—Blood-letting, mercurialization, radiating incisions or excision of the chemosed conjunctiva, (s. 152,)

puncture of the orbital capsule, belladonna to keep the pupil dilated, and anodyne frictions around the orbit or the temples, &c., constitute the treatment, which must be carried into effect with vigour in the commencement of the disease, if the eye is to be saved. Subsequently, when suppuration threatens or has commenced, all that can be done is to apply a poultice, and when the abscess becomes prominent at some point, to evacuate it by puncture with a lancet, in order to relieve the suffering, and perhaps save as much of the eyeball as will form a stump for the support of an artificial eye. Puncture of the eyeball with a lancet may even be advisable before this, to relieve suffering by removing tension. After this it will be necessary to support the system with generous diet and tonics.

APPENDIX TO THE PRECEDING SECTION.

936. There are certain febrile and inflammatory diseases, viz., the exanthemata, a particular form of epidemic fever, and phlebitis, in the course of, or subsequent to which, inflammation of the eyes is apt to supervene. The inflammation is commonly named morbillous, scarlatinous, variolous, postfebrile, or phlebitic ophthalmia or ophthalmitis, according to the general disease with which it is connected. It is, however, to be observed that in these cases the ophthalmia is essentially the same as some of the forms above described, being not only not a specific inflammation, but not even always of the same kind in different cases of the same general disease; thus exanthematous ophthalmia is sometimes phlyctenular, sometimes puromucous, sometimes even internal.

937. Whilst therefore the practitioner, in treating the general diseases above mentioned, must be prepared to encounter supervening ophthalmic inflammation, he must also be prepared to find that inflammation more or less different in kind in different cases of the same disease, and requiring therefore different modes of treatment—modes of treatment, however, not differing from those above indicated for the particular species or form of inflammation, except in so far as is necessitated by the presence of the general disease.

Scarlatinous and morbillous ophthalmia.

938. An inflammation of the eye is apt to occur in scarlet fever and in measles, more frequently in the latter than the former, which usually resembles the phlyctenular or scrofulous

ophthalmia, though sometimes it assumes the puro-mucous character, or even runs into internal inflammation. In general the inflammation is mild, but phlyctenulæ, or even abscess of the cornea, followed by more or less destructive ulceration of it, may take place.

939. *Diagnosis.*—Scarlatinous and morbillous ophthalmia in their commencement so much resemble scrofulous ophthalmia, that they might be taken for it before the general disease has declared itself by eruption. When this has taken place, the scarlatinous and morbillous nature of the disease will, of course, also be evident, irrespective of any differences in their nature in other respects, which may present themselves.

940. *Prognosis.*—Although, in general, these ophthalmiæ subside with the general disease, under very simple treatment, they should be as carefully watched as if they were idiopathic affections. By neglect, very serious or irretrievable injury may take place by ulceration of the cornea, to the extent even of its destruction, and the formation of staphyloma.

941. Scarlet fever and measles are apt to leave behind them a tendency to scrofulous ophthalmia, ophthalmia tarsi, and blennorrhœa of the lachrymal passages.

942. *Treatment.*—The general treatment necessary for the general disease answers for that of the ophthalmia. After the subsidence of the general disease, tonics may be necessary.

943. The local treatment of the inflammation of the eye is to be conducted on the principles laid down for the idiopathic ophthalmia which it may more particularly resemble. Leeches may be applied around the eye and blisters to the nape of the neck, if the inflammation is severe. Fomentations, afterwards some slightly stimulating lotion or drops to the conjunctiva, and salve to the edges of the eyelids, will commonly be necessary.

Variolous ophthalmia.

944. This is generally of a much more severe and dangerous character than the other exanthematous ophthalmiæ, as used to be exemplified with such lamentable frequency before the introduction of vaccination.

945. Variolous ophthalmia most commonly puts on a form resembling scrofulo-catarrhal ophthalmia, with more of the characters of phlyctenular than catarrhal ophthalmia, (s. 697,) or catarrho-rheumatic ophthalmia. Sometimes it is a purulent ophthalmia. Sometimes the internal tunics are implicated.

946. It is about the eleventh or twelfth day or later from the first appearance of the eruption, and when the secondary

fever has commenced, that the ophthalmia most commonly comes on.

947. There is conjunctival and sclerotic redness, accompanied by heat, pain, and the sensation as if a foreign body were in the eye, and intolerance of light, with lachrymation. Pustules or abscesses of the cornea running into ulceration soon took place, and by the extension of the ulceration the cornea may be more or less destroyed.

948. When the disease puts on the form of purulent ophthalmia, the cornea is apt to become infiltrated with matter, and be totally destroyed by rapid ulceration or by sloughing.

949. The cornea being destroyed, in part or in whole, the iris protrudes. Sometimes the lens escapes; sometimes there is evacuation of all the humours.

950. If the eyelids should be so much swollen that the eyeball cannot be exposed for examination, the invasion of the ophthalmia may be inferred from the subjective symptoms, and that destruction of the cornea is going on may be suspected if a bloody, greenish and offensive discharge from between the eyelids takes place.

951. The period of invasion of this ophthalmia being when the general eruption is on the decline, the pustules which are so apt to implicate the cornea, ought not, Drs. Gregory and Marson justly insist, to be viewed as of a specific nature, like the pustules of the skin, but merely of the same nature as those which may occur in any acute external ophthalmia.

952. In the eruptive stage of small-pox there may be some degree of conjunctivitis, but this is neither frequent nor dangerous. When there are many pustules on the eyelids and their margins, indeed, the swelling may be so great that the eyelids cannot be opened, and there may be an increased Meibomian secretion, by which the edges of the eyelids are glued together and the eyelashes encrusted: but there is not much lachrymation, little or no pain in the eye or manifestation of intolerance of light, and when at last on the fading of the eruption, and subsidence of the swelling, the eyelids admit of being opened, the eyeball is found quite safe, the conjunctiva perhaps being merely somewhat injected, and the seat of a little increased mucous secretion.*

953. Small-pox, like scarlet fever and measles, leaves behind a tendency to phlyctenular ophthalmia, ophthalmia tarsi, blennorrhœa of the lachrymal passages, &c.

* The injury which may result to the eyelids from bad cicatrices is considered under the head of diseases of the eyelids.

954. *Treatment.*—As a prophylactic measure during the eruptive stage, any matter which collects at the borders of the eyelids is to be frequently washed away by means of tepid water, and after each ablution, some mild ointment is to be smeared along the borders of the eyelids.

955. Ophthalmia having declared itself, if the patient be still of good strength, it will be found beneficial to vomit and purge, apply leeches around the eye and counter-irritation behind the ears or to the nape of the neck. The eye is to be fomented with warm water or the belladonna lotion tepid, and the weaker nitrate of silver solution, (s. 128,) dropped in once a day or every second day.

956. When the inflammation has begun to abate, tonics and generous diet will be useful. If the system of the patient be in an exhausted state, good diet, cordials, and tonics, as far as they can be pushed, will be necessary from the first.

957. When the cornea is opaque, perforated by ulceration or altogether destroyed, the prognosis and treatment of the case come under the heads of *opacities of the cornea*, *prolapsus iridis*, or *staphyloma iridis*.

Postfebrile ophthalmitis.

958. A remittent fever, sometimes attended with petechiæ, but not with the measly eruption of typhus, often accompanied with jaundice, its first paroxysm coming to a crisis within seven days, a relapse happening almost invariably, but the patient rarely suffering more than two paroxysms, and the mortality not exceeding three and a half per cent., which prevailed very extensively in Edinburgh and Glasgow two or three years ago, and has prevailed at different times in Dublin, was apt to be followed by various sequelæ, of which the most remarkable was the affection of the eye to be here noticed.

959. This disease appears to be a form of posterior internal ophthalmia, usually but not invariably with extension of the inflammation to the anterior segment of the eyeball.*

960. *Symptoms.*—At a period, varying from a fortnight to five or six months, after recovery from the fever, the posterior internal ophthalmia declared itself by the subjective symptoms of muscæ volitantes, and more or less dimness of vision, increasing perhaps until merely a perception of light and shade remained. When anterior internal ophthalmia was superadded

* In some cases, the inflammation of the eye arose in and was confined to the anterior segment, being an anterior internal, or sometimes merely an external ophthalmia. There were therefore no amaurotic symptoms.

to the posterior internal, attention was more forcibly drawn to the disease, not only by the inflammation having become objectively evident, but by the accompanying ocular and circumorbital pain.

961. The greatest number of cases of this ophthalmia occurred in young adults. One eye alone was more commonly affected than both. Of the two eyes the right appears to have been the one which more frequently suffered.

962. *Exciting cause.*—The onset of the disease of the eye was generally traceable to some such exciting cause as exposure to cold, using the eyes too early after recovery from the fever, &c.

963. *Prognosis.*—When early and properly treated, the disease was in general found to yield completely though slowly; vision being restored even when it had become already extinguished. When not thus treated, or altogether neglected, irremediable sequelæ were found to remain, such as imperfect vision, muscæ volitantes, sclerotic staphyloma, opacity in pupil, &c.

964. *Treatment.*—Bleeding, mercury, and belladonna at the commencement; and when the acuteness of the disease began to subside, counter-irritation and quina appear to have constituted the most successful treatment. Though the patients laboured under general debility at the time, it was nevertheless found that unless abstraction of blood was had recourse to, the recovery was slow and imperfect.*

Phlebitic ophthalmitis.

965. This is a suppurative panophthalmitis occurring as a secondary effect of phlebitis, traumatic, puerperal, or of other origin, and analogous to the abscesses which occur in various other organs under the same circumstances.

966. In some cases the ophthalmitis comes on slowly, and does not cause much distress to the patient; in other cases it comes on suddenly and is attended by very severe symptoms. In either case, however, supposing the patient does not sink under the primary disease, the eye is either destroyed by the bursting of the abscess or left amaurotic.

967. The constitutional symptoms which attend this disease are those of the phlebitis, which are of a typhoid character.

* For detailed accounts of Postfebrile Ophthalmitis, as it lately occurred in Glasgow, see the papers of Dr. Mackenzie in the Medical Gazette for Nov., 1843, [republished in American Journal of the Medical Sciences for April 1844, p. 480,] and of Dr. A. Anderson, in the London and Edinburgh Monthly Medical Journal for October 1845; [also Lawrence's Treatise on the Diseases of the Eye.]

968. The general circumstances of the case sufficiently distinguish phlebitic ophthalmitis from common phlegmonous panophthalmitis, or ocular phlegmon, to which, as regards local symptoms, it has, especially in its acuter form, a great resemblance. There is a difference perhaps in the appearance of the chemosis, which in phlebitic ophthalmitis has been remarked to have more of the character of serous chemosis; whilst the conjunctiva was pale rather than bright red, and in some cases at least covered on its surface with a lymphy exudation in the form of a pseudo-membrane.

969. *Treatment.*—Considering the grave nature of the primary disease, the affection of the eye constitutes but a comparatively secondary consideration in the case. The general treatment proper for the phlebitis is that which is also proper for the ophthalmitis. The local treatment should be much the same as that above indicated for phlegmonous panophthalmitis.

Traumatic and sympathetic ophthalmia.

970. Inflammation of the eye excited by injury puts on one or other of the various forms above described. The particular form of ophthalmia excited depends partly on the seat and degree of the injury, and partly on the age, constitution and state of health of the patient. The influence of constitution and state of health, for example, is shown by the circumstance that a similar injury may give rise to a severe internal ophthalmia in one person, whilst in another it may occasion a comparatively unimportant inflammation.

971. The treatment of traumatic ophthalmia must be conducted on the same principles as that for the corresponding forms of ophthalmic inflammation above described. If the medical man is called in on the receipt of the injury, he will have the opportunity of employing prophylactic treatment, such as bleeding, general or local, according to the severity of the injury; rest, saline purgatives, and spare diet, cold, belladonna lotions to the eye, and mercury, if there is reason to fear the occurrence of internal inflammation.

972. In certain cases of injury, the eye injured does not alone become inflamed, the opposite eye ere long becomes affected also, and suffers as much, sometimes even more. This is considered owing to the sympathy which exists between the two eyes, and hence the inflammation supervening in the uninjured eye has been named *sympathetic ophthalmia.*

973. The traumatic ophthalmia on which sympathetic oph-

thalmia of the opposite eye is most apt to supervene, involves the internal textures of the eyeball, posterior as well as anterior; and the injuries which most commonly excite this degree of internal inflammation, are penetrating and lacerating wounds in the region of the ciliary body, especially with some loss of vitreous humour, and prolapse of the iris, inflicted by cutting instruments, or by the forcible projection of splinters of iron or stone, or the fragments of percussion caps.

974. The sympathetic ophthalmia likewise involves the internal textures, more especially those of the posterior segment of the eyeball; hence diminution of vision and photopsy are early symptoms.

975. The period of time after injury of one eye, at which the sympathetic ophthalmia supervenes in the other, is generally five or six weeks.

976. Though the subjects of sympathetic ophthalmia are apparently healthy at the time of the original accident, they do not in general appear to be of sound constitution, for their health readily breaks up under the treatment necessary for the traumatic ophthalmia, and the debilitated state of health thus induced is perhaps one of the conditions which operate in predisposing to the sympathetic ophthalmia.

977. The sympathetic attack sometimes cannot be traced to any immediate exciting cause; sometimes it appears to have been brought on by using the eye too soon after the injury of the opposite eye.

978. The wounded eye in general becomes atrophic and amaurotic, and the sympathetically affected one pretty certainly shares the same fate, in spite of the most carefully conducted and appropriate treatment.

979. Sympathetic ophthalmia having hitherto proved so little amenable to treatment, the greatest attention should be paid to every case of traumatic internal ophthalmia, however slight apparently at first, in the hope of obviating an attack of sympathetic ophthalmia. And after the cessation of the traumatic ophthalmia, especial care should be taken by the patient not to use either eye much for a considerable time to come.

980. It has been supposed that injuries attended with the lodgment of a foreign body in the interior of the eye, are those especially which are followed by sympathetic inflammation. This is, however, not always the case, for the inflammation has been found to occur in cases of injury of the eye in which there could be no suspicion that any foreign body had become lodged in its interior, and sympathetic ophthalmia does not

always supervene in cases of injury of one eye, even when it is certain that a foreign body is lodged in its interior.

981. On the supposition, however, that the presence of a foreign body in one eye, is the cause of supervening sympathetic ophthalmia in the other, Mr. Barton, of Manchester, lays open the injured eye by incision of the cornea, with an extraction knife, so as to form a large flap, which he cuts off, and covers the eye with a poultice, leaving the foreign body to come away with the discharge, &c., which it usually does one or two days after the operation. The healing process after this operation consists in the closing in of the tunics of the eyeball, and the shrinking of it to a stump fit for the support of an artificial eye, as after the operation for staphyloma.

982. That the practice just described has appeared to ward off sympathetic ophthalmia from the other eye, constitutes good ground for adopting the same plan even in cases in which there is certainly no foreign body lodged in the interior of the eye, but in which the injury of the eye is in other respects similar, and has already destroyed vision, and in which sympathetic ophthalmia threatens.

Section IV.—VARIOUS MORBID STATES OF THE EYE, CONSEQUENCES OF THE OPHTHALMIÆ.

Granular conjunctiva.

(Granular eyelid.—Trachoma.—Pladarotes.)

983. This is the morbid state in which the palpebral conjunctiva is apt to be left by the puro-mucous ophthalmiæ, especially the Egyptian ophthalmia (s. 499) and catarrhal ophthalmia in its severer forms, (s. 447.) Granular conjunctiva presents an appearance something like that of a granulating sore, hence the name, but its nature is altogether different. It consists in hypertrophy of the papillæ with which the palpebral conjunctiva is beset, as above explained, (ss. 310, 311, 493, 494, 495.)

984. The ocular conjunctiva does not become granular as the palpebral conjunctiva does, seeing that it does not possess a papillary structure similar to that which in the palpebral conjunctiva forms the peculiar seat of the granular prominences. Any granular appearance which may be presented by the sclerotic or corneal conjunctiva is owing to real granulations.

985. In consequence of the great tendency which the palpebral conjunctiva has to fall into a granular state in the puro-mucous ophthalmiæ, the surgeon should never allow himself to omit the examination of the state of the palpebral conjunctiva after the subsidence of these diseases, for, although the sclerotic conjunctiva may have become free from redness, the palpebral may still be in the morbid state under notice, (s. 483.)

986. This morbid state of the palpebral conjunctiva may be found even in cases in which the sclerotic conjunctiva has not been involved in the inflammation at all, for as above shown the inflammatory congestion on which the development of granular conjunctiva depends, may never extend beyond the palpebral conjunctiva, and may be so slight as scarcely to have attracted the patient's attention, (s. 496.)

987. Granular conjunctiva is attended by more or less chronic inflammation with increased mucous secretion, and is a source of constant irritation, so that the eye is liable to be affected with an acute attack of ophthalmia from slight causes, (s. 518.)

988. Vascularity, thickening, and opacity of the conjunctiva corneæ often exist along with granular conjunctiva, and have been attributed to the friction exerted by the granular eyelid on the upper part of the sclerotic conjunctiva and on the cornea. This does not, however, appear to be the case, for the morbid state of the cornea is met with in cases in which granular conjunctiva does not exist, and may be absent in cases in which granular conjunctiva is much developed. The morbid condition of the cornea just mentioned is rather the result of the extension of the same inflammation which first gave rise to the granular conjunctiva, though there can be no doubt that the morbid state of the cornea is kept up and aggravated by the friction exerted by that of the palpebral conjunctiva, (s. 525.)

989. Granular conjunctiva is a very intractable disease. Even under the best treatment and most favourable circumstances, the conjunctiva is long of regaining, if it ever regains, its natural state. In the treatment of granular conjunctiva, blue stone and other caustics have been sadly misused. Though by them the granulations may have been removed, the conjunctiva has been too often left in a worse state.

990. *Treatment.*—In the treatment of granular conjunctiva, care and perseverance are required. Carefully conducted diet and regimen, tonics, good air, and protection from changes of weather, are important general points of treatment. The local treatment should consist, 1st, of the application of a leech or

two to the eyelids occasionally to relieve congestion; 2d, counter-irritation, kept up by repeated blisters to the nape of the neck; 3d, scarification of the affected conjunctiva (ss. 147, 148) every second or third day, the scarification being made as above directed, (s. 149,) and immediately thereafter the application to it of some strong salve, such as the red precipitate. If the granulations are large and prominent, instead of simply scarifying them, they may be shaven off with a lancet-shaped knife, or if pedunculated, they may be snipped off one by one with curved scissors. After either operation the salve is to be applied as after the scarification merely. [The sulphate of copper and nitrate of silver, when judiciously applied, are extremely useful local applications. See *Lawrence's Treatise on the Eye*, 2d Am. ed., p. 268, *et seq.*]

Cuticular conjunctiva.

(Conjunctival xeroma or xerophthalmia.)

991. In this disease the structure of the conjunctiva is so changed that the membrane presents more of the characters of skin than mucous membrane; its epithelium, the epithelium of the cornea included, is thickened, dry, and semi-opaque, like epidermis, and it is no longer duly moistened with its natural mucous secretion. Along with this change in structure, there is general contraction of the whole conjunctiva, even to obliteration of the palpebral sinuses.

992. *Subjective symptoms.*—The vision is impaired in proportion to the dimness of the epithelium of the cornea, the eye feels dry, the surface of the conjunctiva is but little sensible, and the movements of the eyeball and eyelids are restricted.

993. *Causes.*—Cuticular conjunctiva is commonly the result of some external ophthalmia, such as catarrhal, scrofulous, scrofulo-catarrhal, or the like, which by neglect or mistreatment has been allowed to fall into a chronic state, and which chronic state has been long kept up by the inappropriate use of irritating applications, or by the irritation of inverted eyelashes. The disease may also arise in consequence of the chronic conjunctivitis kept up by the exposure of the conjunctiva in ectropium.

994. The dryness of the eye in this disease, and even the disease itself, have been supposed to be immediately owing to obliteration of the lachrymal ducts; but such a condition is rather assumed than unequivocally established by direct observation; and though there may sometimes be suspension of the lachrymal discharge, this is not always so, for in some cases the patients

have been found to shed tears. It is not, however, the tears which constitute the ordinary means of moistening the eye, but the conjunctival secretion. The suppression of this, therefore, is the cause of the dryness, and the cause of the suppression is the alteration in structure of the conjunctiva above described. See *lachrymal xeroma*, under the head of diseases of the lachrymal organs.

995. *Prognosis and treatment.*—Cuticular conjunctiva having been found incapable of radical cure, the treatment can only be palliative; and this, it is obvious, must consist in the occasional application to the eye of some tepid mucilaginous eye-water.

Onyx and abscess of the cornea.

996. The nature of onyx and abseess of the cornea has been above described, (ss. 335 et seq.,) and their occurrence in various ophthalmiæ referred to when considering the latter. All that requires to be said here on the subject is, that in the treatment no direct interference with the onyx or abscess is in general admissible. The only indication is to subdue the inflammation which has given rise to it as quickly as possible, and then nature will do what can be done for the removal of it.

Ulcers of the cornea.

997. Ulceration of the cornea has been above described, (ss. 348 et seq.,) and its occurrence and characters in the various ophthalmiæ considered. It may be here farther remarked that destructive ulceration of the cornea, without much or any appearance of inflammation of the eye, is sometimes observed in cases of great exhaustion of the system from whatever cause, and also in cases of disease of the fifth pair.

998. The *treatment* comes under the head of that of the ophthalmia which has given rise to the ulceration of the cornea; but such details as the following may be mentioned here:—1. As chronic superficial spreading ulceration of the cornea is frequently accompanied by a granulated state of the palpebral conjunctiva, this source of irritation requires to be particularly looked to. 2. When a deep ulcer is threatening to penetrate, the evacuation of the aqueous humour often proves of great service by taking off the strain from the ulcerated part, and the inflammatory action usually receiving at the same time a momentary check, the conditions are favourable for the operation of remedies and the establishment of granulation. 3. When an ulcer of the cornea near the centre threatens to penetrate, it is advisable to keep the pupil constantly under the influence of

belladonna, in order that, should perforation and consequent escape of the aqueous humour take place, prolapse of the iris may not follow.

999. Sometimes the whole surface of an ulcer of the cornea is found covered with a matter resembling (to use the comparison of Mr. Wardrop) wet chalk. This appearance is attributed by Dr. Jacob to a precipitate from the acetate of lead solution so frequently employed as an eyewater. Beer had frequently remarked that the use of lead lotions rendered the cornea opaque. Any part of the conjunctiva, if abraded, may be the seat of the deposit, but attention is most usually drawn to it when on the cornea. The white deposit is apt to become fixed in the cicatrice, which is then dense and indelible. Dr. Jacob* says that the opacity appears to be produced at once by a single application. He has seen it the day after a drop of solution of acetate of lead had been put into the eye by mistake. A white deposit does not take place in all cases in which the acetate is used; but Dr. Jacob says that he does not think he can state positively the precise condition of the ulcer which causes it.

1000. Dr. Mackenzie recommends a cautious attempt to be made to remove, with a small silver spatula, the white deposit from the surface of the ulcer; and he tells us that in one case he succeeded in separating a scale of lead which had been deposited on the cornea.†

Suffusion, opacities, and specks of the cornea.

1001. *Suffusion of the cornea from distension.*—A certain degree of tension is a necessary condition for the transparency and brilliancy of the cornea, as may be inferred from the dull appearance which the eye presents when the tone of the whole body is reduced by debilitating disease. Increased tension within certain limits adds to the brilliancy of the eye, as is seen in states of mental excitement, but beyond these limits of tension, the cornea becomes suffused. This takes place more or less in all inflammations of the eye, in consequence either of increased distension from within, or pressure from without.

1002. That dimness or brilliancy of the cornea, in the degree referred to, is dependent on its state of tension, is well

* Dublin Hospital Reports, vol. v. p. 370.

† Mr. Tyrrell describes a particular disease of the cornea under the name of "Inflammation of the Cornea with deposition of earthy matter," and this he thinks is the same as the alleged accidental deposition on ulcers of the cornea, from lead lotions, above described. Without denying that an insoluble precipitate may adhere to an ulcerated surface, Mr. Tyrrell considers that in all cases which have come under his notice, the deposition had not this origin.

illustrated by what may be demonstrated in the eye of an animal recently slaughtered. Thus, if a sheep's eye be removed from the orbit, and slightly compressed by grasping it in the hand, the cornea, which was before relaxed and dull, becomes distended and clear; but if the eye be more tightly grasped, the cornea is rendered more tense, but at the same time is suffused with a milky opacity. This, however, disappears on relaxing the pressure.

1003. Opacity of the cornea is a frequent consequence of inflammation, and is owing either to interstitial deposition, or to the cicatrization of an ulcer. The opacity occurs in various degrees of density, extent, and permanency, from a mere speck, which tends ultimately to disappear, to a dense and indelible opacity, involving, perhaps, the whole centre of the cornea, and concealing the pupil.

1004.—*Opacity from interstitial deposition — Nebula— Albugo.*—The speck called *nebula* is semi-transparent, and so shaded off at its circumference, that it presents no precise limits. An *albugo* is also shaded off at its circumference, but its centre is densely opaque, and slightly elevated; both of which characters are owing to the larger quantity of exuded lymph than in the simple nebula. A nebula is usually the result of diffused, but slight exudation; albugo, again, is the result of circumscribed, but more copious exudation, giving rise to a phlyctenula or pustule, but which phlyctenula or pustule has receded without being matured.

1005. Sometimes one or more vessels are seen running into an albugo, and very generally there may be observed, both in cases of albugo and of opaque cicatrice, nebulous streaks extending towards them from the circumference of the cornea, indicating where vessels had run.

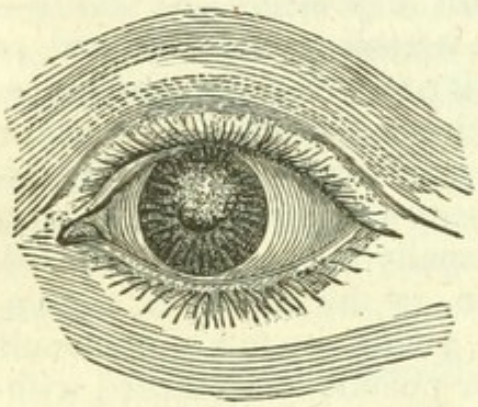
1006. *Treatment of opacity from interstitial deposition.*—In proportion as the inflammation subsides, the opacity diminishes; therefore no special remedy is required for the opacity in the first place, and in the second, it is proper to wait and see what the natural absorbent powers of the part can effect, which, especially in young persons, is often a great deal. If the opacity continues, and if it is so situated as to disturb vision, then we may try what local applications, counter-irritation, and especially tonics and change of air will do. The local applications which have been found most useful, are the drops of the bichloride of mercury with vinum opii, (s. 128,) and the red precipitate salve, (s. 136.)

1007. *Opacity from a cicatrix—Leucoma.*—According as the ulcer of the cornea has involved merely the conjunctival layer, or both this and the proper substance, so is the cicatrice semi-transparent or perfectly white. The circumference of an opacity from a cicatrice, is usually more defined than that of opacity from simple deposition.

1008. Though after the healing of some ulcers of the cornea, no opacity takes place, still, when the cicatrice of an ulcer is opaque, it is indelibly so, unless the ulcer has been a mere abrasion of the conjunctiva corneæ.

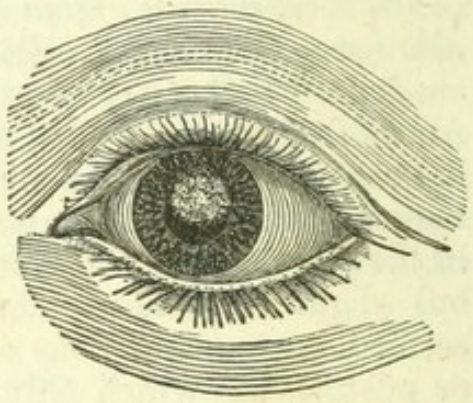
1009. When an indelible opacity lies over the pupil, dilatation of this, kept up by the habitual use of a solution of extract of belladonna or of the sulphate of atropia (s. 128) dropped into the eye is a very valuable resource. Figures 6 and 7.

Fig. 6.



Central opacity of the cornea concealing the pupil.

Fig. 7.



The same eye with the pupil dilated by belladonna.

1010. In cases in which the opacity occupies too much of the centre of the cornea for the dilatation of the pupil to be of any use, recourse must be had to an operation, so as either to prolapse a portion of the iris through a small incision at the margin of the cornea, and thus to draw the pupil opposite the clear part, (Himly's operation of *dislocation of the pupil*,) or to cut out a piece of the iris opposite the clear part of the cornea (*artificial pupil by excision*).

1011. *Dimness of the inner surface of the cornea.*—The membrane of Descemet, when inflamed, is the seat of more or less milky suffusion, interspersed with numerous small opaque dots of an altogether peculiar appearance. When the membrane of Descemet, Dr. Jacob informs us, has been touched by the point of the needle in breaking up a cataract, an opacity is produced, closely resembling capsular cataract. I once ob-

served a uniform but very slight suffusion of the membrane of Descemet produced in a woman, from whose eye I extracted a lenticular cataract, in consequence of her having, after the upper section of the cornea, suddenly turned up the eye, in which movement the flap, being caught by the upper eyelid, was folded down, and the membrane of Descemet consequently grazed by the edge of the lid. Notwithstanding that this occurred twice during the operation, recovery, without any other untoward circumstance than the slight suffusion of the membrane of Descemet above mentioned, rapidly took place.

Vascular cornea and pannus.

1012. Vascularity and more or less opacity and thickening of the conjunctival layer of the cornea is a not unfrequent appearance in chronic conjunctivitis. In a slight degree it is named *vascular cornea;* but when the vascularity and thickening of the conjunctiva corneæ are so great that the cornea appears as if covered with a bit of red cloth, the state is named *pannus*.

1013. Though not always excited by a granular state of the palpebral conjunctiva, vascular cornea or pannus is kept up and aggravated by this morbid condition which, as above mentioned, (s. 988,) has resulted from the same inflammation which first gave rise to the vascularity of the cornea. The continued irritation from inverted eyelashes is also a very common cause of vascular cornea and pannus.

1014. *Treatment.*—The source of irritation being removed, the vascularity of the cornea sometimes subsides of itself, or with the assistance of local applications, such as the strong red precipitate or nitrate of silver ointment, (s. 136,) counter-irritation, and tonics, or good diet and change of air. Often, however, it persists, in spite of treatment, or, having been removed, readily returns.

1015. A peculiar plan of treating the pannus left by Egyptian ophthalmia, suggested about thirty-five years ago by Dr. Henry Walker,* and which, in many cases, has succeeded in the hands of Professor Jaeger of Vienna, Dr. Piringer of Gratz, and others, is to excite in the eye a new attack of the ophthalmia by means of inoculation, (s. 515,) and then to endeavour, by carefully-conducted treatment, to bring the inflammation to a favourable termination. This, it is obvious, is a hit or miss proceeding, even if we could always calculate on the cornea becoming clear in the cases in which we might succeed in saving the eye from total destruction.

* Edin. Med. and Surg. Journal, 1811.

Hernia of the cornea (keratocele).

1016. This has been above described, (ss. 351, 352, 353, 354.)

Prolapsus iridis.

1017. This has been above described under the head of "Effects of penetration of the cornea," (ss. 362, 363.)

1018. The treatment of prolapsus iridis from penetrating wound of the cornea is considered under the head of *wounds of the cornea.* When prolapsus iridis occurs in consequence of the cornea being penetrated by ulceration, there is much less likelihood of restoring the iris to its place than when it occurs in consequence of a penetrating wound of the cornea. Much may, however, be done to prevent prolapse of the iris, by keeping the pupil under the influence of belladonna, when an ulcer near the centre of the cornea is threatening to penetrate.

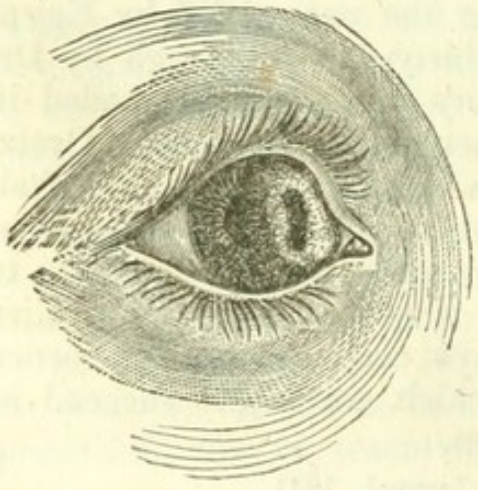
1019. When, in consequence of penetrating ulcer of the cornea, prolapse of the iris has taken place, there should in general be no direct interference with the prolapsed iris. The attention ought rather to be directed to the removal of the inflammation, of which the prolapse of the iris is the remote consequence, in order to promote the result above described, (s. 363.)

Staphyloma of the cornea and iris.

1020. An opacity, and unnatural prominence of a part or of the whole of the cornea of a grayish-white, or mother of pearl colour:—Such is the definition which a first view would suggest of *partial* or *total spherical staphyloma* of the cornea and iris; that it is not quite accurate, however, will be shown when the nature of the morbid change comes under consideration.

Partial staphyloma.

Fig. 8.



1021.—*Objective characters.*—The opaque prominence is usually situated about the lower or lateral part of the cornea, and may vary in extent from a quarter to a full half of the area of that membrane. On close examination, the iris is seen drawn towards and joined to the whole inner surface of the opaque projection. The anterior chamber is in consequence much contracted. According to the situa-

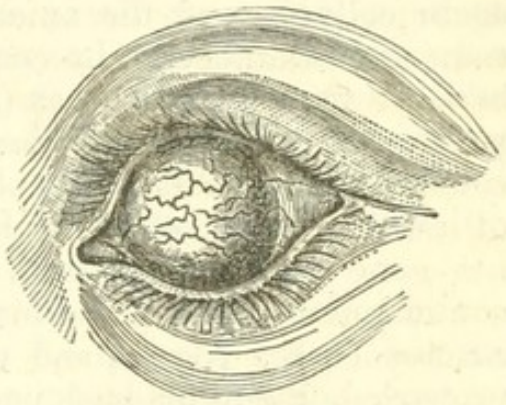
tion and extent of the staphyloma, so is the pupil more or less involved; and that either by direct incorporation of the pupillary margin of the iris, or by opacity extending to the part of the cornea over the pupil.

1022. *Subjective symptoms.*—Vision is impaired in proportion to the degree in which the pupil is involved in the manner just stated. Besides this, the prominence being on the one hand exposed to the desiccant and irritating action of the air, &c., and on the other, acting as a foreign body, frequent nictitation is excited, which frets both the staphyloma and eyelids;—whence the weak state of the eye and frequent attacks of inflammation.

Total spherical staphyloma.

1023. *Objective characters.*—In this case there is no longer any remains of transparent cornea; but its place is occupied by the opaque structure, which forms a prominence so large as to stretch and press out the eyelids, or even to project considerably from between them.

Fig. 9.



1024. *Subjective symptoms.*—Vision is totally gone; but a perception of light and shade, &c., remains.

1025. *Course.*—The staphyloma may remain stationary, but sometimes it goes on increasing in size till it bursts. This is attended with very severe symptoms, such as distension in the eye, and circumorbital pain, preventing sleep, and exhausting the patient. On the bursting of the eye, these symptoms immediately subside, and if, together with aqueous humour, the lens and part of the vitreous humour have escaped, the eye does not again become distended, but contracts into a stump, marked with depressions at the places corresponding to the insertion of the straight muscles. If all the vitreous humour has escaped, the membranes shrink back in the orbit, and form a small shapeless mass at its bottom. If the aqueous humour only escapes, the staphyloma sinks for a day or two, but soon returns to its former state, when by the closure of the laceration, the aqueous humour is allowed to reaccumulate.

1026. *Pathology.*—In consequence of inflammation, the

structure of the cornea is changed, the iris adheres to it surface to surface, and the two together are distended into a more or less extensive opaque prominence. Such, in a few words, was the commonly received opinion regarding the formation of staphyloma of the cornea and iris up to the time I enunciated a different view of the matter.

1027. If in scrofulous, catarrhal, or catarrho-rheumatic ophthalmia, there be a penetrating ulcer of the cornea, the aqueous humour, as has been already mentioned, escapes, the iris falls forward into contact with the cornea, and a small part of it is perhaps prolapsed through the ulcerated opening. The progress of the ulceration being stopped by the yielding of the inflammation, the prolapsed portion of the iris, and the ulcerated part of the cornea are involved in one cicatrice. The opening in the cornea being thus closed, the aqueous humour again collects, and the anterior chamber is restored; though somewhat diminished, in consequence of the partial adhesion between the iris and cornea (*synechia anterior*). There is no prominent distension on the front of the eye in this case, because, as the inflammation subsides, the small protruded portion of iris shrinks and flattens; but if the destruction of the cornea has gone on farther, either by extension of ulceration from a continuance of the inflammation, or by the giving way of an abscess of the cornea, and considerably more of the iris has protruded, the prolapsed portion of the iris does not shrink when the inflammation begins to abate, as in the former case, but remains, and forms a projection at the part of the cornea implicated, which is generally the lower or lateral. This projection is at first merely a bag of the iris distended by the aqueous humour, and is called *staphyloma iridis;* but, by and by, its exposed surface becomes covered by an opaque firm tissue, of the nature of the *tissue of cicatrice*, and this tissue is incorporated at the base of the tumour with the sound cornea. The projection, the mode of origin of which I have just described, is a *partial staphyloma;* it is not a distension of the cornea itself, but a protruded portion of the iris covered by a *new tissue*, intended to supply the loss of substance which the cornea has sustained. The mode of origin of a *total staphyloma* is essentially the same, but differs only in degree. The whole or greater part of the cornea being destroyed, as occurs in gonorrhœal, purulent, and very often in variolous ophthalmia, as also in that of new-born infants, the whole iris falls forward, the pupil becomes closed, and the aqueous humour, being thus allowed to accumulate in the posterior chamber, the iris is kept

distended in the form of a tumour on the front of the eye. Its surface gradually gets covered with an opaque cicatrice-like tissue, or pseudo-cornea, which assumes a greater or less degree of thickness, and a total staphyloma is the result. Sometimes the central part only of the cornea is destroyed, a ring of the circumference still remaining; the staphylomatous projection has then the form of a small globe stuck on the front of a larger, but if disease has extended to the ciliary body, the whole front of the eye is prominent like a blunt cone.

1028. The pseudo-cornea, both in partial and in spherical staphyloma, is more or less pervaded by dark-coloured varicose vessels.

1029. A circumstance in the pathological anatomy of staphyloma worthy of being noticed is, that when the tumour attains a large size, the iris, unable to expand to the same degree as the pseudo-cornea, and its texture much more frail, separates from the choroid and becomes torn into shreds; so that when we examine the internal surface of such a staphyloma, after death, or after it has been removed by operation, we find the iris, which adheres to the pseudo-cornea, broken and reticulated; whereas the internal surface of a staphyloma, which has not reached a great size, exhibits the iris still entire.*

1030. That the cornea and iris do not unite surface to surface, to form a staphyloma, may be inferred from what has been said above; but the following considerations, above merely glanced at, (ss. 278, 372,) show that such a union is not prone to take place under any circumstances.

1031. In penetrating ulcer of the cornea, and prolapsus iridis, of course the prolapsed part of the iris adheres to the cornea at the one point. But though the two membranes have come into contact in the whole extent of their surfaces, in consequence of the escape of the aqueous humour through the opening in the cornea, made by the penetrating ulcer; and though, in consequence of the attending inflammation, the circumstances favourable for adhesion exist, still the iris does not adhere to the cornea, surface to surface, as the pleura pulmonalis does to the pleura costalis. On the contrary, as soon as the ulcerated opening in the cornea closes, so that the aqueous humour is allowed to accumulate, the iris recedes from the cornea, and the anterior chamber is re-established. The only adhesion between the iris and cornea is at the one point where the prolapsus iridis took place. Again, cases of penetrating ulcer of the cornea occur, in which the

* Beer's Ansicht der staphylomatösen Metamorphosen des Auges. Wien, 1805. Mackenzie's Practical Treatise, 3d edition, pp. 572-3. London, 1840.

aqueous humour having escaped, and the iris come into contact with the cornea, but no prolapse of the former having taken place, no adhesion at all between the two ensues, but the iris recedes from the cornea as soon as the opening in the latter from the ulcer closes, and prevents the farther escape of aqueous humour. One would suppose that if adhesion between the anterior surface of the iris and inner surface of the cornea were a thing prone to take place, that it would have been observed in those cases of inflammation of the membrane of the aqueous humour in which the operation for evacuating the latter has been performed; but I apprehend no one ever saw such a result. In the operation for the extraction of the lens in cataract, the aqueous humour having escaped, the iris comes into contact with the cornea, and continues so for a considerable period; but if there be no prolapsus iridis, adhesion never takes place. If the iris does not adhere to the cornea when these two parts come into contact, from the escape of the aqueous humour, and while in a state of inflammation, much less do they adhere, independently of the removal of that fluid.

1032. But it may be said, it is not in consequence of such inflammations of the eye that staphyloma occurs, but that purulent, gonorrhœal, and variolous ophthalmia are the most frequent causes of staphyloma. True; but under what conditions does staphyloma occur in those diseases? Not by adhesion of the iris to the cornea, surface to surface, but only when the cornea has been more or less extensively destroyed. Now purulent, gonorrhœal, and variolous ophthalmiæ are the very diseases in which, as is well known, this takes place.

1033. This view of the pathology of staphyloma has been objected to by some, but none of the objections which have been made appear to me to be of much weight. See, for example, Mr. Lawrence's objections in the second edition of his treatise on the Diseases of the Eye, and my answer to them in a note to the Article Cornea, in the Cyclopædia of Surgery, vol. i., pp. 842, et seq. There is no doubt that morbid states of the eye occur having much of the external appearances of staphyloma, and which have been developed, not as above described, but by the cornea, previously the seat of a small penetrating ulcer, perhaps, becoming opaque, enlarged, and prominent. I would, however, ask, is the iris adherent to the cornea, surface to surface, in such cases? Are these cases not rather examples of disease of the ciliary body, and anterior hydrophthalmia, with opacity of the cornea, than examples of true staphyloma? A combination of such a state with staphy-

loma, properly so called, is above referred to at the end of s. 1027.

1034. *Diagnosis of partial staphyloma.*—Conical cornea can scarcely be confounded with partial staphyloma, but a form of hernia corneæ resembles it in being prominent, but differs from it in not being so opaque, and in not having the iris adhering to it, (s. 353.) An albugo is opaque, but not so prominent as a partial staphyloma, and, as in the preceding instance, free of any adhesion with the iris. A leucoma is opaque, and may be combined with synechia anterior, but the adhesion of the iris is comparatively of small extent, and the prominence of staphyloma is wanting.

1035. *Prognosis and treatment.*—If the staphyloma be small and do not implicate the pupil much, the less that is done by way of treatment the better, but irritation is to be guarded against, and any tendency to inflammation kept down by occasionally dropping in a solution of nitrate of silver or diluted vinum opii. In a case in which the opposite eye is injured and vision lost, if the staphyloma implicate the pupil, it will be proper to attempt to diminish its projection in order to pave the way for an artificial pupil.

1036. The *treatment* which has been adopted with this view, consists in repeatedly touching the staphyloma with some caustic, such as chloride of antimony, nitrate of silver, or caustic potash, in order, by a slow inflammatory process, to produce condensation and contraction of it. The eschar of one cauterization should be allowed to fall off, and the other effects to subside before a repetition of the caustic. The best plan is, to commence touching the base of the staphyloma at points all round, and then gradually proceeding towards the apex. The above described treatment is assisted in effecting the consolidation and flattening of the pseudo-cornea by frequently evacuating the aqueous humour.

1037. Mr. Tyrrell says he has succeeded, in several instances, in effecting a reduction of partial staphyloma, by the careful application of nitrate of silver, or hydrate of potash, in substance. He applies the escharotic first at the base of the projection, taking care not to injure the remaining sound cornea: the effect has been the separation of a small slough; but previous to such separation, a deposit of lymph has taken place beneath, by which the deeper part has become more solid and strengthened. After the part has recovered from one application, he makes a second close to, but not upon the same spot,

and nearer to the summit of the projection. Again and again he repeats this operation, acting upon the more prominent part, until a considerable or perfect reduction of the staphyloma has been accomplished; and this has enabled him, in a few cases, to form an artificial pupil, of much more utility to the patient. He prefers the hydrate of potash, unless the projection be very small; for its use is followed by a much larger deposit of lymph than results from the nitrate of silver.*

1038. *Prognosis and treatment of total staphyloma.*—When an inflammation of the eye has run so disastrous a course, that the conditions for the formation of a total staphyloma are laid, any treatment which may be adopted can have for its object, not to save the eye as an organ of vision, but to prevent it from degenerating into a tumour, which not only causes great deformity, but is a source of considerable irritation even to the opposite eye, so much so, that the patient seeks for its removal by operation, sooner or later.

1039. *Prophylactic treatment.*—According to the account of the mode of formation of total staphyloma above given, it appears that the supply of aqueous humour in the still-existing posterior chamber, is what keeps up the distension of the iris, so that the pseudo-cornea which is moulded on its surface, presents the form of a round prominence on the front of the eye. If this be the case, the destruction of the source of the aqueous humour, by breaking in upon the integrity of the posterior chamber, is a means which offers itself, to prevent the development of the staphylomatous projection. The simplest plan of effecting this appearing to me to be the extraction of the lens, I put the operation in practice in the following case:

1040. A man, about twenty-two years old, came to me labouring under the effects of severe purulent ophthalmia of both eyes. In the right eye, the cornea being destroyed and the pupil closed, the iris protruded and was distended with aqueous humour. The left eye had also suffered very much; there were penetrating ulcer, prolapsus iridis, and consequently considerable distortion and contraction of the pupil. Both eyes were still affected with the inflammation, and it was very doubtful whether the left eye could be prevented from getting worse, especially as it was evidently kept in a state of additional irritation from the presence of the staphyloma in the right. By an

* A practical work on the Diseases of the Eye, &c., vol. i., p. 273. London, 1840.

incision with a Beer's cataract-knife through the protruding and distended iris, the lens was extracted. Severe reaction followed; less perhaps in consequence of the operation, than from the patient not being in a situation to take proper care of himself. The iris did not again become distended; on the contrary, the eye shrank, and irritation being thus removed, the left eye progressively recovered, as far as the organic changes it had already undergone allowed, and further than there had been reason to hope for, as sufficient vision was preserved to enable the patient to resume his employment as a porter.

1041. In those cases in which the eye is destroyed, whether in adults or new-born infants, by purulent ophthalmia, variolous ophthalmia, &c., and in which staphyloma does not result, but the cicatrice which forms in the place of the cornea is flat and the eyeball becomes atrophic, I suspect the lens has escaped on the giving way of the cornea.

1042. A fully-formed total spherical staphyloma is a source of great deformity: its removal therefore is often sought for in order that an artificial eye may be worn. But what principally demands its removal, sooner or later, is the irritation which it keeps up, and which is apt to be communicated to the opposite eye.

1043. *Operation for the removal of fully-formed total spherical staphyloma.*—Compression, ligature, seton, caustics, incision, variously modified or combined, have been recommended as a means of repressing staphyloma; but it is now agreed that the only proceeding to be depended on for the removal of the tumour, is its total excision. The excision of a piece of the size of a lentil, one of the methods recommended by Celsus, was adopted by Scarpa, under the impression that it was less liable to be followed by severe reaction than the removal of the whole. It has, however, been found that the latter is rarely followed by any serious accident, while the former does not always effect the desired object.

1044. The patient is seated on a chair opposite a window, and leans his head on the breast of an assistant who stands behind, and who also supports the chin with the palm of one hand, whilst with the fingers he depresses the lower eyelid. With the fingers of the other hand he raises the upper eyelid. The surgeon then in order to obtain command of the eyeball, passes a large hook through the staphyloma, or a strong thread by means of a curved needle, and proceeds in the following manner:

1045. With the staphyloma-knife, Fig. 10, its edge directed upwards, he transfixes the tumour at its base, from the temporal to the nasal side, and somewhat below its transverse diameter. Pushing the knife on, it cuts itself out, and a flap is formed, as in the operation for extracting the cataract. The flap thus made is seized with a hooked forceps, and the remaining part of the base of the staphyloma divided with a curved scissors, and the whole removed.

Fig. 10.

1046. After the operation, the eyelids of both eyes are to be kept closed by strips of court-plaster, and covered with a light compress and roller.

1047. Under ordinary circumstances, the wound is found, at the end of a week, closed by a semi-transparent membrane, which by and by becomes dense and opaque, forming a flat cicatrice, marked with bluish or brownish streaks. Sometimes a fungus grows from the wound, which, however, readily subsides after being occasionally touched with lunar caustic. Considerable pain attends the operation for staphyloma, and there is usually more or less hemorrhage at the time. It also occasionally happens that, some hours after, the eyeball becomes distended with blood, and the clots, or infiltrated vitreous body, protrude from the wound. The bloody, dark-coloured mass is to be cut away with scissors, and the eye covered with a compress soaked in cold water.

1048. If severe reaction follows the operation, antiphlogistics, anodynes, and warm fomentations, &c., will be required.

1049. Though the lens and even some of the vitreous humour escape, the remains of the eye form a good stump for the application of an artificial eye; the lens often escapes, and it appears to me it might always be removed with advantage. After the loss of much or all of the vitreous humour, the eyeball contracts to a very small size, and does not afford a proper support for an artificial eye.

Conical staphyloma corneæ.

1050. This is a rare affection; I have seen but one case agreeing with the descriptions given of it. It was in

the left eye of a scrofulous girl, whose right eye was the seat of a very large partial staphyloma.

1051. In the eye affected with the conical staphyloma vision was quite gone. The cornea was enlarged at its circumference, and projected in the form of a pretty regular cone. The sclerotica was distended at its junction with the cornea, and partook of the conical transformation, so that the posterior half of the eyeball formed the basis of the cone of which the apex occupied the middle of the cornea. The eyeball was hard to the touch. At their junction the sclerotica and cornea were of a dark bluish colour. At the apex of the cone the cornea was grayish white, and in the intermediate part it was brownish red, but still retaining some traces of its former transparency, though not sufficient to allow of the state of the interior of the eyeball being ascertained. The eye had a dirty appearance, and its front was pervaded by varicose vessels.

1052. *Diagnosis and pathology.*—Conical is quite different from spherical staphyloma corneæ, not only in shape but also in nature. In conical staphyloma, it is really the cornea that is degenerated and projected into a conical form. It is to be remarked, however, that this morbid change in the cornea is merely a part of a disease, involving not only the anterior half of the eyeball, but also the posterior half; whereas in spherical staphyloma the latter is ordinarily sound. The morbid anatomy of conical staphyloma is not yet well determined.

1053. *Cause.*—Conical staphyloma is the result of a slow inflammation of the whole eye in an unhealthy constitution.

1054. *Prognosis and treatment.*—Conical staphyloma has not the same tendency to enlarge as spherical staphyloma. The disease is for the most part better let alone than interfered with.

Hypopyon.

(Oculus purulentus.)

1055. This name has been given to a collection of pus or puriform matter occupying the bottom of the anterior chamber. When the matter accumulates in larger quantity, it rises to a level with the pupil, and flows through it into the posterior chamber. It is to be observed, however, that matter may be primarily effused in the posterior chamber. The matter still accumulating may come to fill both aqueous chambers.

1056. In a small hypopyon, the collection of matter in the anterior chamber necessarily takes a shape somewhat resem-

bling that of *onyx*, (s. 336,) but the two kinds of cases are distinguishable from each other by the circumstances: that on turning the patient's head to one or other side, the matter of onyx does not change its place, whereas that of hypopyon does, unless, as is sometimes the case, it is thick and glutinous; and that on looking at the cornea in profile, the deposition in onyx appears nearer the surface than that in hypopyon. Both onyx and hypopyon may exist at the same time.

1057. An accumulation of matter in the posterior chamber cannot be seen.

1058. When the aqueous chambers are completely filled with matter, the appearance is to be distinguished from that which is presented when the whole cornea is infiltrated with matter; but at the same time that the aqueous chambers are filled with matter, the cornea may be infiltrated also.

1059. *Source of the matter in hypopyon.*—This is different in different cases. The matter may, as would appear from all the circumstances of the case, be poured out from the unbroken surfaces of the walls of the aqueous chambers in the same way that matter is poured out by inflamed mucous and serous membranes; or, it may result from the bursting of an abscess of the iris, (s. 376;) or from the bursting inwards of an abscess of the cornea, (s. 354.) An hypopyon formed in either of the last two ways has been named false, (*hypopyon spurium*,) in contradistinction to hypopyon formed in the first way, and which is named true, (*hypopyon verum*.)

1060. Seeing thus that the source of accumulated matter in the anterior chamber may be different, it will be at once perceived that hypopyon may be the consequence of various forms of ophthalmic inflammation, external and internal.

1061. *Treatment.*—As the inflammation in which hypopyon has originated is still going on, the first indication is to subdue it as quickly as possible, and then the accumulated matter will in general soon disappear.

1062. When the accumulation of matter is very considerable, and there is great distension of the eyeball, occasioning severe pain and keeping up the inflammation, it may be advisable to have recourse to paracentesis corneæ, but instead of being performed as above directed, (s. 176,) the operation should, in this case, consist in a section of the lower part of the cornea with a cataract knife, to the extent of one-fourth or one-third of its circumference.

Dropsy of the aqueous chambers.

(Hydrophthalmia anterior.)

1063. It has been already explained, (ss. 669, 691,) how an increase in the prominence and diameter of the cornea may take place in corneitis, in consequence of the softening of the texture of the cornea, on the one hand, and distension, by increased accumulation of aqueous humour, on the other. This constitutes one form of dropsy of the aqueous chambers—the form which belongs to this section.*

1064. The prominent cornea in dropsy of the aqueous chambers, is distinguished from conical cornea by its spheroidal curve. See *Conical cornea.*

1065. *Treatment.*—Repeated evacuation of the aqueous humour, friction with mercurial or iodine ointment round the eye, blisters behind the ears, change of air, tonics, &c., may be tried, but it must be confessed that, in consequence of the diminished elasticity and resistance of the cornea, it cannot regain its normal degree of prominence, and thus limit the increased exudation of aqueous humour.

Synechia.

1066. Synechia is a morbid adhesion of the iris—generally its pupillary margin—to the cornea or to the anterior capsule of the lens. In the former case it is named *synechia anterior*—in the latter, *synechia posterior;* and according as it is a part or the whole of the pupillary margin of the iris which is involved in the adhesion, the synechia is named *partial* or *total.* The principal points regarding the nature of synechia have been above explained, (ss. 87, 88, 275, 276, 277, 278, 363, 368, 372.)

1067. *Treatment.*—*Synechia anterior* may be so partial, and the transparency of the cornea so unimpaired, except at the point of adhesion, that vision is not disturbed; nothing, therefore, is required to be done. If the cornea be opaque to some extent opposite the somewhat contracted and distorted pupil, dilatation of the latter by means of the habitual use of belladonna or atropia, will, in many cases, be found of the same service as in simple central opacity of the cornea, as above mentioned, (s. 1009.) When, from the smallness of the pupil, and extent of the opacity of the cornea, belladonna does not yield this service, or when the synechia is total, the only prospect of restoring vision is by an operation for artificial

* Dropsy of the eye, independent of inflammation, or at least independent of evident inflammation, is treated of in the next chapter.

pupil; but this of course will be undertaken only if the opposite eye is also blind. See *Artificial pupil.*

1068. As the iritis in which *synechia posterior* has had its origin subsides, we see, under the use of belladonna, one band of adhesion after another give way, and the pupil become free, but very often, on close examination, small brownish specks are seen on the capsule of the lens, indicating the points where the adhesion of the iris to it had been. Vision, however, may not be much disturbed by these specks, even when some of the adhesions remain. But when the adhesion of the pupillary margin is extensive, there is also more or less contraction of the pupil, and extensive deposition of lymph on the capsule of the lens, the consequence of which is, that vision is impaired to a greater or less degree, even if the same inflammation which has given rise to the synechia has not also involved and injured the retina. This state of matters may be sometimes palliated by the habitual use of belladonna. And in course of time it may happen that detachment of some portion of the adhesion takes place, and greater dilatation of the pupil allowed, with corresponding improvement in vision.

Closure of the pupil.

(Atresia iridis—Synizesis.)

1069. Closure of the pupil is generally the consequence of iritis, (ss. 368–9–70,) but it may also result from prolapse of the iris, in consequence, for example, of central penetrating ulcer of the cornea. In the former case, closure of the pupil is complicated with total synechia posterior; in the latter, with total synechia anterior.

1070. *Treatment.*—See *Artificial pupil.*

Iridauxesis.

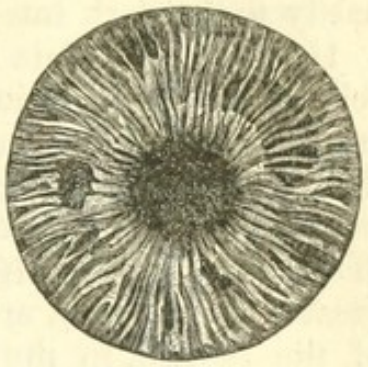
(Staphyloma iridis—Staphyloma uveæ—Iridoncosis—Lymphoncus iridis—Exudation of lymph into the tissue of the iris.)

1071. This and the various other names mentioned above have been given to a peculiar morbid change in the structure of the iris, sometimes occurring in consequence of parenchymatous inflammation.

1072. *Objective characters.*—On the surface of the iris there are elevated spots of a greater or less size, with dark sharply-defined margins. At first they are whitish or whitish-yellow and less elevated, but in general become dark and more elevated, bluish, blackish, even jet black. The iris thus looks as if

it were perforated at the place, or as if its proper substance were gone, and the uvea appeared or even protruded through. The proper substance of the iris which remains evident is changed in colour and presents a remarkable fibrous appearance. Fig. 11.

Fig. 11.



From Klemmer.

1073. The pupillary margin of the iris is generally retracted and adherent to the capsule of the lens, and the pupil more or less obstructed with lymph.

1074. *Pathology.*—This change in the iris was supposed by Jaeger, who first called attention to it, to consist in an attenuation of the substance of the iris in the situation of the dark spots, with adhesion of the uvea, and a bolstering forward of it. But from the observations of Klemmer and others, it would rather appear to consist in a thickening of the iris from exudation of lymph into its substance. In this lymph new vessels are developed, and deposition of pigment subsequently takes place producing the dark spots.

1075. *Cause.*—The morbid state of the iris is a consequence of chronic, neglected, or ill-treated parenchymatous inflammation of the iris; but in addition to this, there has usually been inflammation of the posterior tunics, as manifested by attenuation of the sclerotica, varicosity of the vessels of the white of the eye, and hardness of the eyeball. Hence vision is very greatly impaired, if not wholly extinguished, even although the pupil may not be much obstructed.

Sclerotic staphyloma.

(Cirsophthalmia—Varicositas oculi.)

1076. Sclerotic staphyloma consists, as above stated, (ss. 327, 877,) in a softening, attenuation, and bulging out of some part of the sclerotica, which is at the same time of a bluish-black tint.

1077. The bulging out of the softened and attenuated sclerotica is owing to a collection of fluid, either between the sclerotica and choroid, (*subsclerotic dropsy,*) or, the sclerotica and choroid being adherent, between them on the one hand, and the retina on the other, (*sub-choroid dropsy,*) or within the retina in the seat of the vitreous humour, (*dropsy of the vitreous humour;*) whilst the bluish-black tint is owing partly to the depo-

sition of pigment in the substance of the bulging sclerotica, and partly to the dark interior of the eye shining through.

1078. Staphyloma of this sort may involve any part of the sclerotica, the posterior or lateral as well as the anterior; but it is of course only when the anterior part is affected that the disease is recognizable during life.

1079. When sclerotic staphyloma affects the anterior part of the eye, the bluish-black prominence or prominences, of a greater or less size, are generally adjacent to one or other side of the cornea, in the region of the ciliary body—more commonly the upper and temporal side—or even all round. The white of the eye is at the same time pervaded by varicose vessels.

1080. The same inflammation (viz., posterior internal ophthalmia, in which the choroid is especially affected), which has given origin to sclerotic staphyloma, has usually at the same time occasioned other morbid changes in the eye.

1081. In sclerotic staphyloma, vision is generally nearly or altogether extinct.

1082. By increasing accumulation of fluid, the staphylomatous projections may go on to increase in size so that the eyeball comes to protrude from between the eyelids, and there is at the same time great pain from distension. At last the eye may burst and evacuation of the fluid take place, in which case it may either remain shrunk, or the opening closing, it may become again distended.

1083. *Treatment.*—The restoration of vision is out of the question. Treatment of the staphyloma, therefore, is only called for to relieve the pain arising from distension of the eyeball by the accumulation of fluid, and to reduce the size of the prominence if very great.

1084. Evacuation of the fluid by puncture relieves the distension of the eyeball, and produces collapse of the staphylomatous projection for the time. The fluid, however, by and by reaccumulates; but, by repeating the evacuation over and over again, reaccumulation may at last cease to take place, and the eyeball will shrink to a small size. An accident, apt to occur in this operation, is infiltration of the subconjunctival cellular tissue with the evacuated fluid, which causes great swelling and pain at the time. The fluid is, however, by and by absorbed, and it would seem that its pressure on the empty eyeball may prevent reaccumulation.

1085. In regard to evacuation of the fluid as a means of relieving the pain from distension, it is to be observed, that imme-

diately on evacuation, there may be great exacerbation of the pain, but this gradually subsides, and at last more or less perfect relief is obtained.

1086. When the whole front of the eyeball is involved in the staphylomatous degeneration, and no progress in its diminution has been made by repeated puncture, excision of it, as in common staphyloma, may be had recourse to. After this, the eyeball shrinks to a stump, fit for supporting an artificial eye.

Synchesis.

(Dissolution of the vitreous body.)

1087. This name is given to a morbid state of the vitreous body, consisting in atrophy or solution of the hyaloid, in consequence of which the vitreous body is reduced from its natural gelatiniform to a diffluent state. This we are made acquainted with by dissection; but what are the symptoms of synchesis during life? As the quantity of vitreous fluid may be increased or diminished, there may be hardness or softness of the eyeball. Sometimes there is a tremulousness of the iris, and generally more or less impaired vision.

1088. Synchesis, though often a consequence of internal inflammation, is a change to which, with the advance of life, the vitreous body appears to have a tendency in the same manner that the lens has to opacity. The cataract of old people is indeed often combined with some degree of synchesis, and this is the cause of the principal danger attending the operation of extraction, viz., escape of the dissolved vitreous humour.

Atrophy of the eyeball.

(Atrophia bulbi.)

1089. Atrophy of the eyeball is the result of chronic inflammation, which has fixed itself primarily or secondarily in the internal structures of the eyeball, especially the posterior.

1090. Scrofulous, syphilitic, arthritic, traumatic, and sympathetic ophthalmiæ, are the inflammations which, implicating all the internal structures of the eyeball, and becoming chronic, are most apt to leave the eyeball atrophic.

1091. Morbid enlargement of the eyeball may precede atrophy.

1092. Atrophy of the eyeball presents itself in various degrees, from that in which it has lost merely its natural plumpness and feels soft to the touch, (s. 109,) to that in which it has

become so flaccid and shrunk, that it is indented at the places corresponding to the recti muscles, its prominence gone, and the eyelids fallen in.

1093. The softness and diminution of the size of the eyeball as a whole are owing in a great measure to a reduction in the mass of the vitreous body, but beside this there are disease and wasting of other structures, and especially a more or less morbid condition of the retina. With the morbid condition of the retina, indeed, it is probable that the change in the state of the vitreous body is more particularly connected. The alterations in the other structures of the eye it is not necessary here to notice in detail, much less the changes in structure, which dissection discloses, in eyes which have been long atrophic.

1094. In atrophy of the eye, the prognosis, as regards vision, is altogether unfavourable. Even at an early stage, and though the pupil is free, and the lens still transparent, vision is very much and irretrievably deteriorated; in a more advanced stage, it is reduced to a mere perception of light and shade, or even wholly lost.

1095. The eyeball may, in the course of internal inflammation, become somewhat soft, and yet recover its natural consistence. This, according to Dr. A. Anderson, sometimes happened in cases of the postfebrile ophthalmitis above described (s. 958 et seq.) after recovery from the attack, but such a degree of softness scarcely comes under the head of atrophy of the eyeball.

Shrunk state of the eyeball from evacuation of humours.

(Phthisis bulbi.)

1096. In consequence of extensive ulceration or sloughing of the cornea, or bursting of the eye, as in ocular phlegmon, the humours of the eyeball may be partially or wholly evacuated; the effect of this is collapse of the tunics, and after cicatrization, the reduction of the eye to a mere stump.

1097. This state of the eyeball is to be distinguished from *atrophy*.

APPENDIX TO THE PRECEDING SECTION.

Adaptation of an artificial eye.

(Prothesis ocularis.)

1098. An artificial eye is a shell of enamel, representing the front of the eyeball, the loss of which it is intended to conceal.

It should be of such a shape as to admit of being introduced behind the eyelids, and of fitting, by its hollow posterior surface, over, but without touching or at least pressing on, the stump-like remains of the eye, and by its margins, into the folds formed by the reflection of the palpebral and ocular portions of the conjunctiva into each other.

1099. The cases best adapted for the wearing of an artificial eye are those in which the eye, at the same time that it has been destroyed as an organ of vision, has been reduced in size, viz.—

1st. Those cases in which the cornea is destroyed by purulent ophthalmia, whether in adults or new-born infants, by gonorrhœal ophthalmia, variolous ophthalmia, &c., and in which staphyloma has not resulted, but the cicatrice formed in the place of the cornea is flat, (s. 1041.)

2d. Those cases in which the eye is intentionally reduced to the state just described by the operation for staphyloma, common (s. 1043), or sclerotic (s. 1086).

1100. When the remains of the eye are of a very small size, as after the loss of much or all of the vitreous humour as may happen from the bursting of the eye in purulent ophthalmia, or in ocular phlegmon, or during the operation for staphyloma, there is not a good support for an artificial eye. After extirpation of the eyeball, there is no support at all.

1101. Cases of atrophy of the eyeball do not in general bear the wearing of an artificial eye.

1102. Of course before the use of an artificial eye is thought of, the remains of the eye must be perfectly cicatrized, and the conjunctiva free from inflammation and morbid sensibility.

1103. An eye of a small size is at first tried, and this is to be succeeded by a larger and a larger, until one of a size and prominence, corresponding as nearly as possible to the sound eye, can be borne. In making these exchanges, the particular form of eye which fits best is determined.

1104. An artificial eye, besides resembling the opposite sound eye in the colour and appearance of the iris, ought, if the stump be good, to move in concert with it; this it does by following the movements communicated to the conjunctival folds, into which its margins are fitted, by the movements of the stump. It ought, at the same time, to cause no pain or uneasiness.

1105. For the accomplishment of all this, it is advisable for the patient to apply personally to the artificial eye maker. When, however, he cannot do so, he may send a coloured

drawing of the opposite sound eye, and a shell of lead which fits accurately over the stump and behind the eyelids, and which has the proper size and situation of the cornea and iris marked on it. From these models the artificial eye maker will be able to prepare or select a few for trial.

1106. *Introduction of an artificial eye.*—Raise the upper eyelid and slide the artificial eye, previously dipped in cold water, up behind it, by the end which is to correspond to the temporal angle. Then turning this end towards the temporal angle, and letting the upper eyelid now fall, depress forcibly the lower, and make the lower edge of the artificial eye slip into the lower palpebral sinus. This being done, and the lower eyelid allowed to rise, the introduction of the artificial eye is effected.

1107. *Removal of an artificial eye.*—The artificial eye is withdrawn by an opposite procedure, viz., depress the lower eyelid, and with a large pin, or a bit of wire bent like a hook, or even the thumb nail, hook the lower edge of the eye out from the lower palpebral sinus, whereupon the eye will glide down from behind the upper eyelid, and fall into the hand ready to receive it. In doing this himself, the patient should lean his face over a soft cushion, or the like, in order that if the eye should slip out of his fingers, it may not be broken in the fall.

1108. The artificial eye is withdrawn on going to bed. Immediately on being withdrawn, it is to be put into water in order to cleanse it from the mucus which may be adherent to it.

1109. Both before putting in the artificial eye, and after withdrawing it, the person should bathe his eye with water, tepid or cold.

1110. The artificial eye in the course of a few months becomes rough, from the slow corrosive action of the humours which come into contact with it, and requires to be exchanged for a new one. As it is also liable to be broken by accident, a person using an artificial eye should always have several ready by him.

CHAPTER III.

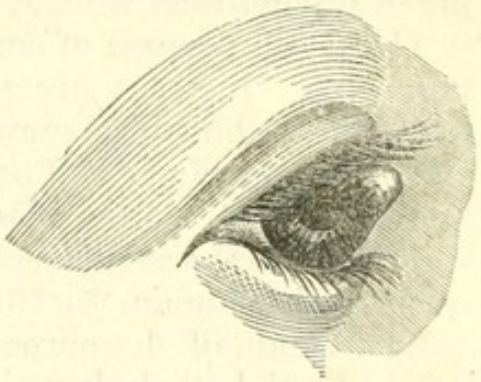
SECTION I.—DROPSIES, TUMOURS, CANCER, &c., OF THE EYEBALL.

Conical cornea.

(Hyperkeratosis—Staphyloma pellucidum—Conical hydrophthalmia.)

1111. *Objective characters.*—Viewed in front, the eye affected with conical cornea has a peculiarly brilliant and sparkling appearance, in consequence of the light being reflected in many different directions. — Viewed in profile, the cornea appears dark between the apex and base of the cone. When the prominence of the cornea is considerable, the eye cannot be kept long and steadily directed forward, but is, by the action of the eyelids, always turned either to the one angle or the other. From the irritation to which it is exposed, the apex of the cone is apt to become more or less opaque, and even ulcerated.

Fig. 12.



1112. *Subjective symptoms.*—Short-sightedness first attracts attention, and, by and by, vision becomes very indistinct at any distance. The patient can then recognize objects only when held close to the eye to one or the other side, so that the rays of light may pass through the cornea as near its circumference as is compatible with their entrance into the pupil. In this state, half-closing the eyelids assists vision. The patient generally sees objects multiplied. This Sir David Brewster ascertained to be owing to small inequalities on the surface of the deformed cornea.

1113. Conical cornea is rather a rare affection. Females have been found more frequently the subjects of it than males; and young persons, than old. Though it occurs most commonly after puberty, Mr. Wardrop has met with conical cornea in a boy of eight, and Dr. Ammon once saw it congenital in three

sisters. Both eyes usually become affected either at the same time or one after the other. Less commonly is the disease limited to one eye. For the most part, the cornea slowly undergoes the change to the conical form.

1114. *Morbid anatomy.*—Opinion has been divided on this point; some asserting that the centre of the cornea is thickened, others maintaining the contrary to be the fact. The late Dr. Jaeger, of Erlangen, examined the eyes of a person affected with conical cornea, who died of phthisis. The middle of the cornea forming the apex of the cone was in the right eye one-third, and in the left eye one-half thinner than natural. In both eyes the circumferential portion of the cornea was thickened. Mr. Middlemore has also had an opportunity of examining, after death, the state of the cornea in a person affected with the disease in an extreme degree. He found the circumference of the cornea of the ordinary and natural thickness, but its apex much thinner than usual.*

1115. The *causes* of conical transformation of the cornea are unknown. It is not necessarily connected with preceding inflammation, though in some cases this has been observed.

1116. *Diagnosis.*—The morbid affections of the cornea, which might be confounded with conical cornea, are:—

1st. The spherically prominent cornea, occurring as a consequence of corneitis, (s. 1063, et seq.)

2d. Hernia of the cornea, (s. 1016.)

3d. Partial staphyloma of the cornea and iris, (s. 1021.)

4th. Conical staphyloma, (s. 1050, et seq.)

The characteristics of these, and their differences from conical cornea, are pointed out in the proper place; here it is necessary only to remark that, as in the early stage the vivid reflection of the light is not apparent, the nature of the case may be altogether overlooked, if the practitioner does not take care to examine the eye from the side.

1117. The *prognosis* of conical cornea is in general unfavourable, though sometimes the disease, after a slight degree of development, has its farther progress arrested.

1118. *Treatment.*—In entering upon this part of the subject, it is well to premise, that restoration of the cornea to its natural form is not to be calculated on. The only indications, therefore, are to arrest the deforming process, and to provide some kind of glass calculated to compensate the malformation of the cornea; or to try by an operation to rectify somewhat the disordered optical condition of the eye.

* Treatise, vol. i. p. 532.

1119. As a means of arresting the deforming process, counter-irritation, astringents locally, and tonics, or iodine internally, have had some equivocal testimony in their favour. So, likewise, repeated evacuation of the aqueous humour.

1120. As to glasses, deep concaves afford assistance to vision in the slighter degrees of the complaint.

1121. In a woman about seventy years of age, affected at the same time with conical cornea and cataracts, Sir William Adams successfully removed the latter, and found that the patient could afterwards see much more distinctly without convex glasses, than is usual for those who have undergone the operation for cataract. Encouraged by this, he removed the transparent crystaline lens, by the operation of division, from one of the eyes of a young woman affected with conical cornea in both. The ultimate result, he says, was beneficial. Others, however, assert, that the operation does no good, which theoretically was to have been expected, as a concave glass was likely to afford all the assistance which removal of the lens could by possibility do.

1122. Dilatation of the pupil by belladonna has been found in some cases to assist vision. This it does by allowing the rays to enter the eye through the less deformed circumference of the cornea. On the same principle, Adams's operation of dislocating the pupil has been proposed by Mr. Middlemore; and Mr. Tyrrell* informs us that he has put it in execution seven or eight times within the last six years, and in each case with benefit, which in two especially was very considerable. In no instance did any evil follow. The operation consists simply in making a puncture, with an iris knife or the point of a cataract knife, through the cornea close to the sclerotica, and *prolapsing* a portion of the iris, so as to bring the pupil from behind the apex of the cone.

Hydrophthalmia.

1123. The morbid accumulation of watery fluid which constitutes hydrophthalmia may have its seat in the aqueous chambers (*anterior hydrophthalmia,*) or in the vitreous body (*posterior hydropthalmia*), or in both at the same time (*general hydropthalmia*), or it may have its seat between the sclerotic and choroid (*sub-sclerotic dropsy*), or between the choroid and retina (*sub-choroid dropsy.*)

1124. *Anterior hydrophthalmia, or dropsy of the aqueous*

* A Practical Work on the Diseases of the Eye, &c.; vol. i. p. 277. London, 1840.

chambers.—This, as it occurs in consequence of corneitis, has been above described, (s. 1063,) and it was stated that the cornea is increased in prominence, but not much in diameter. In cases apparently not depending on inflammation, the cornea is more increased in diameter than in prominence, and may be either still transparent, or cloudy, or opaque.

1125. The sclerotica where it joins the cornea is extended, thin, and of bluish colour. The conjuctiva is pervaded by enlarged and tortuous vessels.

1126. The iris is more or less affected. It has a dark, dead, dull appearance, and is perhaps found to be tremulous. The pupil is usually in a middle state between contraction and dilatation, is motionless, and has its margin directed backwards. In the course of the disease, it contracts adhesions to the crystaline body, which will probably be found opaque.

1127. The eyeball is hard to the touch, except in an advanced stage, when it is often soft from commencing atrophy.

1128. The patient experiences an uneasy feeling of distension in the eyeball, which he moves about in the orbit with difficulty in proportion to its enlargement. Muscæ float before the eyes, and amaurotic dimness of vision succeeds to short-sightedness. Total blindness may at last result.

1129. *Causes*.—A cachectic state of constitution is a predisposing cause of the anterior hydrophthalmia under notice. Its exciting cause is sometimes an injury, but in general its etiology is obscure.

1130. *Prognosis*.—This is in general unfavourable. The disease may remain stationary, with vision much impaired; or the eye may become partially atrophied, or general hydrophthalmia may supervene—in either case with total blindness.

1131. *Treatment*.—The treatment above indicated for dropsy of the aqueous chambers, consequent to corneitis or aquo-capsulitis, viz.—repeated evacuation of the aqueous humour, friction with mercurial or iodine ointment round the eye, blisters behind the ears, change of air, tonics, &c., may be tried.

1132. Dropsy of the aqueous chambers sometimes occurs congenitally. The cornea is more increased in diameter than in prominence, and is at the same time opaque or cloudy.

1133. Congenital dropsy of the aqueous chambers with opacity of the cornea, appears to be a sort of imperfect development as regards the opacity, at least a retention of the fœtal character of the cornea; for in the fœtus the cornea is opaque, and becomes clear only towards the period of birth.

1134. Congenital anterior hydrophthalmia may persist or pass into general hydrophthalmia. In a few instances, however, the cornea has, with the growth of the child, been found gradually to clear, and vision, though myopic, to be acquired. Mr. Ware* relates several such cases, three of which occurred in one family. In two of the children the opacity was quite removed in less than a year; in the third the transparency was not complete until the end of the second year. The corneæ remained very prominent, and the vision myopic. In another case both corneæ were large, prominent, and completely opaque at birth. At the end of nearly three years, the left cornea had become clear enough to allow the perception of large objects; the opacity of the right cornea, though diminished round the circumference, remained at the centre so as to obscure the greater part of the pupil. In a fifth case, similar to the preceding, improvement had, at the end of a year, proceeded so far in one eye that the circumference of the cornea was quite transparent, and the opacity so far diminished in the centre that the pupil could be seen. Improvement was less advanced in the other eye. It is worthy of remark, that in these cases, the clearing of the cornea proceeded from the circumference towards the centre, a course similar to what is observed in acquired opacity of the cornea.

1135. *Posterior hydrophthalmia, or dropsy of the vitreous body.*—The cornea, though pushed forward by the accumulation behind, may be unchanged. The iris is also at first unchanged, but is pressed towards the cornea, so that the aqueous chambers are diminished in size. The eyeball is very hard, and is with difficulty moved in its socket. The vitreous humour is generally in a dissolved state.

1136. In the stage of development of the disease, there is very severe pain in the eye, extending all over the side of the head. Vision, at the same time, goes on diminishing until all sensibility to light is gone.

1137. *Causes.*—Little is known of the process leading to the disease, farther than that it is in general dependent on a cachectic state of constitution.

1138. The *prognosis* is altogether unfavourable.

1139. *Treatment.*—The eye is to be tapped through the sclerotica and choroid where they bulge most, or if there is not much bulging in view, about one-fifth of an inch behind the

* Observations on the Treatment of the Epiphora, &c., p. 285. London, 1818.

margin of the cornea. Repeated tapping may be necessary, and if this fail, the cornea is to be opened, and the lens extracted, along with a portion of the vitreous humour—in order, should the opposite eye be sound, that the eyeball may shrink to a small size, fit for the adaptation of an artificial eye.

1140. When the puncture is made through the sclerotica and choroid, the vitreous humour is apt, as above mentioned in choroid staphyloma, to infiltrate the sub-conjunctival cellular membrane to an enormous extent, sometimes to such a degree, that the cornea is hid by the swelling. In one case in which this event happened in the hands of Dr. Mackenzie,* the pain which ensued was severe; but the dropsy was cured by the continued pressure, exercised for ten or twelve days on the empty eyeball, by the fluid lying under the conjunctiva.

1141. *General hydrophthalmia.*—From the great size the eyeball attains, this has been also named *Ox-eye* or *Buphthalmos.* General hydrophthalmia is a combination of anterior and posterior hydrophthalmia. The eyeball is protruded from the socket, stretching the eyelids, and is usually more or less disorganized. Vision is extinct. There is no remedy except evacuation of some of the contents of the eyeball, to relieve pain, and to effect the reduction of the eyeball to a small size by the means above mentioned, (s. 1139.)

1142. *Sub-sclerotic* and *sub-choroid dropsy.*—These have been above referred to in connection with sclerotic staphyloma, (s. 1076.) In sub-choroid dropsy, by the pressure of the accumulated fluid, absorption of the vitreous humour is apt to be caused, and consequent coarctation of the retina into the form of a cone, having its base at the lens, and its apex at the entrance of the optic nerve. The retina thus crumpled together, appears as an opaque body behind the dilated and perhaps displaced pupil, and has been mistaken, sometimes for cataract, sometimes for fungous disease of the eye.

1143. *Treatment.*—This is the same as is above laid down for sclerotic staphyloma and posterior hydrophthalmia.

Hæmophthalmus.

1144. Effusion of blood within the eye is not unfrequently met with as a result of blows and other injuries of the eye. It sometimes takes place also in the course of internal ophthalmia, (s. 377;) and in cases of females affected at the same time with amenorrhœa, it has been observed to recur about the menstrual

* Practical Treatise, p. 596, 3d ed.

period.* Hæmophthalmus may take place in consequence of unusual bodily exertion†—no evident cause operating directly on the eye—and afterwards recur repeatedly and even periodically.‡ In purpura hæmorrhagica, an effusion of blood has occurred within both eyes.§

1145. *Treatment.*—Blood effused into the eye is in general readily absorbed, and considered by itself alone, requires no interference, unless the chambers of the eye be very much distended, when a puncture of the cornea ought to be made to give it issue.

1146. Extravasation of blood under the conjunctiva has been named *Hæmophthalmus externus*, in contradistinction to the preceding form, which has been named *Hæmophthalmus internus*.

1147. Hæmophthalmus externus, called also *sub-conjunctival ecchymosis*, may be occasioned by various causes, such as blows on the eye or its neighbourhood, efforts, purpura. Its occurrence in connection with inflammation has been above noticed, (ss. 309-454.) Sometimes it occurs without any evident cause.

1148. *Treatment.*—Left to itself, the blood is gradually absorbed; but the absorption appears to be hastened by the application of the nitrate of silver drops, the red precipitate salve, or the like.

Hydatid (cysticercus cellulosæ) in the anterior chamber.‖

1149. Three cases are on record in which a living hydatid, floating free in the aqueous humour, was observed. In a fourth case, a hydatid was discharged through an incision in the cornea, made for the purpose of evacuating the aqueous humour; but its existence, while actually within the eye, was not recognized, in consequence of opacity of the cornea, from chronic inflammation.

* A very interesting case of internal ophthalmia, attended with aggravation of the symptoms, and effusion of blood into the anterior chamber at monthly periods, in a young female in whom the menses had not yet regularly appeared, has been recorded by Mr. Tyrrell in his "Practical Work," vol. ii. p. 40.

† See Mackenzie's Practical Treatise, 3d ed., p. 597.

‡ A remarkable case of this is related by Mr. John Bell, (Principles of Surgery, vol. iii. p. 270. London, 1808,) and a somewhat similar one by Professor Von Walther, (Merkwuerdige Heilung, eines Eiterauges, p. 61. Landshut, 1810.)

§ See a case communicated to Dr. Graves by Dr. Boxwell, of Abbeyleix, (Dublin Journal of Medical Science, vol. xi. p. 395. Dublin, 1837.)

‖ Hydatids in the cellular substance of the eyelids, and under the conjunctiva, are spoken of below.

1150. The subject of the first case, which is recorded by Neuman, (in Rust's *Magazin*, vol. xxxiii.,) was a scrofulous boy, of 14 years of age. In the second, which is recorded by Dr. W. Soemmerring, (*Isis von Oken*, 1830,) and the subject of which was a healthy girl of 18, the hydatid was discovered soon after an ophthalmia. The subject of the third case, which occurred in 1833, and which was first described by Mr. Logan, subsequently by Dr. Mackenzie, (*Med. Gaz.*, vol. xii., and *Treatise*, &c.,) was a healthy-looking girl, seven years of age. In this, as in Soemmerring's case, the hydatid appeared after ophthalmia, in consequence of which there was slight opacity of the cornea.

1151. This latter case I had the opportunity of examining and attending after the operation. The tail-vesicle of the animal was about one-sixth of an inch in diameter, semi-transparent, and might be seen sometimes contracting, sometimes expanding, and at the same time undergoing slight changes of form. Besides this, the body and head were sometimes retracted within, sometimes protruded from the tail-vesicle, the part of which connected with the body and head, was always the most depending. When the body and head were protruded, and hanging downwards, the animal resembled a miniature balloon.

1152. The fourth case occurred about two years ago, at the Westminster Ophthalmic Hospital, and the hydatid, after extraction, was brought to me by Mr. Canton for examination, to whose kindness I am indebted also for having subsequently had an opportunity of seeing the patient, who was a boy about 10 years of age. I found the cornea semi-opaque and vascular, and increased both in diameter and prominence.

1153. The hydatid in this case was more than double the size of that in the preceding, and its appearance at first sight suggested the idea, that it was the lens and vitreous body,—the former opaque and contracted, the latter shriveled, by the draining away of the contained humour; but a slight examination of the body was sufficient to point to its true nature, which a microscopical dissection demonstrated.

1154. *Treatment.*—In Neumann's case, the hydatid, slipping into the pupil while this was dilated by belladonna, was retained there; the pupil appearing to have contracted around it. Severe pain came on. A needle was passed through the cornea, the hydatid disengaged from the pupil, and couched, but on the third day after this, violent inflammation of the eyeball took place, which ended in suppuration.

1155. In Soemmerring's case, uneasiness was experienced from the presence of the animal in the eye only when it moved. Increasing in size, however, it was removed by Dr. Schott, who, having made a small section of the cornea, introduced a pair of hooked forceps into the anterior chamber, seized the hydatid, and extracted it alive.

1156. In Mr. Logan's case no uneasiness was at first experienced, but subsequently pain and redness of the eye setting in, an attempt was made by Dr. Robertson, of Edinburgh, to extract the animal. In consequence, however, of the unsteadiness of the child, the operation did not turn out well; the lens escaped, the iris protruded, and the hydatid was ruptured, but the shreds of it were eventually removed. After the operation, I attended the case in Dr. Robertson's absence. The eye healed, with a broad cicatrice of the cornea, and the pupil remained contracted, distorted, and obstructed with opaque capsule.

1157. In horses in India, during the cold season, a species of filaria, or thread-worm, about an inch long and whitish, moving freely about in the anterior chamber, is not unfrequently observed. In horses in Europe, instances of the same thing, though not unknown, are rare. The worm, unless extracted, excites inflammation of the eye with dimness of the cornea. Extraction is effected through a small incision of the cornea, the aqueous humour, as it escapes, carrying the animal along with it.

1158. No instance is known of a filaria in the anterior chamber of the human eye, but filariæ have been met with in cataractous lenses,* after extraction, as also monostomata and distomata. These, however, were not recognizable while within the eye, having been discovered only on minute examination of the extracted lens with magnifying glasses. They do not appear to be of any practical consequence.

Non-malignant tumours of the eyeball.

1159. Various kinds of growths, cysts, vascular and fleshy excrescences, scrofulous tumours, &c., are met with, sometimes connected with the sclerotica and cornea,† sometimes with the iris, sometimes with the ciliary body and choroid, sometimes with the retina and the vitreous body.

* As will be mentioned below, a species of filaria has also been found under the conjunctiva of the human eye.

† The sclerotica and cornea are more or less involved in the growths and tumours of the ocular conjunctiva. See below.

1160. In regard to non-malignant growths connected with the retina and the vitreous body, it is to be observed, that they give rise to a yellow shining metallic appearance, sometimes traversed by blood-vessels, at the bottom of the eye. The same appearance is presented in incipient cases of medullary fungus of the retina, and is not uncommon after injury of the eyeball.

1161. These different cases have therefore often been confounded together. Indeed, the appearance in question used to be considered so certainly pathognomonic of medullary fungus of the retina, that every case in which it presented itself was pronounced to be one of this formidable disease. It having been observed, however, that many such cases, being left alone, eventually so far did well, that the disease did not go on to the destruction of the patient, but ended merely in atrophy of the eyeball, surgeons are now agreed that, though suspicious, the yellow appearance at the bottom of the eye does not always indicate medullary fungus.

1162. It must be confessed, however, that there is in general no certain means of determining the nature of the case *à priori*. It is rather by its result that we pronounce on the point. It may be observed, however, that, in some cases, the termination of which in atrophy of the eyeball proved their non-malignant nature, the diseased appearances presented themselves after injury of the eyeball, and were from the first attended by inflammation. In such cases the pupil was of medium size, and as atrophy of the eyeball proceeded, the iris became wrinkled, its middle part sunk in, and its pupillary margin projecting forwards.

1163. *Treatment.*—For the treatment of the various kinds of growths under consideration, no general rule can be laid down. Often the best practice is not to interfere with them except when external. Atrophy of the eyeball is in general the common and most desirable result of internal growths.

1164. In illustration of the treatment of cysts in connection with the iris, the following cases are given:—In one case, a cyst, of the size of a small pea, and glistening like tendon, formed in connection with the iris of a boy, an apprentice to a blacksmith, some months after severe inflammation, produced by a small particle of hot iron, which penetrated the cornea and lodged in the iris. In another case, the subject of which was a girl, about nine years of age, a similar disease occurred a few months after inflammation brought on by the eye being struck with some bearded corn. In both cases the cyst was removed. In the first case the patient did not retain useful vision after-

wards. In the second, iritis came on, to which was soon joined sympathetic iritis in the other eye. The inflammation was eventually stopped, and the eye secondarily affected recovered; but that on which the operation had been performed retained the power to perceive large objects only.* In a third case, a lady was affected with considerable pain in one of her eyes, which, on examination, presented a small vesicle pushing into the anterior chamber from under the ciliary margin of the iris behind the lower edge of the cornea. The vesicle gradually increased, separating the iris more and more from the choroid, and the pain became severe. The vesicle or encysted tumor was punctured with the iris knife through the cornea. A minute quantity of fluid was discharged from the cyst, which immediately contracted so much that it was no longer visible. The pain was removed. The wound made in the cyst healed, it filled again with fluid, and again appeared in its former situation, but larger than before. It was punctured a second and a third time at intervals of six and eight weeks. After the third puncture it did not fill again. The iris returned to its natural place; the pain ceased entirely; and vision was preserved.†

Scirrhus of the eyeball.

(Hard cancer of the eyeball.)

1165. Under the name of *scirrhus* of the eyeball, some authors describe a disorganized state of it, characterized by its being misshapen and indurated, shrunk in size, or if enlarged, but little so, whilst its natural structure is replaced by one having the characters of scirrhus—by its being the seat of burning heat and lancinating pain, and attended by hemicrania in nocturnal paroxysms—by its being slow in its progress, occurring in advanced life, in women rather than in men—continuing long without ulceration, and without any implication of the eyelids and neighbouring parts, though eventually ulceration of the eyeball, and implication of the neighbouring parts may take place, and the whole eye thus become the seat of open cancer, the neighbouring lymphatic glands of head and neck being at the same time enlarged, hard, and painful. But such a disease of the eyeball occurring primarily, does not appear to be common. See Cancer of the Eyelids.

* Tyrrell's Practical Work on the Eye, vol. i., pp. 368, et seq.

† Mackenzie's Practical Treatise on the Diseases of the Eye, 3d ed., p. 604.

Medullary or encephaloid fungus of the eyeball.

(Soft cancer—Fungus hematodes.)

1166. Encephaloid fungus of the eyeball occurs principally in early childhood, though not exclusively confined to that period of life, and has its origin generally in the optic nerve, and within the eye.

1167. Three principal stages of the disease are recognized. In the *first stage* the eyeball is still of its natural size and general appearance, except that the pupil is more or less dilated, and through it a brilliant reflection from the bottom of the eye is seen. In the *second stage*, the diseased growth, though still confined within the tunics, has advanced towards the anterior part of the eyeball, which has become bloodshot, and more or less enlarged and misshapen from distension. In the *third stage*, the tunics have given way, and the tumour protrudes in the form of a fungus.

1168. *First stage.*—Through the pupil, which is more or less dilated, irregular, and either sluggish or altogether immovable, or movable only in concert with the pupil of the sound eye, there is seen, under certain lights, a whitish-yellow or reddish-yellow reflection from the bottom of the eye, somewhat resembling that in the eye of the cat. This, on close examination, is perhaps discovered to be owing to the presence of an adventitious substance in the form of a small lobulated tumour, apparently arising from some part of the retina. Red vessels are sometimes seen ramifying on it.

1169. The vision of the eye may be lost from the first, or it may be still partially retained, objects being seen in certain directions. There is in general no pain, unless there be, as is sometimes, though not generally the case, attendant inflammation, when, as accompaniments of this, there are epiphora, intolerance of light, and headache.

1170. *Second stage.*—The disease may remain in this state for months, or even two or three years; but, sooner or later, the morbid growth begins to increase, and continues to do so sometimes with such rapidity, that in the course of a few weeks perhaps it will, at the expense of the vitreous humour, have advanced to the front of the eye, pressing the lens and discoloured iris against the cornea. The eye is now more or less inflamed.

1171. The advancing growth is seen through the now much-dilated pupil to be more or less distinctly lobulated, and to have blood-vessels ramifying on its surface.

1172. By and by the lens becomes opaque, and amber-coloured. The growth being thus concealed, and the general appearance of the eyeball not being as yet very much changed, cases in this part of their progress have been mistaken for cataract, and attempts made to operate.

1173. The eyeball gradually becomes more and more enlarged and misshapen from distension, by the increasing growth of the tumour, and pervaded by varicose vessels. The cornea is much increased in diameter, vascular, and more or less opaque, and ulcerates, and the sclerotica, the boundary between which and the cornea is no longer visible, attenuated and discoloured, bulges out here and there. In this state, the eyeball protrudes from the orbit, and is ready to burst; perhaps the attenuated sclerotica has at some part actually given way, and the tumour, retained by the conjunctiva alone, appears both to the sight and the touch something like an abscess.

1174. The eyelids are distended, swollen, and pervaded by enlarged veins.

1175. Besides pain in the eye, and perhaps intolerance of light, with epiphora, there are pain, chiefly in the forehead, vertex, and nape, occurring in paroxysms which are more severe during the night than during the day.

1176. There are general constitutional disturbance, costiveness, nausea, thirst, loss of appetite, restlessness, fever, delirium.

1177. *Third stage.*—The cornea giving way, a fetid, bloody, yellowish fluid, together with the lens, if this has not been already absorbed, is discharged, with some alleviation to the sufferings of the patient. The tumour now protrudes in its well-known form of bleeding brainlike fungus. When it bursts through the sclerotica, it may be retained, as above said, for some time, by the conjunctiva; but this at last giving way, it protrudes: severe pain attends this process.

1178. The eyelids are now greatly distended, everted, livid, and pervaded by large tortuous veins.

1179. The lymphatic glands of the cheek and neck enlarge.

1180. The other eye frequently becomes affected, and that even at an early period. Both eyes may be nearly equally affected in the first stage of the disease.

1181. Under the bleeding, sloughing, ulceration and discharge, of which the fungus is the seat, and the pain and constitutional disturbance, the patient sinks comatose or convulsed.

1182. Though medullary fungus has been found by Mr. Travers to arise in every structure of the eyeball except the lens and cornea, it nevertheless generally has its origin in the

optic nervous apparatus; the other structures of the eyeball subsequently becoming infiltrated with the morbid matter. The optic nerve has been found generally on dissection to be, in addition to the retina, affected to a greater or less extent, even its cerebral portion, and in some cases the brain is itself implicated. As a consequence of the intracranial disease, death by coma may occur before the disease of the eyeball has reached the fungous stage.

1183. In some cases, the morbid growth, instead of arising from the optic nerve within the eye, and giving rise to the symptoms above detailed, arises from the optic nerve before its entrance into the eye. In this case, the tumour pushes the eyeball before it, expanding and enlarging the eyelids, and at last protruding from between them, but, being covered by the conjunctiva, it does not show itself in the form of a fungus until ulceration of that membrane.

1184. In the dissection of the bodies of those who have sunk under encephaloid disease of the eye, the same morbid degeneration has, in many cases, been found implicating other organs, such as the testicle, the viscera of the thorax, or abdomen.

1185. *Causes.*—The scrofulous diathesis, being often presented by those who are the subjects of encephaloid cancer, has been viewed in the light of a predisposing cause, but scrofula is common, and the disease in question rare. It occurs principally in early age, as above said. Mr. Travers has seen it congenital. Males have been found more frequently the subjects of it than females. As to exciting cause, none has with certainty been detected.

1186. *Diagnosis.*—The characters above given of encephaloid disease of the eyeball in the early stage, are not perfectly diagnostic of it, for, as already stated, very similar characters, viz., the yellow shining metallic appearance at the bottom of the eye, traversed sometimes by red vessels, may be presented by cases which, as is now known by multiplied experience, are not malignant. The characters even of the second stage have been seen by Dr. Mackenzie, presented in a more or less well-marked manner by non-malignant disease of the eye. In the third stage, the nature of the disease can scarcely be mistaken; but even in the earlier stages, the diagnosis is of no great practical importance, as nothing more in the way of treatment ought to be done than in the non-malignant cases.

1187. *Prognosis.*—This is in the last degree unfavourable. Neither medicine nor the knife is of any avail in true encephaloid disease.

1188. *Treatment.*—Cases in which the appearances belonging to the early stage of encephaloid tumour existed, have sometimes turned out so far well, that the eyeball has become atrophic. Long alterative courses of mercury having been used in such cases, it might be said, as Mr. Travers remarks, that they were examples of malignant disease, arrested by this treatment, and not mere examples of non-malignant disease, which would have had the same termination without such treatment.

1189. However this may be, alteratives, the occasional application of leeches, with careful regulation of the bowels, diet, and regimen, constitute the only treatment which experience shows is admissible. Extirpation of the eyeball has been too generally unsuccessful to allow us to hope anything from such a resource. The few cases recorded as recoveries after extirpation, there is every reason to believe were not cases of true encephaloid, but merely of non-malignant disease above noticed, (ss. 1160-1-2,) and which would have undergone a spontaneous cure by atrophy whether they had been left to themselves, or subjected to the treatment above mentioned as the only one admissible.

1190. In the advanced stages of the disease, anodynes are required, both internally and externally.

Melanosis of the Eyeball.

1191. Melanosis of the eyeball occurs in the middle period of life, more frequently in females than males, and is in general slow in its progress.

1192. According to the part of the eyeball in which it arises, so do the appearances differ which present themselves at the commencement, and the degree in which vision is impaired. If the morbid growth has its origin in the coats of the eyeball, in the region of the ciliary body, for example, it first makes its appearance shining through the sclerotica, in the form of small blackish elevations near the margin of the cornea, the white of the eye presenting there enlarged and varicose vessels. There is perhaps also detachment of the circumference of the iris at the place, and the dark mass making its appearance from behind. In this case, vision may be still more or less retained. If the morbid growth arise from the bottom of the eye, there is first seen through the dilated pupil, a slate-coloured appearance, deep in the interior of the eyeball, unless the lens have become opaque. This state is attended with loss of vision. The

disease proceeding the eyeball becomes enlarged, and the black tumour at last presents itself at some part of its surface.

1193. There are now, in consequence of the distension, inflammation, and pain in and around the eye; and at last the coats of the eyeball, where the tumour presents, generally the sclerotica near the cornea, gives way, and a black fluid is first discharged, followed by the protrusion of a black or brown fungous tumour. This tumour does not in general attain any great size. It seldom bleeds much, though the contrary is sometimes the case; but it may throw off considerable quantities of black matter by sloughing. The proper structure of the eyeball becomes atrophic, being in a great measure replaced by the morbid growth.

1194. Impairment of the general health attends this disease.

1195. *Prognosis and treatment.*—The prognosis in melanosis of the eyeball is but little more favourable than in encephaloid disease. After extirpation of the eyeball, patients have survived longer, though in most cases they have eventually sunk under melanotic affections of the viscera.*

Operation of extirpation of the eyeball.

1196. *Preparation of the patient.*—This consists in rest, regulation of diet, and attention to the bowels, some time before the operation, together with the fulfilment of any other indication which the particular case may present.

1197. *Instruments, dressing*, &c.—Bistoury and scalpels,—a pair of large scissors, curved on the flat,—two pairs of large forceps, one a common dissecting forceps, the other a hooked forceps,—a large curved needle and strong ligature,—small suture needles and thread,—water, sponges, and syringe,—charpie, spread linen, lint, and roller.

1198. *Position of the patient, assistants, and operator.*—The patient is to be extended on his back on a table, with his head raised by a pillow. If a child, it should be wrapped round, the arms by the sides, with a shawl or sheet. One assistant secures the head steady on the pillow, and takes charge of the upper eyelid; the other assistant, standing on one side of the table, takes charge of the lower eyelid, whilst the operator stands on the other side of the table—the side, namely, corresponding to that side of the patient on which the operation is to be performed.

1199. The following directions for extirpating the eye must

* Melanosis in the orbit, and of the conjunctiva and eyelids, is considered under these heads.

be understood to be of a general character, such merely as are principally indicated by the anatomy of the parts. The disease for which the operation is undertaken may have occasioned such a condition of parts as to require some considerable modification in the procedure; but this must be determined by the judgment of the operator at the time. The operation comprehends the following steps:

1200. *First, or preparatory steps.*—For the purpose of holding and moving about the eyeball during the operation, it is thrust through with a tenaculum, or a strong ligature is passed through it from the one side to the other, by means of a large curved needle, the ends of the string being then tied together, so as to form a loop to hold by. If the eyeball is much enlarged and protruding, it may be simply grasped with the hand, having been first wrapped round with a bit of lint.

1201. *Division of the external commissure of the eyelids.*—This facilitates the operation, and obviates the risk of cutting the edges of the eyelids. Whilst the eyelids are held much asunder, and the external commissure is well drawn towards the temple, the operator pushes the sharp-pointed bistoury, its back next the eye, between the commissure and the margin of the orbit, and onwards under the skin for the extent of half an inch or more towards the temple, when the point is made to transfix the skin. By now pushing the knife on, it cuts itself out, and the division of the commissure is accomplished.

1202. *Second steps, comprising the extirpation.*—Whilst the assistants keep the eyelids much drawn asunder, the surgeon holding the scalpel in one hand, with the other rolls the eyeball upwards without drawing it forth of the orbit, in order to expose fully the lower conjunctival fold. This he freely divides from one angle to the other by plunging the scalpel into the orbit at one angle, and carrying it along the margin of the orbit with a sawing motion to the other angle. In this step the origin of the inferior oblique muscle should be cut.

1203. Having withdrawn the scalpel, the surgeon next rolls the eyeball downwards, and cuts in the same way through the upper conjunctival fold, carrying the knife along the upper margin of the orbit from one angle to the other. In this step the superior oblique muscle should be cut.

1204. The incisions are now to be made to join each other at the angles, and by rolling the eyeball first to the one side, then to the other, what tags still exist are to be divided.

1205. The optic nerve, with the recti muscles, is next to be divided. For this purpose the curved scissors are introduced

into the orbit along, and with their convexity towards, the upper and inner wall, whilst the eyeball is kept rolled downwards and outwards. Being now opened, they are pushed deeper until they include between their blades the optic nerve, surrounded by the muscles close to the optic foramen, when they are to be closed, and these parts cut through. After this the eyeball is readily drawn forth of the orbit, the scissors being used to divide any remaining tags.

1206. The orbit is now to be explored with the finger, and if any suspicious structure be discovered, it is to be removed. If the lachrymal gland be at all indurated and enlarged, it ought to be seized with a hook, dragged from its fossa, and, along with its surrounding cellular tissue, removed with the scissors. If not diseased, it may be left.

1207. *Dressing.*—The bleeding usually abates of itself, or on the application of cold water; if not, pressure with a plug of lint is to be made. The orbit is now to be lightly filled with charpie, the divided external commissure united by a stitch or two, and the whole covered with a piece of spread linen with holes cut in it, and a light compress and roller.

1208. If the eyelids are so involved in the disease of the eyeball as to require to be extirpated also, an incision is to be made through the sound skin all round the margin of the orbit, and the eyelid detached from the margin of the orbit and reflected towards the eyeball. The eyeball, including the eyelids, is then to be secured with either the tenaculum or ligature, and the extirpation proceeded with as above. In this case it will be observed that there is no cutting of the conjunctival folds, all the conjunctiva being removed along with the eyelids and the eyeball.

1209. *After treatment and healing of wound.*—Although extirpation of the eyeball is very severe and painful, it is in general not attended by any considerable accident, even in weakly patients; and as far as regards the mere operation, recovery in general readily takes place under the treatment usual after great operations. But unfortunately the disease, on account of which the operation is most commonly undertaken, is very apt to break out again in the adjoining or some other parts. In this point of view, extirpation of the eyeball is very far from being a successful operation. Indeed, in many of the cases in which it used to be had recourse to, viz., medullary fungus and cancer, it is now generally refrained from. And as to the other cases, it is rare that there is any pressing necessity for it.

1210. Inflammation must be met actively, as it is apt to ex-

tend to the membranes of the brain and prove fatal. When the charpie has become loosened by the occurrence of suppuration, it is to be removed, and the orbit washed gently out with tepid water and again lightly filled with charpie. As granulation goes on, less and less charpie is to be introduced at the subsequent dressings.

Section II.—CATARACT.

A. GENERA AND SPECIES OF CATARACT.

1211. Cataract consists in a greater or less opacity of the crystaline body, whereby the rays of light are intercepted on their way to the retina, and vision thus impaired or reduced to a mere perception of light and shade.

1212. The opacity may be seated in the lens itself, or in its capsule, or in both lens and capsule at the same time. Different kinds of cataract are accordingly recognized, viz., *lenticular*, *capsular*, and *capsulo-lenticular*.

1213. The distinction of these different kinds of cataract is a point of no small importance, for on it depends a correct conception of the rise and progress of the disease, and, especially, the discrimination of the operative procedure best adapted to effect a restoration of vision in a given case.

1214. Cataract, as above defined, is sometimes distinguished by the epithet *true*, in contradistinction to what has been called *false cataract*, which consists in opaque deposits of lymph, pus, blood, &c., on the anterior capsule, and obstructing the pupil—the consequence commonly of anterior internal inflammation of the eye. False, however, may be combined with certain kinds of true cataract—anterior capsular or capsulo-lenticular. As examples of such a combination may be mentioned, *trabecular*, some forms of *pyramidal*, and *pigmentous cataract;* the first two being so called from the deposit of lymph being in the one of the form of a bar crossing the front of the capsule, and in the other of that of a pyramid; the last from fragments of uvea adhering to the anterior capsule.

I. LENTICULAR CATARACT.

1215. This constitutes the typical example of cataract; and whilst it is the most common kind, it is fortunately that which admits of the most ready and perfect cure.

1216. There are certain appearances which the cataractous lens may present, dependent simply on the natural structure of the lens, rendered visible by its having become opaque, and which may therefore be studied in a healthy lens, removed from the eye after death, and rendered opaque by reagents. These appearances deserve to be noted before proceeding to inquire into the objective characters of the different species of lenticular cataract.

1st. *The glistening appearance like tendon, or mother of pearl.*—This is owing, as in the case of tendon, or mother of pearl, to the mode in which the light is reflected by the peculiar surface of the opaque fibrous structure.

2d. The appearance of a star with three radii, extending from the centre towards the circumference of the lens, one upwards and a little outwards, one downwards and inwards, the third downwards and outwards, less opaque than the rest of the lens, and without the glistening appearance. This is owing to a space filled with a substance different from the fibrous substance of the lens, which intervenes between the anterior ends of the fibres, thus:—

This substance becoming distended, by the imbibition of fluid apparently, the stellate appearance is rendered more evident, thus—

1217. The character by which it is of most importance to distinguish species of lenticular cataract, is consistence; for this has reference to the kind of operation to be undertaken for their cure. According to their consistence, lenticular cataracts are divided into *hard*, *soft*, and *fluid*.

1218. But seeing that their consistence cannot be ascertained in a direct manner before operation, the period of life of the patient, the colour and general aspect of the opacity, and the size of the cataractous lens, inasmuch as they stand in pretty close relation with the consistence, and are ascertainable, con-

stitute points to which the surgeon's attention should be particularly directed, with a view to the diagnosis of consistence.

1219. The size of the cataractous lens is judged of by the distance of its anterior surface behind the iris. When the distance is considerable, the cataract is inferred to be small; when, on the contrary, the anterior surface of the cataract is in contact with the iris, and still more if it appears to press the iris forward, the cataract is inferred to be large. The distance behind the iris of the anterior surface of the cataractous lens is judged of by the breadth of the shadow thrown upon that part of it seen through the pupil by the pupillary margin of the iris, on the side next the light, thus:—The distance is in proportion to the breadth of the shadow. When the anterior surface of the cataract is in contact with the posterior surface of the iris, there is of course no shadow.

1220. *Diagnosis of consistence.*—Generally speaking, hard cataracts are met with in persons advanced in life, have a colour which is a mixture of gray and amber, and are of a size not exceeding that of the healthy lens. Soft cataracts, on the contrary, occur in young persons, have a gray or milk and water colour, and are of a size at least equal to, but often exceeding the natural size of the healthy lens. Fluid cataracts are characterized by their whiteness, especially at the most depending part, and are usually moreover complicated with capsular opacity; the case thus being one of capsulo-lenticular cataract.

1221. *Diagnosis between lenticular and capsular cataract, and between lenticular and capsulo-lenticular cataract.*—The opacity of lenticular cataract is of some tint of gray, and uniform; in capsular cataract, on the contrary, the opacity is white and streaked or speckled; whilst in capsulo-lenticular cataract, the opacity is a variable combination of lenticular and capsular opacity, as will be more particularly detailed under the head of capsulo-lenticular cataract.

Hard or common lenticular cataract of old people.

1222. The *consistence* of the lens in this case is greater than its natural consistence, especially as regards the central nucleus. The *size* is not greater than in the natural size of the lens. The *colour* a mixture of gray and amber—the amber colour predominating in the middle, where consequently the opacity appears greatest. The cause of this peculiarity of coloration is, that the central nucleus of the lens is the seat of the amber

colour, and this sometimes without any actual opacity, whilst the superficial part of the lens is the seat of the gray opacity.

1223. Along with this gray opacity there may be more or less of the glistening appearance on the surface above described, (s. 1216, 1st.) The opacity is usually otherwise uniform. The cataractous lens may, however, present more or less distinctly the stellate appearance described above, (s. 1216, 2d.) Sometimes it presents an appearance of streaks more *opaque* than the rest of the lens, *converging* from its circumference, where they are broad, towards the centre, where they become narrow. These streaks are fasciculi of fibres more opaque than the rest. They usually occur in the posterior strata of the lens, and therefore appear deep-seated. The lens in this case is more opaque at the circumference than at the centre. Sometimes hard cataracts are of a dark-brown colour, like mahogany; such are called *black cataracts*.

1224. Lenticular cataracts occur, in which, while the central nucleus is as hard as in hard cataracts just described, the peripheral strata are softer—softer even than in the healthy state of the lens. They also belong to advanced life, and indeed appear to be an advanced stage of the preceding form. The peripheral strata of the lens, at the same time that they are softer, are more opaque. In consequence of this, the brown-yellow or amber colour of the hard central part of the lens is not seen, or but indistinctly, the general colour of the cataract being that of the more opaque superficial strata, viz., whitish-gray.

1225. *Subjective symptoms.*—When the cataract is pretty fully formed, a thick mist or cloud generally appears to the patient to obscure or conceal everything placed right before him, but objects placed to one side, or above or below, he may still perceive less indistinctly. In bright light, vision is more indistinct: in moderate dull light it is less so. The opposite of all this, however, sometimes, though rarely, occurs, viz., that the patient sees right before him better than to one side, and in a strong as well as in a dull light—sometimes better. Lastly, objects may not be seen at all, but vision may be reduced to a mere perception of light and shade.

1226. The peculiarities in the state of vision now enumerated, present themselves according as the opacity is greater or less in the centre than at the circumference of the lens, or as it is equally great in the centre and at the circumference.

1227. In the first and more common case, *i. e.*, when the opacity is greater in the centre than at the circumference of the

lens, the rays of light from objects right in front of the eye are less freely admitted or are altogether intercepted by the more opaque central part of the lens; whilst the rays of light from objects situated to one side are more freely admitted through its less opaque circumferential part. In bright light the pupil being contracted, the less opaque circumferential part of the lens is covered, and only the more opaque central part of the lens presented to the rays of light, so that even the vision of objects placed sideways is interrupted; whereas in dull light, the pupil being dilated, the less opaque circumferential part of the lens is, to a considerable degree, uncovered, and more free entrance of light thus permitted. When the pupil is under the influence of belladonna, vision is still more decidedly improved, as the dilatation produced by belladonna is greater than that which takes place in dull light.

1228. In the second and rarer case, *i. e.*, when the opacity is less in the centre than at the circumference, the rays of light from objects right in front of the eye are more freely admitted by the less opaque central part; whilst the rays of light from objects to one side are less freely admitted, or are altogether intercepted by the more opaque circumferential part of the lens. In bright light, though the pupil is contracted, the less opaque central part of the lens is still uncovered for the passage of the rays of light, and hence vision is uninfluenced.

1229. When the opacity involves equally the central and circumferential part of the lens, vision is nearly equally defective, whether during a dilated or a contracted state of the pupil.

1230. Objects, when they are still to be perceived, sometimes appear to the cataractous patient distorted and multiplied.

1231. *Objective symptoms.*—The general bearing of the cataractous patient, the expression of his features, and the movements of the eyeball, have been above noticed, (s. 9.) By keeping his head bent forwards, his eyebrows knit and depressed, his eyelids half closed, and by looking at objects sideways, he appears as if intolerant of light. He does, indeed, by these means, seek to shade the eyes, but not because he cannot bear the light, but because he in general finds that when his eyes are shaded he sees better, (s. 1227.)

1232. As regards the appearance of the eye: The clear black of the pupil is wanting, and in its stead there is an opaque appearance, presenting in various degrees of intensity, combination and extent, the characters above described, (ss. 1222-23-24.) On examining carefully the opaque appearance, especially by looking into the eye sideways, (s. 103,) it is seen

in the situation of the crystaline body. On making a catoptrical examination of the eye, (ss. 104-5,) it is found that the inverted image is no longer seen, and that the deep erect one, if still seen, is very indistinct.

1233. That the opacity is seated in the lens, may generally be determined by a practised surgeon without dilating the pupil by belladonna, but of course no formal opinion should be pronounced by beginners of the exact nature of the case until an examination has been made whilst the pupil is under the influence of belladonna.

1234. The pupillary margin of the iris, which is naturally darker than the rest of that membrane, is in cataract brought by contrast more distinctly into view than usual, and looks like a dark ring bounding the pupil all round.

1235. The form and motions of the pupil are natural, unless the cataract be so large as to press upon the iris, which, however, is not usually the case in hard cataract, or unless the case be complicated with morbid adhesions, amaurosis, &c.

1236. *Rise and progress.*—The dimness of vision, and objective opacity, in general begin in a very unmarked manner, and increase slowly for perhaps months or years, until they have attained the degree above described. Along with dimness of vision, there may be some degree of over-sensibility to light and muscæ volitantes, but these are accidental complications not necessarily dependent on the cataract.

1237. *Nature and causes.*—Lenticular cataract consists in a marasmus and opacity of the proper substance of the lens, and not in any opaque deposit, but nothing is known of the exact nature of the change. It may be looked upon in some degree as a natural effect of old age; but there are circumstances which especially predispose to the complaint, such as hereditary tendency, habitual exposure to strong fires, &c.

1238. *Diagnosis.*—Glaucoma and amaurosis are the diseases with which the lenticular cataract of old people is most likely to be confounded. It is, however, to be observed, that a case of this cataract, even in its incipient stage, is less likely to be mistaken for a case of glaucoma or amaurosis, than a case of glaucoma or amaurosis is for one of cataract. The following diagnostic table displays the principal points of difference between cataract on the one hand, and amaurosis and glaucoma on the other.

1239. *Subjective symptoms.*

CATARACT.	AMAUROSIS AND GLAUCOMA.
1. Sometimes coloured spectra and muscæ volitantes precede or accompany diminishing vision. Vision in general diminishes slowly; in rare cases, however, quickly.	1. Often coloured spectra and muscæ. Diminution of vision often sudden; sometimes, however, slow and gradual, without muscæ.
2. In general quite unattended by any constitutional disturbance. No pain.	2. Generally accompanied by headache, vertigo, and derangement of the digestive organs. Supra-orbital or temporal pain.
3. Objects situated sideways more distinctly seen in general; inwards, outwards, upwards, downwards, indifferently.	3. Objects situated to some *one* side, not any side indifferently, often more distinctly seen, as some *one* part of the retina may be less affected than the rest—inside or outside, only, above only, or below only.
4. Vision better in dull light. The opposite of this occurs, but rarely, when the circumference of the lens is more opaque.	4. Vision worse in dull light. The opposite of this, however, sometimes occurs in the erethitic form.
5. The flame of a candle or lamp appears expanded and diffused, as it is seen when we look at it through obscured glass, not iridescent.	5. The flame of a candle or lamp appears broken, confused, iridescent, and spreading out into rays.
6. In general, the vision is not liable to be better some days, worse others, but this is sometimes the case.	6. Often vision is better one day, worse another.
7. Diminution of vision is in proportion to the opacity.	7. Diminution of vision much greater than the *appearance* of opacity, supposing it were opacity, of the lens, would account for.
8. In cataract, perception of light at least never lost.	8. In amaurosis when fully formed, all perception of light is lost, and yet the appearance of opacity may be no greater. In glaucoma it may, however, increase.

1240. *Objective symptoms.*—The difference in the general aspect of the patients, and the movements of the eyeballs, in cataract and amaurosis, have been above pointed out, (s. 9.) The differences here falling to be noticed are those which regard the eye itself.

CATARACT.	AMAUROSIS AND GLAUCOMA.
9. The eyeball presents to the touch the natural degree of firmness.	9. The eyeball may be either preternaturally hard to the touch, or preternaturally soft.
10. The opacity behind the pupil in incipient lenticular cataract in old people, might at first be mistaken for the pale opaque appearance in amaurosis; in a more advanced state again it might be mistaken for the appearance in glaucoma.	10. In amaurosis there is often an appearance as if of opacity behind the pupil; in *glaucomatous* amaurosis, it is a constant and well-marked appearance. In simple amaurosis it is pale,* in glaucoma it is greenish.
11. In cataract, however, the opacity is readily recognized to be something real, well-defined, and distinctly seated in the lens, more or less close behind the pupil, and not to change its place (except in cataracta tremulans, the character of which is otherwise quite evident). The cataract is seen as distinctly or more when we look into the eye sideways. When the pupil is dilated by belladonna, the cataract is still more distinctly and extensively seen.	11. In amaurosis and glaucoma, the appearance of opacity is evidently deeper seated, but where it is seated one cannot, by merely looking into the eye, say exactly, especially as it appears to change place according to the direction in which light is admitted to the eye. It is seen most distinctly when we look direct into the eye—indistinctly, or not at all, when we look sideways from the side opposite the light. It is most distinct in the ordinary state of the pupil, but when the pupil is dilated, it is scarcely or not at all to be seen.
12. The pupil and its movements always quite natural.	12. The pupil and its movements not in general natural;

* A similar appearance may often be observed in old people unaffected with amaurosis.

CATARACT.	AMAUROSIS AND GLAUCOMA.
Readily and quickly yields to the influence of belladonna.	the pupil is more or less dilated, and if not quite immovable, its movements are limited and slow. Yields slowly and imperfectly to the influence of belladonna, if not already quite dilated.
13. In cataract, even in an early stage, the inverted image is obscure, or obliterated, and the deep erect one very indistinct.	13. In amaurosis, uncombined with glaucoma, the three images are always distinct. Glaucoma only when much advanced, obliterates the inverted image, while in all its stages, it renders the deep erect one more evident than it is in the healthy eye.
14. The inverted image, long before the cataract is fully formed, is not produced, or but indistinctly, whether the candle be held opposite the central or the circumferential part of the lens, owing to the circumstance, that it is the superficial strata of the lens which are first affected, and which of course prevent the distinct formation of the inverted image, as well by the middle as by the circumferential part of the lens.	14. In glaucoma at a middle stage, the inverted image is pretty distinct when formed near the edge of the crystaline; but if the candle be brought in front of the eye, the inverted image is less distinct, and in some cases is altogether extinguished. This extinction of the inverted image, when the candle is brought in front of the eye and not otherwise, is owing to a loss of transparency in the kernel of the lens, while the superficial strata are still transparent.

1241. *Prognosis and treatment.*—When once begun to form, it may be prognosticated that the opacity will go on to increase until all useful vision is prevented in the eye. And it may also be prognosticated, that the other eye will likewise become affected. How quick or how slow the progress to loss of useful vision, however, may be, cannot be prognosticated—it may be months or it may be years.

1242. Restoration of vision can be effected only by an operation, by which the opaque lens shall be removed from its situation—pressed down below the level of the pupil, (*the ope-*

ration of displacement,) or extracted from the eye altogether—(*the operation of extraction.*)

Soft or common lenticular cataract of young people.

1243. The cataract is of the same consistence as that which is natural to the lens, or softer, and of a grayish-white, or milk and water opacity throughout its whole substance. It presents, in the earlier stages of its opacity, the glistening tendinous aspect and stellate appearance above described; in short, the soft cataractous lens at first very closely resembles a healthy lens, rendered opaque and swollen by the action of reagents. But by and by it may come to have less of the appearance of the original structure, looking like broken spermaceti or white sugar. The lens is generally of the natural size, but is sometimes larger.

1244. *Subjective symptoms.*—Vision is diminished in proportion to the opacity, in a manner analogous to what is above described to be the case in hard cataract.

1245. *Objective symptoms.*—These are, on the whole, much the same as those of hard cataract above described, with the exception of what differences are produced by the differences in colour, general aspect of the opacity, and size of the cataractous lens.

1246. The iris and pupil may be natural, but according to the size of the lens, so will be its closeness to the iris and the breadth of the shadow. If, as is often the case, it is so large as to press on the iris, the motions of the pupil are impeded, and the shadow is altogether wanting.

1247. *Causes.*—The occurrence of opacity of the lens in young persons, is very much rarer than in old persons. It is often met with as the result of injury. In children affected with lenticular cataract, we are sometimes told that the opacity made its appearance after convulsions. In other cases it cannot be traced to any cause.

1248. *Diagnosis.*—There is less likelihood of this form of lenticular cataract being confounded with amaurosis than the preceding—none at all with glaucoma, as this does not occur except in old persons. It is to be remembered, however, that this form of cataract is not unfrequently complicated with amaurosis. Soft lenticular cataract being whiter than hard, is less readily distinguished from capsular cataract.

1249. *Prognosis and treatment.*—What is above said on these heads (s. 1241), in regard to hard cataract, is in general applicable here, except that the kind of operation best adapted

for the removal of the opaque lens, is that by *division*, in order to its solution and absorption.

II.—CAPSULAR CATARACT.

1250. The anterior and posterior walls of the capsule may be separately affected with opacity. Hence are recognized anterior capsular cataract, and posterior capsular cataract. Opacity of the lens is apt to supervene, so that the case merges into capsulo-lenticular cataract. Opacity of the lens more speedily supervenes on posterior capsular cataract than on anterior. Occasionally both the anterior and posterior walls of the capsule are the seat of partial opacity, the lens remaining transparent.

Anterior capsular cataract.

1251. The opacity in anterior capsular cataract has more analogy with opacity of the cornea than opacity of the lens. It is usually dead white, and either implicates the whole anterior wall of the capsule, or perhaps one half, or occurs in abruptly defined patches, spots or streaks quite irregular both in form and disposition, except in the case of *central capsular cataract*, in which the opacity occurs in the form of a single elevated opaque spot, seated in the centre of the capsule. This elevated opaque spot is sometimes of a pyramidal shape, its apex projecting towards the pupil.

1252. According to the differences in the general aspect of the anterior capsular cataract, produced by the differences in the disposition of the opacities, such names as the following have been given to the cataract: *cataracta capsularis anterior totalis, dimidiata, centralis, marmoracea, striata, &c.*

1253. *Motions of the pupil.*—The motions of the pupil may be natural, but very often they are impeded by adhesions between the pupillary margin of the iris and the capsule of the lens.

1254. *Subjective symptoms.*—According to the situation and extent of the specks, so the loss of sight may be greater or less than in lenticular cataract. Complications often exist which may disturb the vision more than the mere capsular opacity.

1255. *Causes.*—Anterior capsular cataract appears generally to be the result of inflammation of the eye, ophthalmia neonatorum, or scrofulous ophthalmia, for example, more frequently than iritis.

1256. The *diagnosis* of anterior capsular cataract is founded principally on the superficial seat and whiteness of the opacity, and its speckled disposition.

1257. *Prognosis and treatment.*—Anterior capsular cataract is like opacity of the cornea, not prone to extend, the inflammation which originally gave rise to it having ceased, and it may continue for many years, or for life, without the supervention of lenticular opacity. Not unfrequently so much vision is still preserved, that no interference in the way of operation is required. Any operation that may be undertaken, must be the same as for capsulo-lenticular cataract, for the capsule cannot be removed without sacrificing the lens.

Posterior capsular cataract.

1258. Simple uncombined opacity of the posterior wall of the capsule is rare, for it is soon followed by lenticular opacity. Little, therefore, is known of its appearances. Opacity of the posterior strata of the lens has been sometimes mistaken for it. Dr. Mackenzie, who has had frequent opportunities of examining posterior capsular cataract, describes its appearances:—The opacity, in posterior capsular cataract, is never uniformly diffused, but always exhibits the form of radiating lines, proceeding from the centre of the affected membrane. The ground upon which these opaque lines are placed, is evidently concave and deep-seated, while the lines themselves, being seen through the crystaline, have a watery dullness of appearance, which forms a striking contrast to the sharp chalky whiteness of the specks in anterior capsular cataract.

1259. Posterior capsular cataract of itself has no more influence on the motions of the pupil than other kinds of cataract. Being liable, however, to be complicated with amaurosis, it may be attended by a dilated and fixed pupil.

1260. Vision is impaired in very various degrees—the patient being able in some cases to read by the aid of a magnifying glass; while in others he is almost blind.

1261. *Prognosis and treatment.*—As above said, posterior capsular is soon followed by lenticular opacity, and the case thus becomes one of capsulo-lenticular cataract, so that the treatment must be the same as for capsulo-lenticular cataract; but the prognosis is in general unfavourable, in consequence of the liability of this species of capsular cataract to be complicated with amaurosis.

III.—CAPSULO-LENTICULAR CATARACT.

1262. In capsulo-lenticular cataract, the opacity may be partial or complete. It may be confined to a small spot on the

middle of the anterior capsule, and of the lens, the rest of the body being healthy; or the opacity may be to a greater extent, and the lens hard, soft, or in a more or less fluid state. The opacity of the anterior capsule, which varies in degree as in simple anterior capsular cataract, may be combined with thickening of it.

1263. Sensibility to light is occasionally very feeble in capsulo-lenticular cataract, owing in some cases to the density of the opacity, in others to the presence of amaurosis. Cataract supervening to amaurosis, and especially to traumatic amaurosis, is frequently capsulo-lenticular. The cataract is slow in its progress under such circumstances. At length the vitreous humour dissolves, and the iris and cataract become tremulous.

1264. According to the differences above enumerated, different species of capsulo-lenticular cataract are recognized.

Central capsulo-lenticular cataract.

1265. This seems to belong to the same head as central capsular cataract, from which it differs merely in presenting a circumscribed opacity of the lens at the place corresponding to the opacity of the capsule. Both species occur congenitally, or make their appearance shortly after birth—often after ophthalmia neonatorum. The lenticular opacity may be broader, but is not in general so dense as the capsular. Central cataract is rarely capsular merely, it is in general capsulo-lenticular. It often co-exists with congenital defects. I have met with it along with night blindness.

1266. The effect of central capsulo-lenticular cataract on vision is short-sightedness.

1267. *Treatment.*—No operation is called for. If the pupil is not habitually dilated so as to expose the clear part of the crystaline for the passage of light, the drops of belladonna or atropia are to be used for that purpose, (s. 128.)

Common capsulo-lenticular cataract.

1268. The appearances are those principally of anterior capsular cataract, when the opacity of the anterior capsule is complete. When the opacity is incomplete, the opacity of the lens is seen through the transparent places. The lens may be hard, soft or fluid.

1269. When dissolved, the lens forms an opaque white or yellowish fluid, which distends the cataractous capsule. In some cases, the opacity and fluidity of the lens precede the opacity of the capsule; while in other cases the diseased state

of the capsule appears to lead to the disorganization and dissolution of the lens. The latter is probably the case in ordinary cases of capsulo-lenticular cataract, while in *congenital cataract*, which is generally capsulo-lenticular, when it comes under notice, the opacity of the capsule is certainly preceded by that of the lens.*

1270. What has been called Morgagnian cataract appears to be an early stage of fluid cataract, and to consist in softening and opacity of the exterior part of the lens, with perhaps absorption by endosmose of aqueous humour into the capsule, determined by the diseased state of the lens, similar to what takes place after death, and which is the true source of what is called the Morgagnian fluid.

1271. In fluid cataract, the capsule may be seen, when the pupil is dilated, bulged forwards at the lowest part by the subsidence of the opaque fluid. In this state, the opacity is, of course, greater below than above.

1272. The iris being more or less pressed upon by the capsule, distended with the fluid lens, the movements of the pupil are impeded. The iris may be pressed forward towards the cornea.

Siliquose capsulo-lenticular cataract, or membranous cataract.

1273. This results from the more or less complete absorption of the lens, and collapse and thickening of the opaque capsule. It is of a grayish-yellow colour, and softish, easily broken up, in young persons: whiter, firmer, and tougher in grown-up persons. It is sometimes so much shrunk in diameter, that when the pupil is dilated, the *zonula lucida* appears around it, and radiating white bands are seen extending from it to the ciliary body, (*cataracta cum zonula.*) It is also so much shrunk in thickness, that it is evidently at a considerable distance behind the iris, which may, in consequence, be inclined backwards.

1274. Of course the movements of the pupil cannot be influenced by the cataract, but they may be so by concomitant complications.

Cystic capsulo-lenticular cataract.

1275. In this species the lens is fluid, and the capsule opaque and distended with it, so that the crystaline body is globular and enlarged, pressing forward the iris. When the vitreous body is at the same time dissolved, the cataract pre-

* Mackenzie's Practical Treatise. Third Edition, p. 657.

sents tremulous movements with every turn of the eye or head, (*cataracta cystica tremulans vel natatalis.*) Being no longer fixed, it falls down below the pupil, and is apt to pass through it into the anterior chamber.

1276. Cystic capsulo-lenticular cataract is almost always complicated with amaurosis, and is generally the result of a blow on the eye or its neighbourhood.

B. THE OPERATIONS FOR CATARACT.

1277. The restoration of vision in cataract cannot be effected by any means except by operation. The different operations for this purpose have for their common object the removal of the opaque lens, or of both it and its capsule from behind the pupil, so that the rays of light may be again allowed to pass on to the retina. This object is sought to be effected in one or other of three different ways, according to the circumstances of the case, viz.—1st. By at once extracting the cataract from the eye. 2d. By simply displacing it to below the level of the pupil. 3d. By lacerating the capsule and dividing the lens, in order that the latter, being exposed to the action of the aqueous humour, may be gradually dissolved and absorbed, and thus eventually removed altogether from the eye. Of these three different ways, again, there are different modifications.

General observations and questions regarding the operations for cataract.

1278. *Prognosis of the operations for cataract in general.*—The success of operations for cataract depends very much on the kind of cataract, the age of the patient, and the local and constitutional complications; but, as a general estimate, it may be admitted with Dr. Mackenzie, that three-fourths of patients operated on recover useful vision, and two-thirds excellent vision, when such cases only as are fitted for operation are operated on; when the mode of operating is adapted to the particular case; when the operation is well performed, and the after-treatment skillfully conducted.

1279. *Kind of cataract.*—The prognosis in lenticular cataract is much more favourable than in capsular. As to hard and soft lenticular cataract, the prognosis in them merges into that of extraction and division.

1280. *Age of the patient.*—The prognosis is better in young children and old persons than in persons in the prime of life; but this is mainly because it is in early life and old age that

the cataracts most favourable for operation occur. The general complications connected with age which are unfavourable to the success of operations for cataract, are, in early life, scrofula, and in advanced life, gout.

1281. *Complications of cataract.*—Before an operation for cataract is determined on, it is necessary to examine not only the state of the eye in other respects, but the state of the system in general, lest complications should exist which might interfere with the success of the operation. This they might do in two ways, viz., either by interfering with its success as an operation simply, or the operation as an operation being successful, by interfering with the accomplishment of its ultimate object of restoring vision.

1282. The complications which might interfere with the success of the operation as an operation, i. e., the successful removal of the cataract, without subsequent injury to the eye from undue inflammation or the like, may be either local, such as entropium, ectropium, trichiasis, ophthalmia tarsi, chronic ophthalmia, or the like; or constitutional, such as disposition to erysipelatous and catarrhal inflammations, scrofula, syphilis, gout, scurvy, chronic diseases of the skin, habitual ulcers of the legs, nervous complaints.

1283. In regard to local complications it is to be observed, that there are certain morbid states of the eye, which, though they might seriously interfere with the success of an operation as an operation, performed in one way, would be little or no impediment to the success of an operation performed in another way; thus, whilst synechia anterior, contracted pupil, or dissolution of the vitreous body, would be incompatible with the success of the operation of extraction, they would offer little or no impediment to the success of displacement or division.

1284. The operation as an operation being successful, the complications which might interfere with the accomplishment of its ultimate object of restoring vision, are local, such as defective sensibility of the retina, extensive opacity of the cornea.

1285. Of the different kinds of complications of cataract above enumerated, most admit of cure, or of such palliation as is calculated to remove or diminish the risk of their interfering to prevent the success of an operation. Defective sensibility, or total insensibility of the retina, however, in general admits of no cure, and is therefore, of course, a complication rendering all operative interference fruitless.

1286. The *diagnosis* of the various complications of cataract above referred to, is either quite evident, or not obscured

by the presence of the cataract; but it is different in the case of complication of cataract, with defective sensibility of the retina; for without a careful consideration of all the circumstances of the case, including an inquiry whether, at the commencement, the loss of vision was accompanied by any symptoms of posterior internal ophthalmia, (s. 860,) and an examination of the eye, with the pupil under the influence of belladonna, the defect of vision might be attributed solely to cataract, especially as ready perception of light and shade still remains. In the case of total insensibility of the retina, the diagnosis is in general easy, seeing that cataract never produces complete blindness (s. 1239).

1287. *When one eye only is affected with cataract, and the vision of the other good, should an operation be performed?*—Under such circumstances, the practitioner will not recommend recourse to an operation, and indeed the patient is not likely to desire it, except, as is sometimes the case with young persons, generally females, when the cataract is white and very evident, for the sake of getting rid of the deformity.

1288. *When in one eye useful vision is lost, and in the other, vision has become misty from cataract, should an operation be performed on the former?*—The usual advice is to wait until useful vision is lost in the latter also; but it is better to operate at once on the blind eye, though the determination of the point may be left to the convenience of the patient.

1289. *When in an elderly person double lenticular cataract has become so far developed as to interfere with useful vision, when should an operation be had recourse to?*—If extraction is to be performed, operate as soon as possible, for there is more chance of the vitreous body being sound than at a later period; if, on the contrary, displacement is to be performed, the operation may be deferred until the cataracts be more developed.

1290. *When cataract is fully formed in both eyes, may both be operated on at the same time?*—As a general rule, the answer is in the negative, if extraction is to be performed; in the affirmative, if displacement or division.

1291. *In cases of congenital cataract, at what age should the operation be performed?*—It ought to be performed in infancy, and, if possible, before teething commences; if not, soon after teething is completed.

1292. *Preparation of the patient for undergoing an operation for cataract.*—If the case be free from local or constitutional complications, the patient requires no other preparation

than a few days' rest of mind and body, some attention to diet, and to the state of the bowels. If, on the contrary, any such complications exist, he ought, before the operation is undertaken, to be subjected to such treatment as is adapted either to remove them altogether, or to palliate them so far as to remove or diminish the risk of their interfering to prevent the success of the operation. The previous habits of the patient as to diet, the use of strong drinks, smoking, &c., should be carefully taken into consideration.

1293. The treatment of the morbid states of the eye, which may complicate cataract, is discussed under their proper heads. In regard to the treatment of the various constitutional complications, it would be out of place here to enter into detail. It is proper, however, to observe, that in some cases the abstraction of blood may be necessary, besides restriction of diet, even to abstinence from all strong drink, and animal food too, though in these respects care should be taken not to interfere violently with confirmed habits. For the regulation of the bowels, repeated purges may be required. In other cases, strengthening diet and tonic and even stimulating treatment may be called for.

1294. It need scarcely be remarked, that if the patient is subject to gout, rheumatism, or erysipelas, the operation should be carefully avoided, when there is reason to fear an attack is impending. Shortly after an attack, is the occasion which should be chosen. In any case, the operation is not to be undertaken while the patient has a foul tongue.

1295. On the morning of the operation, if there is no natural evacuation, a clyster should be given to procure one.

1296. The only special preparation of the eye for the operation is the dilatation of the pupil, by means of the softened extract of belladonna, smeared on the eyebrow and eyelids, two or three hours before.

1297. *Season of the year and time of the day best adapted for operations for cataract.*—The operations for cataract may be performed during mild and steady weather at any season; and such weather most usually occurs from March to the end of October. [In the middle portions of the United States, from June to the end of November.] Noon is the best time of the day for operating for cataract.

1298. *Position of the patient, assistants, and operator.*—The patient may either sit on a chair, or he may lie extended on a sofa or table with a pillow under his head. Infants are best secured by wrapping them in a shawl, to confine their arms and hands, and laying them on their backs on a table.

1299. When the patient sits, the operator usually stands, or, if he sits, it is on a high chair, before the patient, whilst an assistant stands behind to support his head, and to take charge of the upper eyelid. The patient's head should be held with the face looking somewhat upwards; and in order to secure it in this position, the assistant supports it against his breast, and holds the chin by one hand, whilst the other—the right if the right eye, the left if the left eye is the subject of the operation—rests on the forehead; with the latter hand the assistant secures the upper eyelid. The operator takes charge of the lower eyelid, and for this purpose he uses the forefinger, the middle finger being applied to the inner corner, ready to prevent the rolling inwards of the eyeball, the ring finger is bent to be out of the way, the little finger rests on the patient's opposite cheek: with the right hand the operator holds the instrument.

1300. The operator may, however, stand behind the patient; in which case, with one hand resting on the forehead, he secures the upper eyelid, whilst with the other he holds the instrument. This may also be the position of the operator when the patient is extended on a sofa or table.

1301. If the operator is not ambidexter, he, when the patient sits, stands before him, and takes charge of the lower eyelid, if the operation is on the left eye;—behind him, and takes charge of the upper eyelid, if on the right eye. When the patient lies extended on a sofa or table, the operator still stands behind the head, if it is the right eye which is to be operated on; but if the left, then he must stand by the side of the patient. In this case, the assistant stands at the head, and secures the upper eyelid; the operator himself secures the lower.

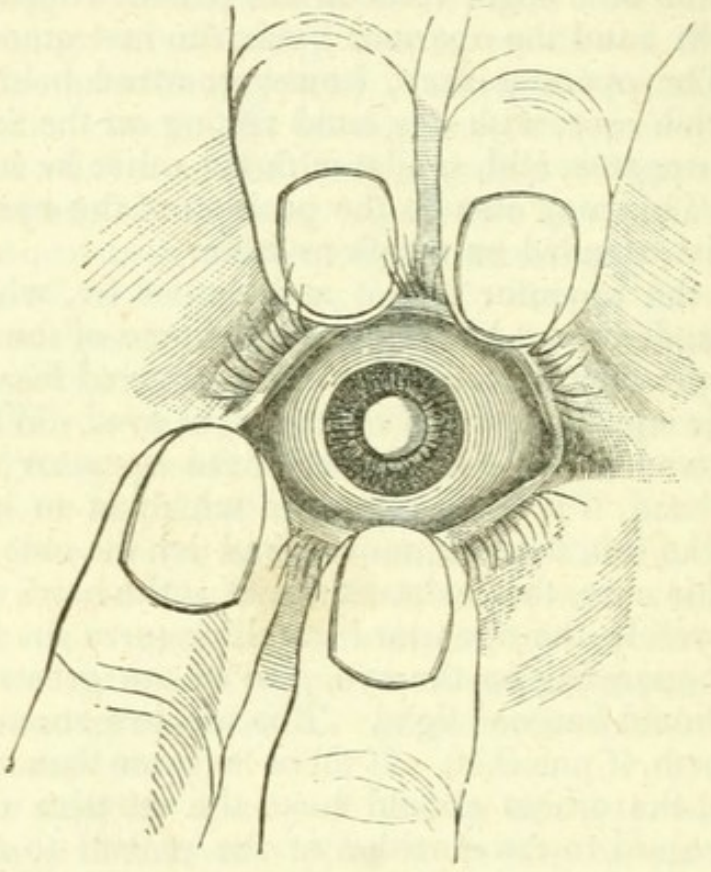
1302. In operating on the eye, it is of the greatest moment that there should be good light. The window should be directed to the north, if possible. If there be more than one window in the room, the others should have the curtains drawn over them. In regard to the position of the patient to the light, it should be such, that the eye is fully exposed to the light, and that neither the operator's body nor his hand be interposed between the eye and the light during the operation.

1303. *Opening and securing of the eyelids.*—The patient, assistant and operator being in their places, the next business is to open and secure the eyelids. The proper securing of the upper eyelid is a most important point; it is effected by applying the points of two fingers, the fore and middle, or the middle and ring finger, according to circumstances, against the broad border of the tarsus, the eyelashes being smoothly extended be-

tween the eyelids, and the surface of the fingers, and gently raising the eyelid, pressing the firm part of the eyelid back under the margin of the orbit, until the fingers come to press against that margin; the eyelashes are now interposed between the fingers and the margin of the orbit. The upper eyelid may thus be completely secured without any great force, and without the slightest pressure on the eyeball, without the eyeball even being touched.

1304. The lower eyelid is secured in a similar manner, and still more easily, with the forefinger, whilst the middle finger is applied over the caruncle. Fig. 16.

Fig. 16.



1305. It is seldom necessary to employ a speculum for securing the upper eyelid, except in the case of children.

1306. When the eyelids are held apart unskillfully, folds of the conjunctiva are apt to be thrust out between the eyelids by the action of the orbicularis muscle, so that they almost bury the front of the eyeball, and consequently impede the operator.

1307. The eye not operated on, should be covered as a general rule. A compress of charpie is laid over the closed lids, and secured by a roller. If, however, the patient has com-

plete command over himself, and can keep his gaze steadily fixed, the eye should be left uncovered, that he may direct it to some point, and thus properly direct and steady the eye to be operated on.

EXTRACTION OF THE CATARACT.

1308. Extraction of the cataract may be effected through an incision, either in the cornea, or in the sclerotica. Extraction through an incision in the cornea, is the operation commonly practised; extraction through a sclerotic incision not having been found so successful.

1309. The kind of cataract for the cure of which the operation of extraction is most commonly undertaken, is the common hard lenticular cataract of old persons. It is also performed in certain cases of capsulo-lenticular cataract, and in siliquose cataract; but these cases being for the present left out of the question, the reader's attention is requested to an account of the operation as it is performed for hard lenticular cataract in old persons.

Extraction of the hard or common lenticular cataract of old persons.

1310. *Conditions necessary for, or at least favourable to the successful performance of the operation.* 1. Steadiness on the part of the patient during and after the operation, is especially necessary. 2. Large palpebral fissure, so that the eyelids may admit of being sufficiently separated, to allow the whole front of the eyeball to be duly exposed. 3. The eyeball neither much sunk nor very prominent. In the one case the section of the cornea cannot be well made; in the other, the healing of the wound does not proceed so favourably. 4. The cornea, healthy in structure, (an *arcus senilis** is no impediment,) and of due size and prominence. 5. The iris, free

* *Arcus Senilis* (*Gerontoxon*) is an annular opacity of the cornea within its circumference, which occurs in advanced periods of life, though it is sometimes observed below middle age.

The opacity is about the twentieth or thirtieth of an inch broad, and has an equal breadth of nearly clear cornea intervening between it and the circumference of the cornea.

Arcus senilis appears first at the upper and lower parts of the cornea, and by and by extends all round, though this does not always happen.

It is never so extensive as to obstruct vision.

Arcus senilis must not, as above observed, be confounded with the bluish-white ring round the extreme margin of the cornea, commonly called arthritic, and seen in some cases of internal inflammation, particularly in old persons, (s. 831.)

from synechia, and not inclined towards the cornea, so that the anterior chamber may be of good width. 6. The pupil natural, freely contracting and dilating according to the degree of light.

1311. *Conditions unfavourable to, or wholly forbidding, the performance of the operation.*—Unsteadiness on the part of the patient; chronic cough; difficulty of breathing; very overhanging superior orbital margin and eyebrows; narrow palpebral fissure; very sunk or very prominent eyeball; the cornea unhealthy in structure, small and flat; the anterior chamber consequently small; synechia, small pupil; and not widely dilatable, even by belladonna; or, and above all, a dissolved state of the vitreous body and its connections.

1312. When a dissolved state of the vitreous body exists, as it often does in old persons, the section of the cornea is, perhaps, no sooner made than the cataract, along with a greater or less quantity of the vitreous humour, bursts out from the eye; or, the cataract sinking down behind the iris, a large quantity of vitreous humour alone burst out. If the dissolution of the vitreous body be in a great degree, it will be evacuated wholly or in large quantity, and the eyeball may thus be destroyed, notwithstanding the utmost dexterity, delicacy, coolness, and circumspection on the part of the operator. But how is the existence of this state of the vitreous body ascertained before operation? (See ss. 1087, 1088.)

1313. If, during the operation of extraction on one eye, any indications of softening of the vitreous body should be observed, this ought to warn any one against proceeding at once to operate on the other; because, during the second operation, the muscles of the eyes and eyelids are apt to be involuntarily contracted, and the vitreous humour of the eye already operated on squeezed out.

1314. It is to be observed, that in the eye in which the cataract has more lately formed, the vitreous body is less likely to be softened than in the other; so, that supposing it be determined to operate by extraction on both eyes at the same time, it would be advisable to operate first on that in which the cataract has more recently formed.

1315. *Prognosis.*—When the case is one of common hard lenticular cataract, and when the other conditions are favourable, the prognosis is good. Recovery of the eye, from the effects of the operation, sometimes takes place in a very short time; but usually some degree of external, or even anterior internal inflammation occurs, so that recovery is retarded. In

general, recovery should not be calculated on, sooner than from four to six weeks; in some cases dangerous and destructive inflammation occurs, although the case appeared to be in all respects a proper one, and the operation well and successfully performed.

1316. The operation having succeeded as an operation, more perfect vision is in general obtained after extraction than after any other mode of operating.

1317. *Instruments and dressings.*

Two of Beer's knives for making the section of the cornea.

A set of Daviel's scissors, for enlarging the corneal incision if necessary, or the knife more commonly used for the purpose.

A needle for lacerating the capsule.

Daviel's curette or spoon.

A fine hook, or slender-bladed forceps, for extracting or assisting out the lens, in case of its sinking in the vitreous humour.

A pair of Maunoir's scissors.

Several strips of black court plaster, about a quarter of an inch broad, and long enough to extend from the eyebrow to the cheek, over the eyelids.

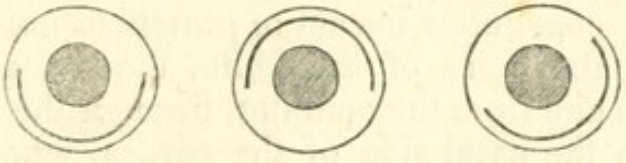
Two soft compresses of lint.

A roller or broad ribbon.

1318. The operation of extracting a lenticular cataract, through an incision in the cornea, may be viewed as comprehending two principal parts, viz., 1st, the section of the cornea; and 2d, the laceration of the capsule, and extraction of the lens.

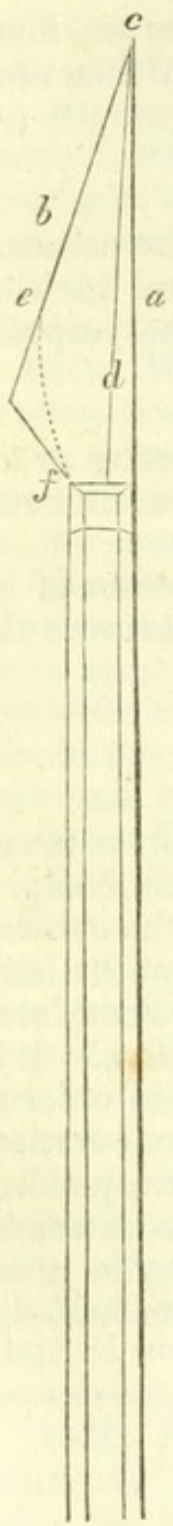
1319. *Section of the cornea.*—This is usually considered the nicest, if not the most difficult part of the operation. It is made concentric with the margin of the cornea, and in order to be of sufficient size for the escape of the lens, about one-fortieth of an inch from the sclerotica, and to an extent corresponding to rather more than half—to the extent say of nine-sixteenths of the circumference of the cornea. This section may be made in the lower half of the cornea, fig. 17, or the upper half, fig. 18, or the outer and lower half, fig. 19, thus:—

Fig. 17. Fig. 18. Fig. 19.



1320. The instrument usually employed for making the section of the cornea, is Beer's cataract knife, which is represented in the annexed figure.

Fig. 20.



1321. The back of the blade *a* is straight with the handle, the cutting edge *b* oblique, and forming with the back at the point *c* an angle of about 18°. For about one-tenth of an inch from the point, the back is cutting, as well as the edge.

1322. The back of the blade generally, though blunt, should be thin, but in a line between the back and edge, extending from point to heel, the blade is thick, the thickness increasing gradually from point to heel on the one hand, and from the edge and back respectively on the other. The line in the direction of which the thickness is greatest, is indicated by *d*. This conformation imparts the necessary rigidity to the blade, and is farther of use, during the performance of the operation, in filling up the incision as it is made, and thus preventing the premature escape of the aqueous humour, until the completion of the section of the cornea, which is a very important condition for its successful performance.

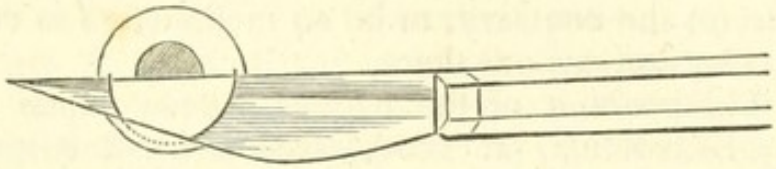
1323. It may be remarked, that the great breadth of the blade towards the heel is quite unnecessary for the completion of the section of the cornea, as may be seen in figure 21, and is sometimes positively inconvenient during the operation, by coming into contact with the edge of the eyelid. All the part, therefore, comprised between *e* and *f*, fig. 20, might be advantageously cut away as far as the dotted line.

1324. The handle of the knife should be broad, as much as one-fifth or one-fourth of an inch broad, and flat, the flat sides to correspond to the flat surfaces of the blade.

1325. The mode in which the section of the cornea is made with the knife, which has now been described, is to pierce through the cornea on the temporal side into the anterior chamber, which constitutes the act of *puncturation;* then to push the point of the knife, the flat surfaces of the blade being to and from the operator, through the anterior chamber, across to the nasal side of the cornea, where the point of

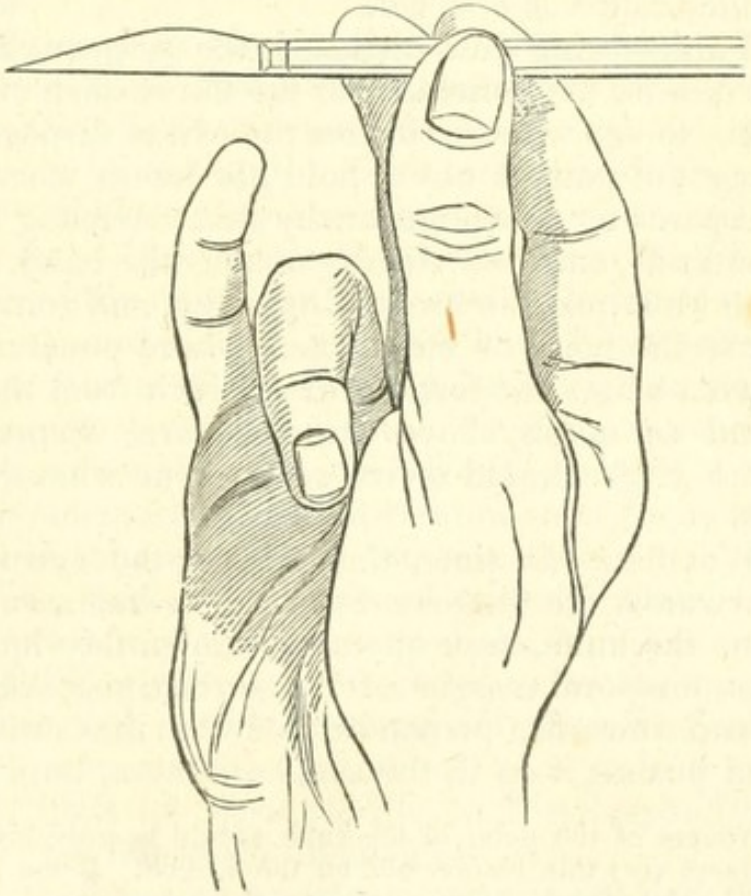
the knife is again made to pierce through the cornea from the anterior chamber, an act called *counter-puncturation*. By now continuing to push the knife onwards, it, by its increasing breadth, *cuts itself out* in the direction of the dotted line, fig. 21, and so the section of the cornea is completed. The section of the cornea thus comprehends three acts, viz., *puncturation*, *counter-puncturation*, and *cutting out*.

Fig. 21.



1326. *Method of holding the cataract knife.*—The handle is to be held not exactly in the middle, but rather nearer the blade; its flat surfaces being between the points of the fore and middle fingers on the one hand, and the point of the thumb on the other, and the general direction of the handle somewhat at right angles to the thumb. Fig. 22.

Fig. 22.



1327. By having the handle of the knife broad and flat, and by holding it in the manner just described, it is not liable to roll betwixt the fingers, and the little finger resting on the patient's cheek, all the manœuvres after puncturation, can be readily executed by the movements of the fingers alone, so that the surfaces of the blade can be kept unerringly parallel to the surface of the iris, and the base of the cornea, during the passage of its point, through the anterior chamber: consequently its edge will have no tendency, either to cut abruptly out from the cornea; or, on the contrary, to be so inclined, as to come upon the sclerotica, and cut out there.

1328. The position of the patient, whose pupils should be dilated by belladonna, (s. 1296,) assistant and surgeon being arranged as above recommended (ss. 1298, et seq.), the operation is proceeded with as follows:—

1329. *Section of the cornea downwards—Puncturation.* The surgeon holding the cataract knife* in the manner above described, and with its back upwards and horizontal, rests the hand by means of the little finger on the patient's cheek, in such a way, that the blade of the knife may be by its corresponding flat surface close in front of the cornea, and with its point as far advanced towards the nose, as it must be, when counter-puncturation is effected.

1330. Things being thus disposed, the surgeon, after touching the surface of the cornea, with the flat surface of the blade of the knife, to see whether or not the eye is disposed to start, and warning the patient not to hold his breath when the knife pierces, prepares for puncturation, by first retracting the fingers holding the knife, and then slightly turning the hand, so that the point of the knife may be brought opposite, and somewhat perpendicular to the point of the cornea, where puncturation is to be made, viz., about one-fortieth of an inch from the temporal margin, and as much above the transverse diameter. The point of the knife should therefore be somewhat deeper than the handle.

1331. Watching his time, then, when the eye is directed steadily forwards, the surgeon by a quick but assured movement, enters the knife, back upwards, one surface looking back towards the temporal margin of the cornea, the other looking forwards and inwards, perpendicularly to the surface of the cornea, and pushes it on in the same direction, until it has just

* The sharpness of the point of the knife should be previously tested, by making it pierce very thin leather put on the stretch. If the knife pierces without force, and without making any noise, the point is good.

penetrated the thickness of the cornea, and thus gained the anterior chamber.

1332. Great care should be taken not to push it farther in, to avoid spitting the iris. Should this happen, the point of the knife must be withdrawn so far, that it may get free from the iris; but in doing this, some aqueous humour is apt to escape, in which case the iris will fall before the edge of the knife, in its passage across the anterior chamber.

1333. The perpendicular direction recommended to be given to the point of the knife, in the act of puncturing the cornea, is to obviate the risk of the point of the knife being thrust obliquely into the substance of the cornea, instead of penetrating directly through its substance into the anterior chamber. That the knife has been thrust into the substance of the cornea, and not penetrated into the anterior chamber, is readily perceived by the dull-looking way in which the knife shines through, in comparison to what it does when it is fairly in the anterior chamber; and also, by the continuance of resistance to the onward progress of the knife. All this can be readily illustrated, by practising on the eye of a sheep or pig. The remedy is to withdraw the knife, and commence the puncturation anew, and with more careful observance of the necessary precautions.

1335. *Passage of the knife across the anterior chamber, and counter-puncturation.*—Immediately on puncturation being effected, the handle of the knife is to be inclined backwards, by bringing the hand back into its former position, so that the surfaces of the blade may become parallel to the iris and base of the cornea. The handle of the knife is at the same time to be inclined a little downwards, so that the point may be directed a little upwards, as if to make counter-puncturation at a point higher than is really intended, otherwise in consequence of the depression which the point of the knife necessarily experiences in its progress towards the opposite side of the cornea, counter-puncturation would fall too low, and the section of the cornea would consequently be too small.

1336. The knife, thus disposed with its point directed towards the place of counter-puncturation, is pushed steadily and quickly on through the anterior chamber, to the opposite side of the cornea, and until counter-puncturation is effected. The point of the cornea where this should take place is one-fortieth of an inch from its nasal margin, and corresponding to, or a little above, the transverse diameter.

1337. If, before counter-puncturation is effected, the aqueous

humour should escape by any accident, such as the sudden movement of the eye away from the knife, in such quantity that the iris falls forward against the cornea, further proceedings should be desisted from, and the operation deferred until the restoration of the aqueous humour, and the subsidence of the reaction, if any, which may have taken place in consequence of the simple puncturation. Or if the eyeball should roll inwards and upwards so much that the surgeon cannot see the opposite side of the cornea, and if the patient cannot turn the eyeball right, it is better to withdraw the knife than counter-puncture at hazard.

1338. *Cutting out.*—Counter-puncturation being effected, a short pause is to be made, to allow any spasmodic action of the muscles of the eyeball to subside. Preparatory to cutting out, the surgeon, having now complete command over the eyeball, makes it turn rather outwards, in order that in completing the section of the cornea, the point of the knife may not come upon, and be stopped by, the parts at the inner canthus.

1339. In pushing the knife on in order to cut out, which is to be done slowly but steadily, its edge must not be pressed down against the substance of the cornea which it is cutting, but, by depressing somewhat the handle, the back of the knife should rather be kept pressed up against the upper angle of the wound of counter-puncturation. By this means the blade of the knife is made to fill both the incision and counter-incision in the cornea, in proportion as it makes them, and thus no room is given for an escape of aqueous humour.

1340. When the knife has almost cut itself out, a pause is to be made; and if none of the aqueous humour has yet escaped, some may now be allowed to do so. After this, the tag of the cornea which remains is to be slowly and cautiously cut by a sawing motion. The upper eyelid is at the same time to be let go, and as soon as the tag is cut, and the knife withdrawn, the lower eyelid is to be allowed to rise, care being taken that its border does not interfere with the corneal incision.

1341. Whilst the cutting out is thus being accomplished, the patient is to be cautioned not to hold his breath, or make any effort to squeeze the eyelids together, for at this moment the lens, with a portion of vitreous body, if the latter is at all in a dissolved state, is apt to burst out. If there is much reason to fear this, it is advisable to leave the tag of cornea uncut, allow the eyelids to close, and cut the tag only after laceration of the capsule has been effected.

1342. If, in cutting out, the iris should fall against the edge of the knife, in consequence of premature escape of aqueous humour, the surgeon should pause, and whilst pulling the eye forwards with the whole knife, apply the point of the middle finger against the cornea, and try by gentle pressure to disengage the iris from the edge of the knife, and to keep it so whilst completing the section. If this does not succeed, and if much of the iris lies before the edge of the knife, this instrument should be withdrawn, and the section completed as well as possible with the probe-pointed knife, or Daviel's scissors. But if a small part merely of the iris falls before its edge, the knife may be pushed on, even although the piece of the iris be cut off. If in consequence of this excision of a piece of the iris an opening is made, this and the pupil should be thrown into one by dividing the isthmus before concluding the operation.

1343. *Section of the cornea upwards.*—This has of late years been the method preferred. The procedure differs from that above described only in the circumstances, that the edge of the knife is directed upwards—the back, which is directed downwards, as in the former case, being horizontal—and that the points of puncturation and counter-puncturation should be *below*, instead of *above*, the transverse diameter of the cornea. In this case also greater care is required at the time of completing the section of the cornea, in withdrawing the knife, and allowing the upper eyelid to fall down, for in consequence of the tendency of the eyeball to roll up suddenly, the flap of the cornea is apt to be caught either by the knife or by the edge of the upper eyelid, and to be folded down.

1344. *Section of the cornea in its outer and lower half.*—This was the section generally adopted by the first Wenzel, (who used a double-edged knife for the purpose,) and has again been pretty extensively practised by Professor Rosas, of Vienna, (who uses a Beer's knife, with a sharp-cutting back,) and the late Mr. Tyrrell, who used the common Beer's knife. To effect the section, puncturation is made on the temporal side, 45° above the horizontal diameter of the cornea, and counter-puncturation below the horizontal diameter on the nasal side; so that of the semicircular incision, one-fourth is above, and three-fourths below, the horizontal diameter.

1345. *Section of the cornea too small.—How to be remedied.*—The section of the cornea may prove too small, either in consequence of the incision being too much within the margin of the cornea, thus—fig. 23,

Fig. 25.

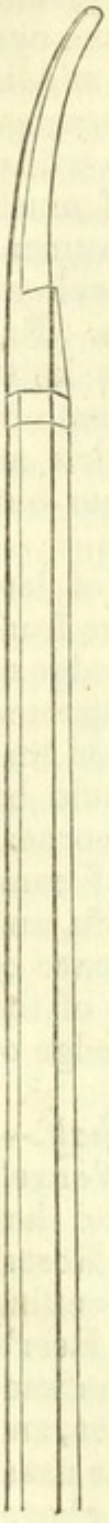


Fig. 23.

Fig. 24.

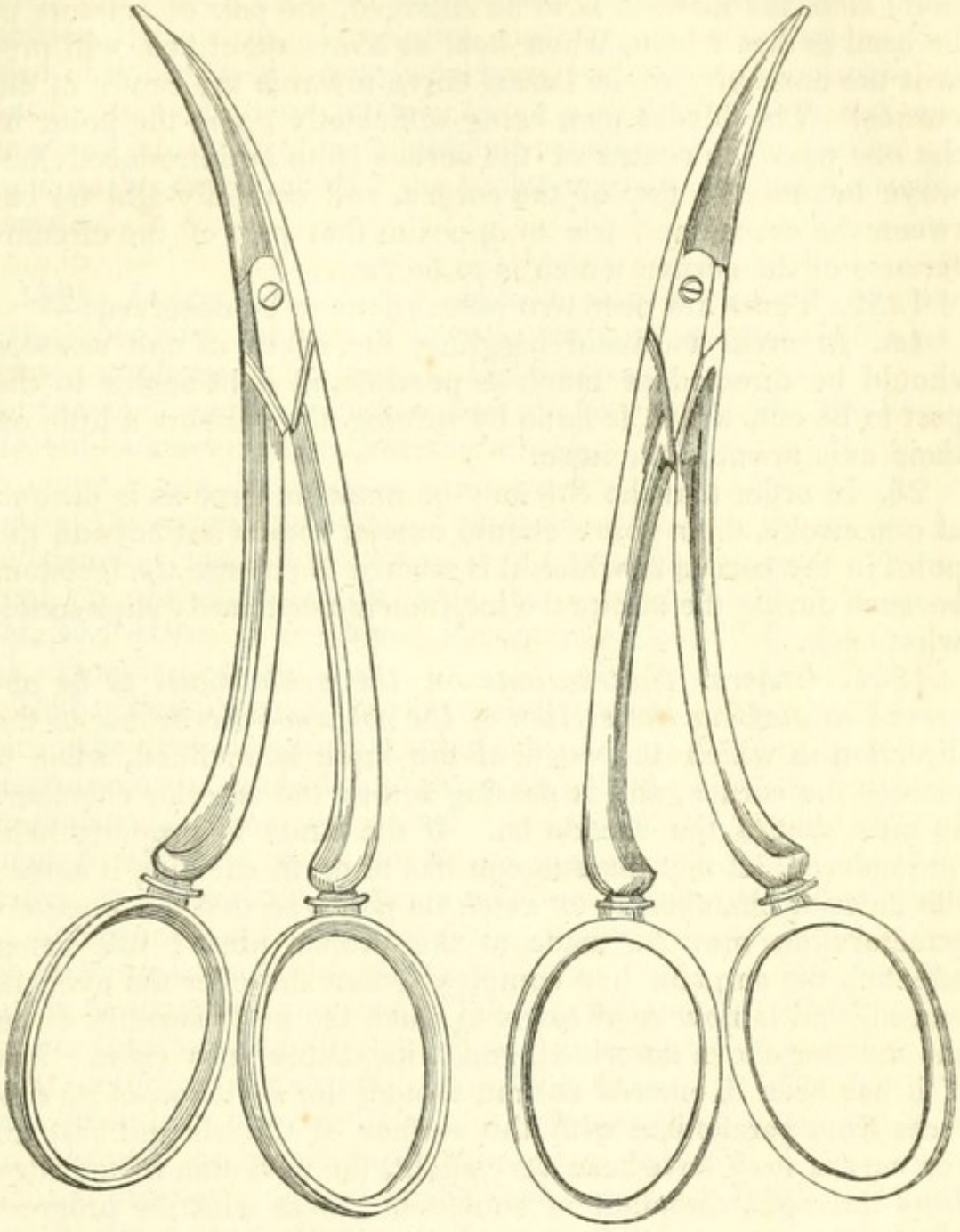
or not extending to the half of the circumference, as above, fig. 24. The first-mentioned defective section can scarcely be remedied, the second may be so very readily.

1346. For enlarging the section of the cornea when too small, a small probe-pointed knife, such as is here represented, fig. 25, is the instrument most recommended, because the incision made by it heals better than one made by scissors. If, however, the surgeon finds he can effect his purpose more easily by means of Daviel's scissors, the disadvantage attending an incision made by them is, on the whole, not so great as to deter from their use.

1347. When the knife is used, it is held as the cataract knife, and it is introduced through the incision of the cornea flatways, its round and blunt point gliding against the posterior surface of the cornea, contact with the iris being avoided as much as possible, and its edge directed against the angle where the incision is to be enlarged. By withdrawing the knife a little, the cornea is cut; the knife being again pushed in, it is again a little withdrawn, and an additional cut made and so on, cutting only on withdrawing the knife, until the wound is sufficiently enlarged, and that as much as possible in a line concentric with the margin of the cornea.

1348. When the scissors are had recourse to, Daviel's should be those employed. Daviel's scissors have a double curve, to adapt them to make as direct a snip of the cornea as possible. Two pairs bent in opposite ways are consequently required. One pair to enlarge the incision, supposing the section downwards, on the temporal side of the right eye, and on the nasal side of the left; or supposing the section upwards, to enlarge the incision on the temporal side of the left eye, and on the nasal side of the right. Another pair to meet the opposite circumstances. Figures 26 and 27.

Fig. 26. Fig. 27.



1349. The way in which the scissors are to be held is this:—The thumb in one ring, the ring-finger in the other, the point of the fore-finger on the joint, the middle finger on the branch in the ring of which the ring-finger is. The thumb and ring-finger may be inserted into the rings, either from the convex or concave surface of the scissors, according to circumstances; but the convexity of the instrument ought of course always to be towards the eye.

1350. Supposing the eye operated on to be the left, that the

section of the cornea is downwards, and that it is on the temporal side, the incision is to be enlarged, the pair of scissors to be used is that which, when held as above described, will present the concavity of its lateral curve towards the centre of the cornea. The blades then being sufficiently open, the point of the one next the centre of the cornea is to be introduced flatways behind the flap of the cornea, and carefully slid up between the cornea and iris to opposite that part of the circumference of the cornea which is to be cut.

1351. There are now two precautions to be observed:—

1st. In order to avoid haggling, the edges of the scissors should be directed, as much as possible, at right angles to the part to be cut, which is done by turning the scissors a little on their axis towards the nose.

2d. In order that the cut may be made as large as is desired at one stroke, their points should extend somewhat beyond the point in the cornea to which it is wished to enlarge the incision, because during the stroke the instrument necessarily slips somewhat back.

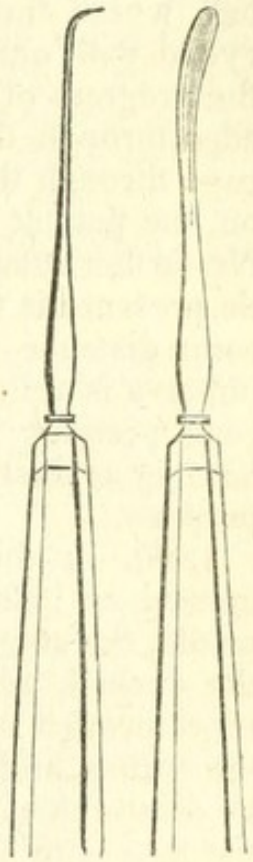
1352. *General observations on the precautions to be observed in making the section of the cornea.*—According to the direction in which the edge of the knife is inclined, when it pierces the cornea, and is passing across the anterior chamber, so must that of the section be. If the knife is properly held and entered, all that the surgeon has to do in carrying it across the anterior chamber, is to watch its point, so that the counterpuncturation may be made at the proper place; this being effected, the surgeon has complete command over the eyeball, and all that is now required is to push the knife steadily on in the manner above described, and it inevitably goes right. But if it has been ill entered at first, though the deviation of its surfaces from parallelism with the surface of the iris and base of the cornea may have been very slight, the deviation of the edge from the right direction of course increases with the progressive movement of the knife, and then if attempts are made to bring the knife again into a proper direction, they cause the opening in the cornea already made to gape, and thus the aqueous humour is allowed to escape, so that the iris falls against the edge of the knife; and besides all this, undue and irregular pressure is exerted on the contents of the eye, so that the completion of the section of the cornea is perhaps followed by the bursting forth of a quantity of vitreous humour, with or without the lens.

1353. If the faulty direction of the edge of the knife is such

that it will cut out too soon, so that the section will turn out too small, the operator should nevertheless proceed, and enlarge the incision afterwards. If, on the contrary, the direction of the edge of the knife is too much inclined towards the sclerotica, so that if the knife were pushed on it would cut both it and the conjunctiva, it should be withdrawn in time, and the section of the cornea completed with the probe-pointed knife or Daviel's scissors.

1354. *Laceration of the capsule, and extraction of the lens, when the downward section has been made.*—Different shaped instruments are in use for lacerating the capsule; sickle-shaped, or straight broad-pointed cataract needles, but the simplest instrument is one like a common sewing needle, bent at the point (fig. 28). The instrument, of whatever form it may be, is commonly fixed on the same handle with the curette, (fig. 29,) which is employed for assisting in the extraction of the lens.

Fig. 28. Fig. 29.



1355. The assistant having gently raised the upper eyelid, without making the slightest pressure on the eyeball, and the patient being directed to turn the eye a little upwards, the surgeon with one hand depresses the lower eyelid, and through it makes gentle pressure on the lower part of the eyeball, and with the other slips the bent needle with the convexity of its curve first behind the flap of the cornea, until opposite the pupil, and then up as far as he can behind the iris. This being done, he rotates the handle of the instrument so as to turn the point against the upper part of the cataract. By a rotatory movement now of the handle whilst held horizontally, he makes the point of the instrument lacerate the capsule from above downwards as far as the middle. He next, in a similar manner, lacerates the lower part of the capsule by a stroke from below, and before withdrawing the instrument, he makes in that part of the capsule exposed by the pupil several up and down strokes with the point of the instrument.

1356. In its natural state, the capsule, when punctured merely, will readily tear and allow the lens to escape; and although in lenticular cataract the same thing will often take

place, it is proper not to trust to this, but to take pains to lacerate the anterior capsule freely, as just described.

1357. The capsule having thus been freely lacerated, the instrument is to be carefully withdrawn with its convexity foremost, so as not to hook the iris or cornea.

1358. It often happens that immediately on the laceration of the capsule, the lens begins to escape; if it does so, the surgeon will at once proceed to help it out in the manner to be described below; but if it does not, the eyelids are to be allowed to fall together for a minute or so before the extraction is proceeded with.

1359. In the former case, the assistant still keeps the upper eyelid carefully elevated without making pressure on the eyeball, whilst the operator, continuing to keep down the lower eyelid with one hand, takes the curette in the other, and watches the progress of the escape of the lens, the advance of its lower edge through the pupil, its clearing the pupil, and its final escape through the incision of the cornea. Whilst this is going on, the patient is to be directed to turn the eyeball upwards. No farther interference may be required, but if necessary, gentle pressure is to be made on the lower part of the eyeball, at some distance from the margin of the cornea, where the conjunctiva is reflected, and this may be done either by the surgeon pressing the margin of the lower eyelid which he is holding against the eyeball, or employing the curette for the purpose.

1360. In the latter case, after the pause, the eyelids are opened as before, and the patient being directed to look upwards, the surgeon makes gentle pressure on the lower part of the eyeball, when the lens will be seen to slide by its lower edge through the pupil, which it stretches, to raise the flap of the cornea, and finally make its escape through the incision. If its escape through the incision of the cornea should be stopped, the lens is to be helped out by a hook or by the curette, from between the lips of the incision.

1361. *Laceration of the capsule, and extraction of the lens when the upward, or the downward and outward section has been made.*—This part of the operation is effected in a manner essentially similar to that above described for the downward section; only in the one case, the laceration of the capsule is to be made from below upwards, and in the other from above downwards to below and outwards. In the extraction of the lens again, the patient should in the one case be directed to turn the eye downwards, and any pressure on the eyeball

which may be necessary, is to be made with the curette on its upper part, whilst in the other the patient turns the eye inwards and upwards, and pressure with the curette is made on the lower and outer part of the eyeball.

1362. In its passage out, some of the soft exterior of the lens is often stripped off and retained in the aqueous chamber. No attempt need be made to remove this, as it becomes by and by absorbed. If, however, the lens should break in pieces, and a considerable piece be left in the anterior chamber, it should be scooped or hooked out.

1363. After a few minutes' rest to the patient, the surgeon gently opens the eyelids to see if the iris and flap of the cornea are in their proper position, and the pupil clear. If the iris and pupil do not appear to be quite right, the upper eyelid is allowed to close, and is to be rubbed gently with the finger over the front of the eyeball, and then quickly opened to the light, when the iris will contract, and will thus, along with the pupil, be brought into a proper position. This being the case, and the flap of the cornea in proper apposition, the eyelids are to be closed—first the upper and then the lower.

1364. If after laceration of the capsule, and moderate pressure on the eyeball, the lens does not advance, the surgeon must consider whether or not the section of the cornea is large enough, and whether or not the capsule has been sufficiently lacerated. If he is assured that everything is right in these two respects, he should consider whether, in consequence of adhesion, &c., the pupil is not restrained from yielding to allow of the passage of the lens through it. If this appears to be the case, the adhesions ought to be divided, and the pupil enlarged with Maunoir's scissors. (Fig. 30.) If still the cataract does not advance, an attempt is to be made to extract it with a hook. (Fig. 31.) In such a case, if any vitreous humour escape, which it is apt to do, the lens will fall back and sink below the pupil.

1365. Protrusion of the iris may take place after the lens has escaped. If uncomplicated with escape or protrusion of vitreous humour, it is in general readily remedied by drawing down the upper eyelid, and after rubbing the finger over it at the place corresponding to the cornea, suddenly raising it, and thus exposing the eye to the light. By this means, contraction of the pupil is excited, and the protrusion drawn in. If this does not succeed, attempts should be made to replace the protruded iris with the curette, and by a repetition of the above

Fig. 30.

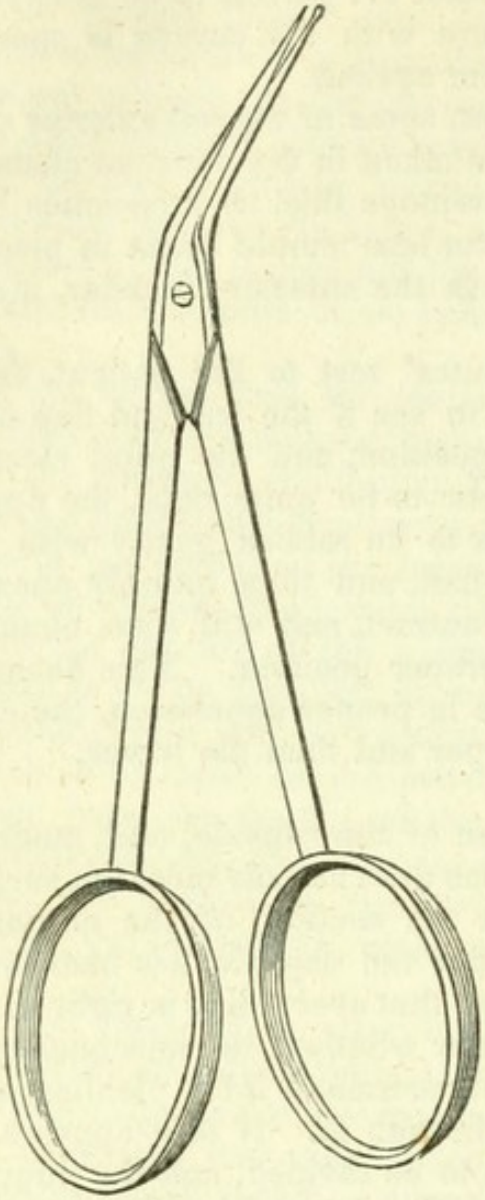
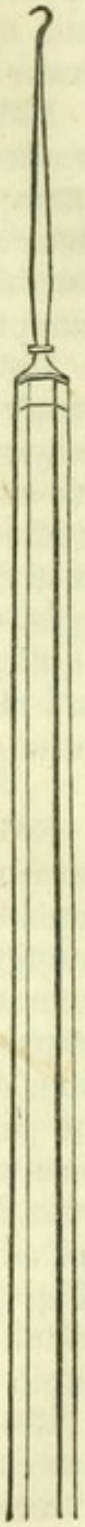


Fig. 31.



manœuvre. If the protruded iris appear to have aqueous humour pressing on it from behind, a small snip is to be made in it with scissors to allow the aqueous humour to escape; after that the iris will more readily return into its natural situation.

1366. Of all the untoward circumstances which may occur in performing the operation of extraction, the bursting out of the vitreous humour in greater or less quantity is assuredly that most to be dreaded. For though it may be promoted by undue pressure on the eyeball, either by the operator or assistant, restlessness of the eye or spasmodic contraction of the muscles of the eyeball at the time of completing the section of the cornea or afterwards, the con-

dition on which it essentially depends is a softened or dissolved state of the vitreous body and its connections.

1367. When the vitreous body is of its natural consistence, and its connections unweakened, as in young persons, there is little danger of its escape,—nay, if its escape were desired, it would perhaps not be easy to produce it by any ordinary pressure. To be convinced of this, take the eye of an animal newly slaughtered, make a free section of the cornea, and then try to squeeze out the vitreous humour. It is only when the connections of the vitreous body have become dissolved by keeping the eye for twenty-four hours or so after death, that the vitreous body can be readily squeezed out. With the advance of age, however, softening of the vitreous body and its connections, as above observed (s. 1088), tends to take place; hence it is that in the operation at present under consideration, viz., extraction of the common hard lenticular cataract of old persons, bursting out of the vitreous humour, with or without the lens, is so apt to occur.

1368. *Bursting out of the lens, together with a greater or less quantity of vitreous humour immediately on completing the section of the cornea.*—In this case the operation is completed, and whether it is likely to be followed by a good or bad result will, in a great measure, depend on the quantity of vitreous humour lost. If the quantity does not exceed one-fourth or one-fifth, it is possible for the eye to recover with pretty good vision; if more is lost, such an event is not to be hoped for.

1369. In any case the mode of procedure is to close the eyelids immediately, and after some time, cautiously open them to see how the flap of the cornea lies, and whether any of the hyaloid or the iris, as it is very apt to be, is protruded. If so, an attempt is to be made by the manœuvres above described, to replace the iris, and bring the edges of the corneal wound together, as far as can be done preparatory to bandaging the eye. A portion of the hyaloid, however, may continue to protrude, and thus prevent the replacement of the iris and accurate closure of the corneal wound. All that can be done now is to close up the eyelids, and leave things to nature. Under the most favourable circumstances, the wound of the cornea heals slowly, with a broad cicatrice, the iris and hyaloid being involved in it, and the consequence is that the pupil is dislocated and distorted. Still, good vision may be restored.

1370. *Vitreous humour may begin to escape without the lens.*—In this case the small hook is immediately to be intro-

duced, and the cataract hooked by its lower edge, and brought out as quickly as possible, a proceeding which demands great dexterity, coolness and circumspection on the part of the operator.

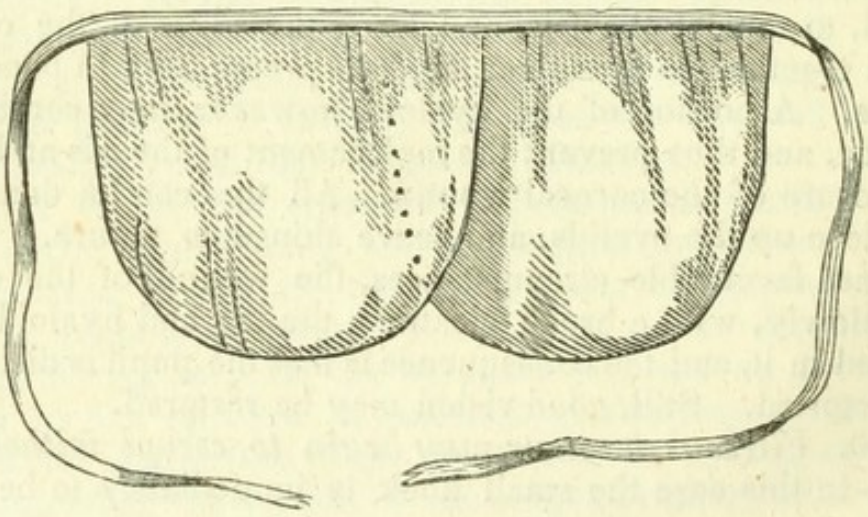
1371. If the cataract should sink in the vitreous humour nearly or quite out of sight, some attempt may be made to hook it out, but not persisted in if unsuccessful. In this case it must be left, and the eye closed, otherwise the complete evacuation of the vitreous humour will inevitably take place.

1372. *Bandaging of the eye and treatment after the operation.*—The flap of the cornea lying in proper apposition, the eyelids are to be closed. The upper eyelid is allowed to fall slowly over the eye, when the upper section has been made. If it has been the lower section, it must be carefully seen that the edge of the lower lid does not interfere with the lower part of the flap; if it does so, the lower lid should be kept somewhat retracted by a strip of plaster, extending from it down on the cheek.

1373. Both eyes are to be kept closed, and for this purpose a light compress is to be laid over them when closed, and secured by a bandage, the middle of which is laid over the nape of the neck, where it may be sewed to the back of the night-cap, and the ends brought round over the eyes, crossed on the forehead, and then pinned to the sides of the night-cap.

1374. Another method of bandaging the eyes is to apply over them strips of court plaster, extending from the eyebrows to the cheeks, in order to keep them closed, and then hanging over them a fold of soft linen, to which is fixed a tape to tie round the head, thus:

Fig. 32.



1375. The patient need not be put to bed immediately after the operation, unless he desires it, but may recline on an easy chair or sofa, until about his usual bed-time. The room should be somewhat darkened, and perfect quietness observed in the house. The patient should refrain from speaking, and endeavour to keep himself as composed as possible. His food should be so prepared as not to require chewing.

1376. At bed-time an opiate should not be omitted, if the patient is in the habit of taking one to procure sleep; if not in the habit, an opiate is to be given only if the patient is restless and not disposed to sleep.

1377. Some practitioners make it a practice to bleed the patient to ℥viij or ℥xvj, on the evening of the operation, if he has not been bled before; but this is unnecessary, if the patient is, as he should be, in a proper condition at the time of the operation. It is time enough to take blood when symptoms of undue inflammation, such as pain in the eye, redness and swelling of the eyelids, begin to manifest themselves; and these symptoms ought to be carefully watched for from day to day. The third or fourth day is the time at which they most generally occur.

1378. During the night the patient should be watched, lest by turning in bed or rubbing the eye with his hand while asleep, the eye should be injured. A good precaution is to secure the patient's hands to his side, so far that they may be prevented from being carried to the eye.

1379. The patient should lie on his back until at least the third day, when, if matters go on well, he may sit up in bed. On the fourth day, he may be allowed to get out of bed for a few hours in the afternoon.

1380. During the 24 or 48 hours succeeding extraction, the patient feels as if he had received a blow on the eye, and also from time to time experiences a slight smarting and pressing sensation, which is always relieved when a watery fluid, partly tears, partly aqueous humour, escapes from the eye. From these and encrusted Meibomian secretion, the eye is to be from time to time carefully cleansed with tepid water and a soft linen rag. The eye is not to be opened until the fourth or fifth day, but that things are going on well may be inferred if there is no pain, and the upper eyelid neither red nor swollen. On the fourth day, after the borders of the eyelids have been cleansed from any adherent matter, by means of tepid water, and a bit of soft lint, as just mentioned, and the strips of black court plaster, if they have been used, removed, the eye may be opened

and looked at, but closed again, and so on from day to day, until the ninth or tenth. After that, the eyes being protected by a shade, the patient may freely open them.

1381. The corneal incision heals in the course of two or three days or even sooner, if there is nothing to prevent union by the first intention, such as prolapsus iridis, with or without prolapse of the vitreous body, or non-apposition of the edges of the incision. The incision, when enlarged by scissors, is apt not to heal completely by the first intention.

1382. When there has been prolapse of part of the vitreous body at the time of the operation, after some days it presents itself as a viscid puriform slimy mass, hanging from the wound, and extending into the pupil. It by and by drops away, what of it remains within the eye gradually disappearing, and the pupil becoming black, though distorted, and drawn towards the corneal wound, which is healed by a broad cicatrix. The vision, however, may be good.

1383. *Inflammation, &c., occurring in consequence of the operation.*—Though the cataract may have been extracted without accident, and though when the eye is bound up everything appears right, untoward circumstances may yet occur in the course of the following seven days. The most to be dreaded is inflammation, both external and anterior-internal, and which may be acute or slow, in either case impeding the union of the corneal incision and disposing to protrusion of the iris.

1384. In the *acute inflammation*, along with severe pain, the eyelids are swollen, red, and tender to the touch, the conjunctiva is red, and perhaps in a state of inflammatory chemosis, the edges of the corneal incision are opaque, swollen, and everted, and the iris is discoloured.

1385. In the *slow inflammation*, which is apt to occur in old, weakly persons, the pain may not be less severe than in the acute, but the swelling of the eyelids is merely œdematous, and the chemosis of the conjunctiva serous. The edges of the corneal incision are whitish-gray ; the iris is discoloured ; pulse small and feeble ; the patient is low and restless.

1386. The acute inflammation requires to be treated actively by venesection and mercury, with low diet, and laxatives. Under the circumstances, the use of mercury has been dreaded, lest it might check the adhesive process, and thus prevent union of the section of the cornea. Experience, however, shows that after the operation of extraction the patient may be put under the use of mercury, without any prejudice to the union of the

section of the cornea, but the reverse; for the mercury, reducing inflammation, promotes adhesion.

1387. The slow inflammation is equally dangerous with the acute, but requires to be treated on an opposite plan, viz., with cordials and generous diet.

1388. *Secondary prolapsus iridis.*—It has been above stated that prolapsus iridis is apt to take place at the time of the operation (*primary prolapsus iridis*); but though such has not occurred, the eye is not yet safe from prolapsus iridis, for in the course of the three or four days following the operation, the iris may yet protrude. This secondary prolapsus iridis may be occasioned by the bursting open of the half-healed corneal wound in consequence of some such effort as coughing; but it is generally owing to non-union of the corneal incision, and swelling of the iris, occasioned by the supervening inflammation. Behind the prolapsed iris there may be also protrusion of the vitreous body.

1389. If there is much inflammation, nothing should be done directly, except puncturing or cutting off a piece of the protruded iris, if it appears to be much distended by fluid behind. As the inflammation subsides, the protrusion sinks, and the iris will be involved in the cicatrice of the cornea, which will be broad and unsightly, whilst the pupil will be displaced and contracted, or altogether closed. Touching the protruded iris once a day or every second day with the nitrate of silver pencil, will promote cicatrization. This may even be done from the first, if, instead of inflammation, there is defective action in the part.

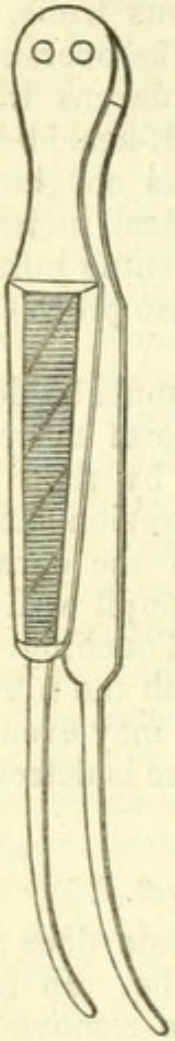
Extraction of capsulo-lenticular cataract.

1390. It is well known that an opaque capsule does not become dissolved and absorbed as the lens may be. In capsulo-lenticular cataract, therefore, it is necessary to remove the opaque capsule as well as the lens, out of the axis of vision.

1361. The section of the cornea being made in one or other of the ways above described, an attempt may be made before extracting the lens, to cut out by scratching with the point of the needle, a circular piece from the middle of the opaque anterior wall of the capsule. If this does not succeed, the lens is to be extracted in the usual way; and if the shreds of the opaque capsule occupy the axis of the pupil, an attempt may be made to extract them. For this purpose the slender-bladed hooked forceps is employed, (fig. 33.) This instrument, closed, being introduced through the incision of the cornea, and its point

passed through the pupil, is opened, and the shreds of opaque capsule laid hold of, cautiously detached by a gentle twitch, and extracted. If there be any indications of a dissolved state of vitreous body, this attempt to remove an opaque capsule is not safe. It is better to leave it, and by a subsequent operation with the needle, displace it from the axis of vision.

Fig. 33.



Extraction of siliquose cataract.

1392. For the extraction of siliquose cataract a section one-third of the circumference of the cornea is sufficient. The section being made, the slender-bladed hooked forceps (fig. 33), is introduced, the cataract seized, cautiously detached from its connections, by being twisted and moved in different directions, and extracted.

1393. Dr. Mackenzie recommends the siliquose cataract to be first detached and pushed into the anterior chamber by means of a cataract needle, introduced through the sclerotica, then the small section of the cornea to be made, a hook introduced, the capsule laid hold of and extracted.

1394. In cases of capsulo-lenticular and siliquose cataract, the same good vision is not in general restored by extraction, as in cases of common hard lenticular cataract; but this is because the retina in those cases is not in general quite so sound. The result may be as good, however, as is consistent with the nature of the case, and better than could be obtained by any other mode of operating.

Advantages and disadvantages of the three different sections of the cornea.

1395. The section downwards is on the whole more easily made than that upwards; the lower half of the cornea in general admitting of being better exposed, and thus more accessible to the knife than the upper half.

1396. When the section of the cornea downwards is completed, the knife is more readily withdrawn, and the upper eyelid can be allowed at once to fall gently down over the flap

without disturbing it; whereas, when the section upwards is completed, more nicety is required in withdrawing the knife and letting down the upper eyelid, in order that its border may not catch the flap of the cornea, and turn it down.

1397. When the section downwards has been made, the escape of the lens takes place more easily, and less injuriously to the iris and corneal flap, than when the section upwards has been made, the tendency of the eyeball to roll upwards and inwards being a great impediment to the escape of the lens in the latter case.

1398. Escape of vitreous humour, it has been thought, takes place more readily when the section is downwards than when it is upwards, in consequence of the operation of gravity, but this is not the case. It has been above seen that this accident is owing to the vitreous body being in a dissolved state, and thus readily squeezed out by the spasmodic action of the muscles of the eyeball, an effort which is produced in whatever direction the section may be made, and whether the patient be lying horizontally or seated upright.

1399. Nor is prolapsus iridis more prone to take place when the section is downwards than when it is upwards; but if it does take place when the section is downwards, the bad cicatrice which results is more readily seen, interferes more with vision, and if the pupil be closed, an artificial pupil cannot be made in so advantageous a situation afterwards. The contrary of all this is the case when the section is upwards: a bad cicatrice from protrusion of the iris and vitreous body is not seen, nor does it interfere with vision, and, supposing the pupil closed, the eye is in a better state for artificial pupil.

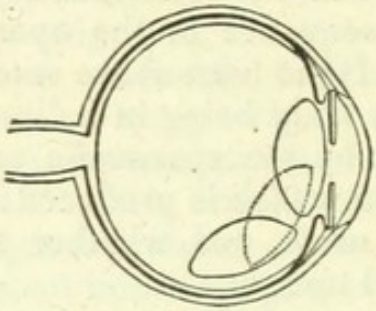
1400. The flap of the cornea when the section is upwards, is kept in good apposition by the upper eyelid, whereas, when the section is downwards, the tarsal border of the lower eyelid is apt to displace the edges of the incision, and so give rise to inflammation, prolapse of the iris, &c. This may, however, be obviated by careful bandaging.

1401. The section downwards and outwards has the advantages of the other two sections, with the additional one, according to Mr. Tyrrell, viz., that when prolapsus of the iris takes place after the operation to such an extent as to displace the pupil, the situation of the pupil downwards and outwards admits of more useful and perfect vision than when it is displaced upwards.

DISPLACEMENT OF THE CATARACT AND ITS MODIFICATIONS.

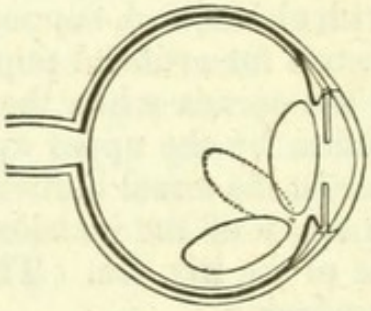
1402. There are two modifications of the operation of displacement, viz., *couching* or *simple depression, and reclination.* In the one case the displaced lens has its anterior surface downwards and somewhat forwards,—its posterior surface upwards and somewhat backwards,—its superior edge forwards and somewhat upwards,—its lower backwards and somewhat downwards, thus:—

Fig. 34.



In the other case, the displaced lens has, at the same time that it was depressed, been made to turn back on its lower and outer margin, so that, its upper edge being forced back into the vitreous humour, its anterior surface comes to be uppermost, its posterior surface directed downwards, thus:—

Fig. 35.

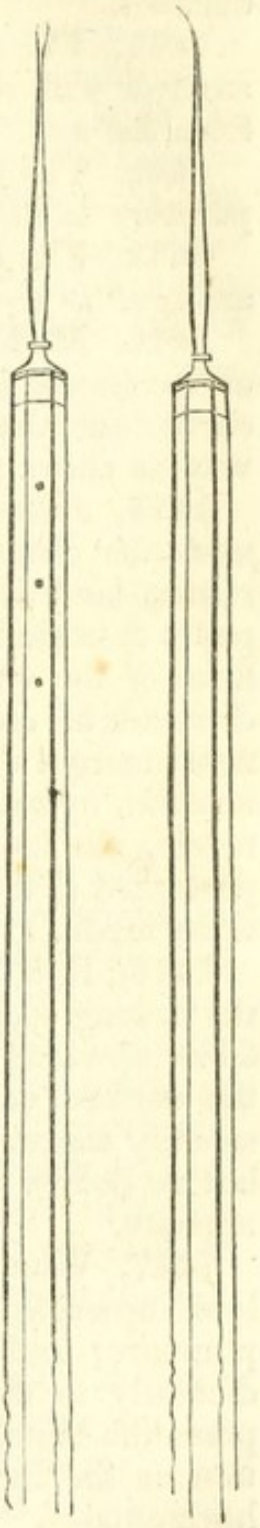


1403. Both couching and reclination of the cataract may be effected by introducing the cataract-needle, either through the sclerotica, that is, by *sclerotic puncturation* (*scleroticonyxis*), or through the cornea, that is, by *corneal puncturation* (*keratonyxis*).

1404. Reclination effecting all that couching can, and being in every respect a better operation, couching has altogether fallen into disuse. It is, therefore, unnecessary to say more about it here.

1405. *Indications for the operation of displacement.*—The kind of cataract best fitted for displacement is the same as that best fitted for extraction. Whether or not, therefore, displacement should be performed instead of extraction, will depend upon the absence of the conditions necessary for, or at least favourable to the successful performance of extraction, (s. 1310,) or the existence of the conditions unfavourable to or wholly forbidding it, (s. 1311.)

Fig. 36. Fig. 37.



1406. *Prognosis.*—The success of displacement is apt to be marred by the occurrence of posterior internal inflammation either of an acute character, supervening immediately on the operation, or of a slow destructive character, coming on some time subsequently, and leading to loss of sensibility of the retina. The displaced lens, if disengaged from its capsule, may eventually disappear, or be reduced to a small size by solution and absorption. In many cases, however, it does not dissolve, and is always apt to rise again.

1407. *Instrument and dressing.* — The only instrument required is a lance-shaped cataract-needle, either straight or curved. The sharpness of its point is tested in the same way as above mentioned for the cataract-knife. The dressings are the same as above mentioned for extraction.

Reclination by sclerotic puncturation.

1408. For the convenience of description, the operation may be supposed to be divided into different steps.

1409. *The first step* comprehends the puncturation and the introduction of the needle into the posterior chamber, so that its lance head is seen through the pupil. The point of puncturation should be about three-twentieths of an inch from the temporal margin of the cornea, and in the line of its transverse diameter.*

* The direction to introduce the needle either above or below the transverse diameter of the eye is that which is most generally given; and the

1410. *The second step* comprehends the reclination of the cataract.

1411. *The third step* comprehends the free laceration of the anterior wall of the capsule, and the withdrawing of the needle from the eye.

1412. The pupils of the patient should be well dilated preparatory to the operation.

1413. *The position of the patient, assistant and operator*, is arranged as above recommended, (ss. 1298, et seq.)

1414. *Method of holding the cataract needle.*—The handle of the needle is to be held between the fore and middle fingers on the one hand, and the thumb on the other, much in the same way as above recommended for the cataract knife.

1415. *Puncturation and introduction of the needle into the posterior chamber.*—The surgeon thus holding the needle, and resting his hand by the little finger on the patient's cheek, disposes it in such a way, that the blade of the needle is close in front of the cornea, in a line corresponding to the transverse diameter of the latter, and its point extending to opposite the nasal margin of the dilated pupil. He now prepares for puncturation, by retracting the fingers holding the needle, and slightly turning the hand, so that the point of the instrument may be presented to the point of the sclerotica, where puncturation is to be made.

1416. If it be a straight needle that is used, its point, with the cutting edges looking to and from the cornea, the flat surfaces upwards and downwards, is directed perpendicularly to the surface of the eyeball at the place above-mentioned, and steadily thrust in a direction towards the centre of the eyeball, but no deeper than until the lance head of the instrument disappears.

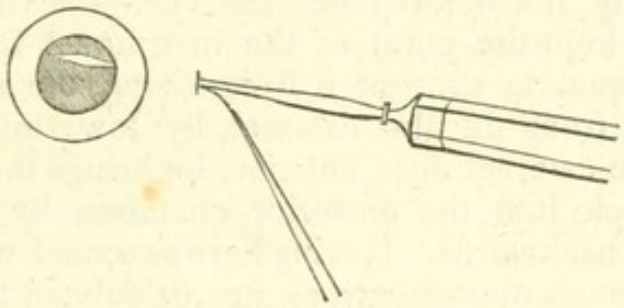
1417. When a curved needle is used, its convexity should look upwards, and its concavity downwards in making the puncture; and in order that the point may be applied perpendicularly to the place to be punctured, it is necessary to depress the handle of the instrument; but, of course, in proportion as the instrument penetrates, the handle is raised to the horizontal.

1418. The handle of the instrument is now to be rotated

reason assigned for it is, that the long ciliary artery runs in the line of the transverse diameter; but as at about a quarter of an inch from the iris, the long ciliary artery of the temporal side divides at an acute angle into two branches, an upper and a lower, it is obvious that the artery cannot be touched, and the surest way to avoid the branches is, to enter the needle as above recommended.

one quarter round its axis, so as to bring the cutting edges to look upwards and downwards, its surfaces backwards and forwards; or if the needle be a curved one, the convexity of the curve forwards, the concavity backwards. The handle is at the same time inclined well back towards the temple of the patient, in order that the lance head of the instrument may be so directed, that when pushed on, it will pass between the ciliary body and the circumference of the lens into the posterior chamber, when it will be seen through the pupil with one surface looking forward, the other towards the cataract, and its edges upwards and downwards. Fig. 38.

Fig. 38.



1419. In conducting the point of the needle between the ciliary body and the circumference of the lens, care should be taken not to spit the ciliary body on the one hand, or the lens on the other. If this should occur, the needle ought to be a little withdrawn, to get its point free again, before pushing it on. In entering the posterior chamber, the point of the needle is apt to spit the iris, especially if the needle be a straight one. The remedy for this, also, is to withdraw the instrument, until its point gets free, when it may again be pushed on. The importance of having the point of the needle free is evident. Again, the point of the needle may be made to project through the pupil, and spit the inner surface of the cornea.

1420. *Reclination of the cataract.*—Being sure that the point of the needle is free from entanglement, the surgeon applies its lance head flat against the lens, a little above its transverse diameter, (if the needle is a curved one, it is by its concave surface that its lance head is to be applied to the lens,) and then by moving the handle of the instrument gently forwards a little, he presses back the upper part of the lens, in order to loosen the connections of the cataract, and to see that there are no adhesions between it and the iris. There being none, he continues to press back the lens steadily, but slowly. When

the upper part of the lens has yielded to this backward pressure, he rotates the needle slightly to keep it flat on the surface of the lens, and then presses the latter downwards and backwards, by gently raising the handle of the instrument upwards and forwards. The lens being thus depressed, is to be moved a little backwards, if its lower edge now become anterior should appear to press on the iris or ciliary body.

1421. If the needle used is a curved one, it will be necessary in order to complete the depression, to apply the convexity of its lance head to the cataract. This is done, by depressing the handle a very little, so as to lift the lance head from off the cataract, and then rotating it one-half round its axis.

1422. *Laceration of the anterior wall of the capsule, and the withdrawing of the needle from the eye.*—Having for half a minute or so, kept the point of the instrument resting on the depressed cataract to prevent it from rising, the surgeon now lifts it slowly from off the cataract, by lowering the handle. Seeing that the cataract does not rise, he brings the head of the instrument back into the posterior chamber, by moving the handle a little backwards. Having here executed with the point of the needle such movements as are calculated to ensure the laceration of the anterior wall of the capsule, the surgeon still retains the instrument within the eye for half a minute longer. The cataract remaining depressed, the needle may now be withdrawn from the eye, by a series of manœuvres exactly the converse of those performed in introducing it. This is especially to be attended to, when its head comes to the puncture in the coats; here it is to be so rotated, that the surfaces shall be above and below as at the introduction of it, and then it is to be drawn out at right angles to the surface of the sclerotica, for which purpose, when the needle is curved, its handle must be depressed in proportion as the head is withdrawn.

1423. If instead of being hard, as was supposed, the cataract should be found friable, breaking under the needle, reclination ought not of course to be persisted in, but the anterior wall of the capsule is to be freely lacerated, and the lens left to be dissolved and absorbed; in short, division is to be substituted for reclination.

1424. Again, should it happen that the lens is fluid, and that when the capsule is opened by the needle it escapes, and mingles with the aqueous humour, rendering it turbid, all that remains to be done, is immediately to lacerate the anterior wall of the capsule as freely as possible.

1425. If adhesions are found to exist between the iris and anterior wall of the capsule, they are to be separated if slight; if not, they must be left, and a central opening made in the anterior wall of the capsule, and the lens, after the posterior capsule is lacerated, is to be reclined. Division, however, if the case admits of it, would be better.

1426. Reclination as now described, is in general readily effected in the common lenticular cataract of old people; but sometimes the cataract rises as soon as the point of the needle is withdrawn from it, and this over and over again. Such a cataract has been called *elastic cataract.*

1427. The cause of the elastic re-ascension of the cataract is, I am disposed to believe, that in such cases the vitreous body still possesses its natural consistence, and therefore resists the sinking of the lens into its substance, as every one who has been accustomed to dissect healthy eyes, knows the vitreous body will do. Moreover, the circumferential connections of the lens are as yet unweakened.

1428. A persistence in attempts at displacement in such a case, would prove extremely detrimental to the internal structure of the eye. The attempt, therefore, ought not to be repeated, until the posterior wall of the capsule has been lacerated, and a breach made in the vitreous body, for the reception of the reclined lens.

1429. In order to do this, the needle is to be withdrawn from the posterior chamber, and indeed so far, that its lance head merely is within the eye. The head with its cutting edges upwards and downwards—if a curved needle, the concave surface of course forwards,—is then to be directed against the posterior wall of the capsule, and made to lacerate it and the vitreous body behind and below it, to the necessary extent.

1430. Having effected this, the surgeon withdrawing the instrument now so far, that its neck comes again to correspond to the point of puncture, as it did when first introduced, and assuring himself by the marks on the handle, that the edges of the lance head are directed upwards and downwards; and, if the needle be a curved one, that the convexity of the curve is forwards, and the concavity backwards, inclines the handle of the instrument well back towards the temple of the patient, and proceeds as before to push it into the posterior chamber, and to recline the lens.

1431. In order to anticipate the necessity of lacerating the posterior capsule and vitreous body subsequently, some surgeons do so at once, before pushing the needle into the posterior

chamber, and proceeding to the reclination. I would, however, remark, that when the vitreous body is of such firm consistence as to resist the lens being forced into its substance, extraction of the cataract would be a much better and safer operation, if there existed no particular indication of any weight against it.

1432. The lens may, instead of going down before the needle, suddenly burst through the pupil into the anterior chamber. In such a case, if it appears that it was on account of the firmness of the vitreous body that the lens did not yield to the needle, the surgeon should immediately proceed to extraction; but if it appears that the vitreous body is dissolved, the connections of the lens weakened, and that on these accounts it was that the lens slipt into the anterior chamber, it would be safer practice, instead of extracting, to endeavour with the needle to bring the cataract back through the pupil, and to depress it.

1433. If extraction be had recourse to, it will be sufficient to make a section of one-third only of the circumference of the cornea. This being done, a hook is introduced, the lens laid hold of, and extracted.

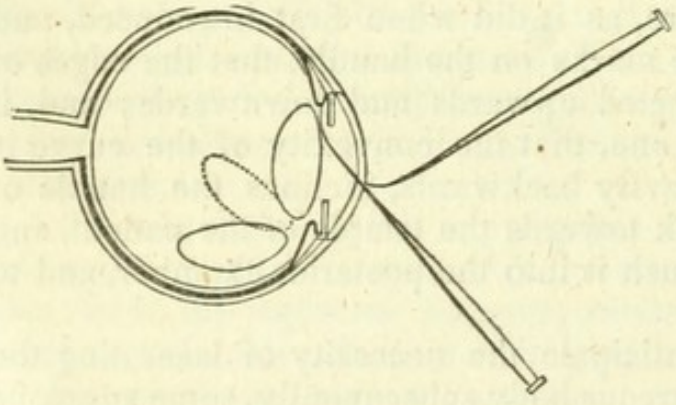
Reclination by corneal puncturation.

1434. The instrument for this operation is the curved cataract needle.

1435. The pupil should be well dilated, preparatory to the operation, and the position of the patient, assistant, and operator, arranged as above recommended, (ss. 1298, et seq.)

1436. The needle is held between the thumb on the one side, and the fore and middle fingers on the other. The side of the handle on which the thumb is, corresponds to the convexity of the instrument; that on which the fore and middle fingers are, to the concavity.

Fig. 39.



1437. *The first step* comprehends the puncturation, the advance of the point of the needle through the dilated pupil, towards the cataract, and the application of the convexity of the needle against the upper part of the anterior surface of the cataract.

1438. *The second step* is the reclination of the cataract.

1439. *The third step* is the withdrawing of the needle from the eye.

1440. *Puncturation, &c.*—The point of the cornea where puncturation is made, is about one-twentieth of an inch below its centre.

1441. Holding the needle as above directed, the operator directs the lance head of it towards the place of puncturation in such a way that the convexity of the curve is downwards, the concavity upwards, the extreme point perpendicular. The handle of the needle must therefore be directed upwards. Fig. 39.

1442. When the eye is in a proper position, the operator pierces the cornea perpendicularly, with a quick but steady thrust, executed solely by the movements of the thumb and fingers holding the instrument. When the lance head of the needle has penetrated as far as the middle of its curve, the handle of the needle is to be gradually depressed towards the cheek, the puncturation completed, and the needle pushed on through the pupil, with the point upwards, and convexity of its curve towards the upper part of the cataract behind the upper part of the iris. Fig. 39.

1443. *Reclination of the cataract.*—Having applied the convexity of the needle against the upper part of the anterior surface of the cataract, and right in the middle line, the operator raises, gently at first, the handle of the instrument. The instrument acting as a lever, the fulcrum being the point of puncturation in the cornea, the point of the needle is by this movement made to press back the upper part of the cataract.

1444. When the operator sees that the upper part of the cataract yields, he continues to raise the handle of the instrument firmly and steadily, thus turning the cataract before the needle downwards and backwards, and sinking it in the vitreous humour.

1445. Having kept the point of the needle for half a minute or so resting on the reclined lens to prevent it from rising, the surgeon now withdraws it a little slowly, still keeping the handle elevated, and watches for another half minute whether or not it is disposed to rise again. If not, he continues to withdraw the needle still in the same direction until it is quite free of the cataract and the vitreous humour immediately surrounding, when he depresses the handle, and then brings its point again into the pupil.

1446. *Withdrawing of the needle.*—The cataract not rising, the needle, after another pause, is finally withdrawn from the eye. And this is done by drawing it out in a horizontal direc-

tion, until the middle of the curve head becomes engaged in the puncture of the cornea, when the handle is to be raised, so that the extreme point may be withdrawn at right angles to the place of puncturation, as it was introduced.

1447. In this operation, care is to be taken that the pupillary margin of the iris is not caught by the needle, and during the reclination, that the lower pupillary margin of the iris be not pressed on.

1448. In elastic re-ascension of the cataract, attempts at reclination should not be persisted in, but the plan of operation relinquished. In this case, laceration of the vitreous body and posterior capsule cannot be effected, as it can in reclination by sclerotic puncturation.

1449. Reclination by corneal puncturation has not been found to answer so well as that by sclerotic puncturation, and therefore has fallen into disuse.

1450. *Bandaging and after-treatment.*—The light fold of linen, (s. 1374,) to hang over both eyes, is sufficient bandage. In other respects, the same general management is to be adopted as above recommended after extraction.

1451. *Accidents attendant on the operation of reclination.*—Amaurosis may be at once occasioned by the pressure of the reclined lens. Should this happen, the needle must be re-introduced, and the lens raised a little, so as to relieve the pressure.

1452. In the course of a few hours after the operation, vomiting sometimes occurs. Re-ascension of the lens may be thereby occasioned.

1453. Acute internal inflammation of the eye is apt to be excited by the operation. Most frequently, however, the supervening inflammation is of a chronic character, ending in disorganization of the eye and loss of vision. The inflammation appears to be at first posterior internal, with exudation on the surface of the retina, and into the vitreous humour, but by and by extending to the anterior segment of the eye. It commences from four to eight days after the operation. When the operation is performed by corneal puncturation, corneitis and iritis are apt to be excited primarily.

DIVISION OF THE CATARACT.

1454. The object of this operation is to lacerate the capsule, and divide the lens, so that the latter may be gradually dissolved

and absorbed, and thus ultimately altogether removed from the eye.

1455. Considered as an operation, this is the most simple of all those for cataract, both in performance and in the extent of injury necessarily inflicted on the eye.

1456. *Indications.*—Division is indicated in:—

1st. Soft, or fluid cataracts,—the cataracts of most common occurrence in early life. To this head belongs congenital cataract.

2d. Sometimes in the common cataract of old people, division of the capsule is had recourse to in order that the lens may, by solution and absorption of its exterior part, be diminished in size preparatory to extraction through a small section of the cornea.

1457. *Prognosis.*—In the cases proper for the operation, the prognosis is good. There is in general little reaction, but though the lens may be perfectly absorbed, the capsule, which does not admit of solution and absorption, if not already opaque, may become so, and form what is called *secondary cataract.* To anticipate this, the anterior wall of the capsule should, during the first operation, be as completely cut up as possible at the part corresponding to the pupil. The rapidity with which solution and absorption go on, varies from a few days to several months. In general it may be said that in children the absorption proceeds more quickly than in adults.

1458. One operation may suffice, but, generally, solution proceeding slowly, the operation requires to be repeated, and that more than once. This, as the operation is so simple and painless, is no great objection. The interval between the repetitions of the operation should be about six weeks.

1459. It is best to operate on both eyes at the same time. I have observed the solution to proceed more quickly after the operation on both eyes at the same time, than after the operation on one eye only. When the eye becomes inflamed, solution appears to be arrested.

1460. If the retina was previously quite sound, a perfect restoration of vision may be calculated on, if solution and absorption go on pretty quickly; if not, by the time the cataract disappears, the sensibility of the retina may be found impaired.

1461. The operation of division may be performed either by sclerotic puncturation, or by corneal puncturation.

Division of the cataract by sclerotic puncturation.

1462. The instrument best adapted for this operation is a

curved lance-shaped needle. The pupil should be well dilated, and the patient, assistant, and operator placed as above recommended (s. 1298).

1463. *First step.*—This comprehends the puncturation and the introduction of the needle into the posterior chamber, so that its lance-head is seen through the pupil, and is altogether the same as the first step of reclination by sclerotic puncturation. In performing it the same precautions require to be observed to avoid spitting the ciliary processes, the lens or the iris.

1464. *The second step* in division comprehends the laceration of the anterior wall of the capsule and the division of the lens, so far as is considered necessary, if a first operation on the eye; or the further division of the lens if it be a repetition of an operation.

1465. *The laceration of the anterior wall of the capsule* is effected in the first instance, by a number of vertical incisions in the part of it corresponding to the pupil, made by slight rotatory movements of the handle of the needle, whilst the point of its curved lance-head is directed against the surface of the cataract. The vertical strips into which the middle of the capsule is thus divided, are then to be cut across horizontally, by directing one of the edges of the needle against them, and pressing it back through them into the substance of the cataract, which is done by slightly moving the handle of the instrument forwards.

1466. *Division of the lens.*—Having thus freely divided the capsule, the surgeon turns the sharp point of the needle against the lens opposite the pupil, and by slight rotatory movements of the handle of the instrument, breaks up its substance; if the lens is firm enough, he shaves off pieces with the edge of the lance-head of the needle, its concavity being directed forwards, and spoons the detached fragments into the anterior chamber.

1467. It is to be remembered, that it is better not to risk reaction by attempting too much at one time, in the way of breaking up the lens, but the capsule ought always to be freely lacerated at first. Especial care should be taken not to displace the whole lens, or even any considerable piece of it unbroken up.

1468. *The third step.*—This comprehends the withdrawing of the needle from the eye, and is effected by a series of manœuvres, exactly the converse of those performed in introducing it. Especial care should be taken, in withdrawing the needle through the puncture in the coats, to rotate it so that the surfaces of its lance-head shall be—the convex one upwards, and the concave one downwards,—as when introduced, and also to

depress the handle in proportion as the curved lance-head is withdrawn through the puncture.

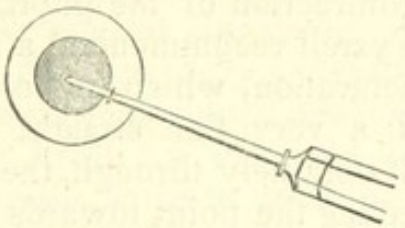
Division of the cataract by corneal puncturation.

1469. The instrument with which the performance of this operation is most simple, is a straight needle ground flat on the sides towards the point, so that as it penetrates the cornea, it fills completely the puncture, though not in a forced manner, and thus prevents the escape of aqueous humour.

1470. Preparatory to this operation, the pupil should be well dilated by belladonna.

1471. *First step.*—This comprehends the puncturation and the advance of the point of the needle through the dilated pupil towards the cataract.

Fig. 40.



1472. The point of the cornea where the needle is to be made to pierce, is about half way between its centre and its outer and lower margin.

1473. The flat surfaces of the needle being the one towards the centre of the cornea, the other towards the margin, the point of the instrument is directed perpendicularly to the place above indicated, when it is to be made to pierce by a quick thrust, executed solely by the movements of the fingers. Having thus pierced the cornea, the handle of the instrument is depressed, and its point steadily pushed on towards the cataract, still by the movements of the fingers.

1474. *Second step.*—This comprehends the laceration of the anterior capsule if a first operation, or the breaking up of the lens, if a repetition.

1475. One of the edges of the instrument being directed against the capsule, one or more incisions are to be made in it from above and outwards, downwards and inwards, by a lever-movement of the handle of the needle.

1476. The division of the lens is effected, so far as is proper, by similar incisions.

1477. *Third step.*—This comprehends the withdrawing of

the needle from the eye. In doing this, the surfaces of the instrument are to be directed in the same way as when it was introduced.

1478. *Treatment and accidents after division.*—The treatment after division, is the same in general as after displacement, except that the pupil is to be kept dilated.

1479. Vomiting often occurs after division through the cornea, especially when the cataract is fluid, and may continue several hours. Opiates are to be given to relieve it.

1480. When the operation is performed by corneal puncturation, corneitis, aquo-capsulitis and iritis are not unfrequently excited, and are apt to prove very stubborn and destructive to the eye.

1481. In cases of cataract complicated with extensive synechia posterior and contraction of the pupil, the consequence of iritis, the late Mr. Tyrrell recommended a modification of division by corneal puncturation, which he designated *drilling*.

1482. He passed a very fine straight needle, of uniform thickness, somewhat obliquely through the cornea at the outer part; and then, directing the point towards the anterior capsule of the lens, close to the inner margin of the pupil, (taking care not to injure the iris,) and causing the instrument to penetrate the capsule, and enter the substance of the lens, to the extent of about one-sixteenth of an inch, he rotated the handle of the needle between the fore-finger and thumb, so as to make the point act as a drill, and then withdrew the needle. An opening was thus secured more free than could be effected by a simple puncture.

1483. He usually had to repeat this operation seven or eight times at intervals of from three to five weeks, taking care to puncture the opaque capsule in a fresh place at each operation, before the pupil was cleared.

1484. The operation in no instance produced inflammation of any consequence, and did not confine the patient for more than two or three days.

1485. In a few instances it was necessary to make an artificial pupil subsequently by incision with Maunoir's scissors. See *Artificial Pupil.*

Congenital Cataract.

1486. This is generally lenticular at first, but eventually becomes capsulo-lenticular; and if left to itself, it may degenerate into siliquose cataract.

1487. The operation for congenital cataract is division (ss. 1454 et seq.), by sclerotic puncturation, if the patient be still an infant; if already some years old, either this or the operation by corneal puncturation.

1488. The period after birth at which the operation should be performed, is before teething commences, or soon after it is completed, (s. 1291.)

Secondary Cataract.

1489. After the operation of extraction of the lens, but especially after division, the capsule is apt to become opaque and obstruct the pupil. This forms secondary *capsular* cataract. What is called secondary lenticular cataract, is merely some portion of the cataractous lens remaining, obstructing the pupil, after any of the operations above described. It in general requires no interference, except keeping the pupil dilated by belladonna, being sooner or later absorbed.

1490. *Operation for secondary capsular cataract.*—At the same time that the capsule becomes opaque, it is apt to become thickened and very tough; it may not therefore be easy to divide it with the needle, so as to make an opening through it, opposite the pupil, but this should be first attempted; though the opaque capsule may often be detached in a mass, it does not admit readily of being depressed, as it always tends to rise again. This is owing to the resistance of the vitreous body, if sound, or if in a dissolved state to the opaque capsule being lighter than the fluid. In the former case, the opaque capsule should be extracted through a small section of the cornea, as above recommended for siliquose cataract; in the latter case, the capsule should be detached from below, and pushed upwards behind the iris, where it will float out of the way of vision. The same proceeding should be adopted in siliquose cataract, if there is reason to suppose that the vitreous body is in a state of dissolution.

Comparative advantages and disadvantages of extraction, displacement and division.

1491. By the operation of extraction, the cataract is removed wholly and at once from the eye, and very good vision restored; but the operation is a nice, if not a very difficult one, and liable to the occurrence of the various untoward circumstances above mentioned, by which its success is readily marred.

1492. The operation of displacement, which may be per-

formed in the same cases as extraction, is neither so nice nor so difficult an operation, does not expose the eye to the same risk of immediate destruction, and though the cataract is apt to return to its former place, the operation may be repeated; but though displacement may have succeeded as an operation, and vision be restored, the eye is not so safe as after successful extraction, but, as above mentioned (s. 1453), is liable to become affected with internal inflammation, which ends in amaurosis.

1493. Extraction thus possesses a decided advantage over displacement, and is therefore generally preferred, except when the unfavourable complications above mentioned exist, (s. 1311.)

1494. The degree of softening of the vitreous body requisite to admit of safe displacement of the lens is not so great as to forbid extraction, but of course, if, in the cases in which the vitreous body is so much dissolved, that the displaced lens is apt to float up again, displacement be contra-indicated, extraction is much more so.

1495. All other things being equal, it might perhaps be laid down as a general proposition, that in the very cases in which displacement admits of being most readily and safely performed, extraction is less safe, whilst, on the other hand, in the cases in which, in consequence of the soundness of the vitreous body, extraction is most safely and easily performed, displacement is least so.

1496. As the cases for which division is best fitted are different from those in which extraction or displacement is indicated, there is no comparison to be made between them. It is, however, to be observed, that a combination of division and extraction is sometimes had recourse to in cases of common lenticular cataract of old people. The object of having recourse to this compound operation is, as above mentioned, (s. 1456,) that the lens may, by solution and absorption of its soft exterior part, be reduced to its hard nucleus, which, in consequence of its small size, will admit of being extracted through a small section of the cornea.

Cataract glasses.

1497. The difference in refractive power between the air and the cornea being much greater than between the aqueous humour and crystaline body, the greatest amount of refraction which the rays of light undergo in the eye, in order that they may converge to foci on the retina, is that effected by the cornea on their first entrance. The crystaline body contributes

comparatively little to the convergency. Hence, vision, after a successful operation for cataract, may be still *tolerably distinct* for objects at a certain distance. Still, in order, that it may be *perfectly distinct*, the use of convex glasses is required.

1498. But as with the loss of the crystaline body, there is loss of the power of the eye to accommodate itself to different distances, except so far as variations in the size of the pupil contribute to this effect, glasses of different degrees of convexity are required according as the patient wishes to view near or distant objects. Thus, convex lenses of two and a half inches focus are generally required for reading, and lenses of four and a half inches focus for viewing distant objects.

1499. Of course before fixing on any particular powers, the patient will try which suit him best, and the test which should guide him in his choice is, that when the spectacles are put on, or, if hand-glasses, when they are held immediately before the eyes, he sees objects distinctly at the same distance as he saw them before he became blind.

1500. Recourse is not to be had to the use of cataract glasses until the eyes have perfectly recovered from the operation, and have been so for some time.

Section III.—OPERATIONS FOR ARTIFICIAL PUPIL.

(Conformatio pupillæ artificialis—Coremorphosis—Coreplastice.)

1501. An artificial pupil is an opening made in the iris, to serve as a substitute for the natural pupil, when this is either covered by extensive central opacity of the cornea, with or without being contracted, or complicated with synechia; or when it is actually obliterated, with or without being complicated with opacity of the cornea or synechia, so that the rays of light can no longer be transmitted through it to the retina.

1502. There are three principal modes of operating for artificial pupil which may be had recourse to, according to the nature of the case, viz., first, making the opening in the iris, by means of a simple incision or incisions—*the operation for artificial pupil by incision.* Second, making the opening by cutting out a piece of the iris—*the operation by excision.* Third, instead of actually making an opening in the iris, detaching the membrane at some part of its circumference from its ciliary connection—*the operation by separation.*

1503. In some cases, the natural pupil admits of being so freed, as to be again available for the transmission of light to the retina. The operations by which this is effected, though not strictly operations for *artificial pupil*, are properly enough referred to the same head, as both in their performance and in their object they closely agree. The operations are: First, the restoration to its natural position of the pupil dragged to opposite a leucoma, by partial anterior synechia, by means of *abscission of the band of adhesion.* Second, the *dislocation* of the natural pupil to opposite a clear part of the cornea.

1504. In the cases in which an artificial pupil is required, the crystaline body may be healthy, or it may have been removed by a previous operation for cataract (of which operation the condition requiring the formation of an artificial pupil may be an effect) or it may be cataractous. In the first case, the crystaline must, if possible, be preserved untouched; in the last case, the operation for artificial pupil will require to be combined with that for cataract.

General conditions necessary, or at least favourable, to the success of operations for artificial pupil.

1505. An operation for artificial pupil is not to be thought of, unless the patient has lost *all useful vision with both eyes;* and then, only when there is reasonable evidence that the retina is still sound.

1506. Before the operation is undertaken, the eye must have quite recovered from the inflammation which has been the cause, or been co-existent with the cause of the altered state of the eye requiring the operation.

1507. Besides being free from inflammation, the eye should be otherwise tolerably healthy, at least free from granular conjunctiva, vascular cornea, varicosity, unnatural hardness or softness, dropsy, atrophy, &c. If there is dissolution of the vitreous body, operations through the cornea, like extraction of cataract under the same circumstances, require to be performed with extreme caution, or they may be altogether forbidden. If the inflammation which has caused the state of the eye requiring the artificial pupil has been scrofulous in a child, no operation should in general be attempted, until after puberty.

1508. *Prognosis* of the operation for artificial pupil. As the eye has in general already suffered so much from inflammation, inflammation is apt to be re-excited to such a degree as to occasion failure, or even complete destruction of the eye. This is especially the case, if the inflammation which has

caused the state of the eye requiring the artificial pupil has been scrofulous, syphilitic, or gouty. The most promising cases are those in which the condition of the eye requiring the operation, is of traumatic origin, as after operations for cataract, or has been occasioned by purulent ophthalmia.

1509. The amount of vision restored by the operation, depends upon the previous state of the eye, and the mode of operating, which that state permitted to be adopted, together with the degree of reaction which follows the operation. The same good vision is seldom or never restored by the operation for artificial pupil, as by the operation for cataract; indeed, it may in general be considered *success*, if by means of an operation for artificial pupil, sufficient vision be restored to enable the person to move about by himself.

1510. *Preparation of the patient for the operation for artificial pupil.* In addition to the same general treatment above laid down for the operation for cataract, in order to get the patient into as good a state of general health as possible, the preparation for undergoing the operation for artificial pupil, should consist in bringing the eye into the favourable condition mentioned in ss. 1506-07.

1511. *Place of the iris where the artificial pupil should be made.*—The artificial pupil should be made, 1st, as near the middle as circumstances of the case will allow. 2d. After the middle, the nasal or temporal side is the next best place; then the lower, and lastly the upper.

1512. *Position of the patient, assistants, and operator.*—This should be the same in general as above recommended for the operations for cataract in general, (ss 1298 et seq.)

1513. The *securing of the eyelids* also is to be effected in the same way as above recommended, (ss. 1303 et seq.)

ARTIFICIAL PUPIL BY INCISION.

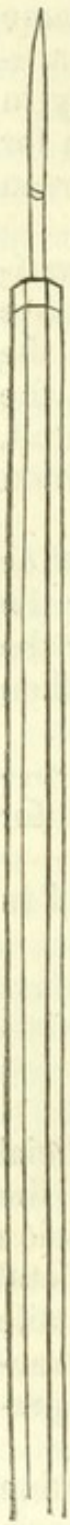
(Iridotomy.)

1514. There are two principal ways of operating for artificial pupil by incision, viz., through the sclerotica, and through the cornea. An important condition for the success of incision performed either way is, that the larger circle of the iris be still in a healthy state, as regards intimate structure and contractile endowments, so that the opening made in it may, by its retraction, come to gape, and the edges of the incision thus be prevented from reuniting.

1515. In the cases which may be the subject of the operation of incision, the closure of the pupil may have been the conse-

quence of iritis succeeding an operation for cataract. If the lens is still present but cataractous, it must be divided or displaced in the operation through the sclerotica extracted, if possible, in the operation through the cornea. The same must also be done even if the lens be quite healthy, as wounding it, which would of course be followed by opacity, cannot be avoided in the operation for artificial pupil by incision. It is, however, to be remarked, that if the lens be still clear, some other operation than incision must if possible be chosen, by which the lens may be preserved untouched.

Fig. 42.



*Incision through the sclerotica.**

1516. In this operation, a single incision is made through the iris in a transverse direction, above or below the situation of the natural pupil. The radiating fibres being thus cut across, the edges of the incision retract, and a fusiform opening is the result. The cases in which this succeeds best, are those in which the closure of the pupil is owing to the iris having been prolapsed through a wound or large ulcerated opening of the cornea, and is thus on the stretch. It will also succeed in simple closed pupil, provided, as above said, the substance of the larger circle of the iris is still quite healthy. There should be a sufficiency of clear cornea, opposite the place where the incision of the iris is made.

Fig. 41.

1517. *The instrument for incision through the sclerotica.*—The instrument used for this purpose, and known under the name of Adams' iris knife, has a blade about nine-tenths of an inch long, about one-twentieth of an inch broad, single-edged, and sharp, but somewhat bellied at the point. Fig. 42.

1518. The operation comprehends the following steps:—

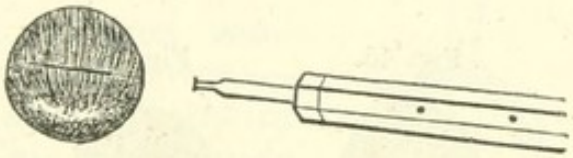
1519. *First step—Puncturation.*—The point of puncturation is the same as in the operation of reclination of cataract, viz., three-twentieths of an inch from the temporal margin of the cornea, and in the line of its transverse diameter.

* Cheselden's operation for artificial pupil. This was the first operation performed for artificial pupil. The two cases in which Cheselden operated, were cases of closed pupil, after the operation for cataract, by couching. Philosophical Transactions, vol. xxxv. An. 1728.

1520. The operator holds the knife, like the straight cataract needle in reclination, its surfaces upwards and downwards, its cutting edge backwards, and rests his hand by the little finger on the patient's cheek, in such a way that the blade of the knife is close in front of the cornea, in a line corresponding to its transverse diameter, and the point extending to nearly opposite the nasal margin. The hand being thus disposed, the thumb and fingers holding the knife are retracted, in order that the point may be applied perpendicularly to the surface of the eyeball, at the place above mentioned, when it is to be steadily thrust towards the centre of the eyeball, but no deeper than about one-eighth of an inch.

1521. *Second step.*—The handle of the knife is now to be inclined *very much back towards the temple*, more than in the operation for cataract, in order that the point of the knife, when pushed on, may come to pierce the iris from behind, near its temporal margin, say one-tenth of an inch, and appear in the anterior chamber. This being effected, the handle of the knife is now to be inclined forward a little, so that when the knife is pushed further on, its point may pass across the anterior chamber towards its nasal side. Fig. 43.

Fig. 43.



1522. *Third step.—Incision of the iris.*—By now inclining the handle of the knife still more forwards, so that its edge may be fairly applied against the iris, and then by withdrawing it somewhat, it is made to cut the iris. If by this first stroke, the incision of the iris is not sufficiently large, the knife is to be again pushed on and again withdrawn, its edge being still kept fairly directed against the part of the iris to be cut. This is to be repeated until a sufficiently large incision, at least one-fifth of an inch, has been made. By the contraction of the iris, previously on the stretch, this incision immediately gapes, and that to a considerable degree, and so the fusiform pupil is made.

1523. Incision of the iris being effected, the lens, if still present, must, whether clear (s. 1515) or cataractous and soft, be divided, in order to its removal by solution and absorption; if cataractous and hard it should be displaced.

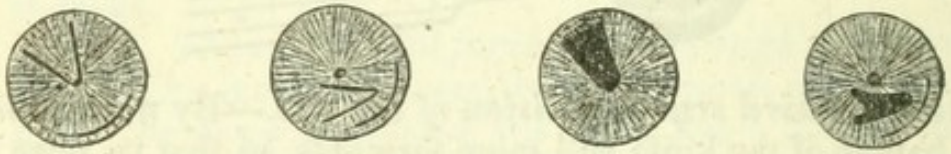
1524. In this step of the operation, it may happen, especially

if the edge of the knife is unduly pressed back against the iris, that the iris becomes detached from its ciliary connection at some point, most frequently at the nasal side. This will impede the completion of the incision to the proper size. The aperture left by the separation may continue open, especially if the iris is healthy in its texture, but more frequently it will close from supervening inflammation. In such a case incision or some other operation through the cornea may be subsequently had recourse to.

Incision through the cornea.

1525. The particular modification of this operation usually adopted, is that of Janin, as improved on by Maunoir. It consists in making a small section of the cornea, at its lower and outer or its lower part, and by means of Maunoir's scissors introduced through the opening, dividing the iris by two incisions divaricating from the situation of the natural pupil, Fig. 44. By this both the circular and radiating fibres of the iris are divided. Modifying this plan, which cannot always be followed, Dr. Mackenzie cuts the radiating fibres only, making the incisions divaricate from a point near the margin of the iris, Fig. 45. In either case, the result of the two incisions is a triangular flap of iris which contracts and shrivels, so as to leave a free opening. Figs. 46, 47.

Fig. 44. Fig. 45. Fig. 46. Fig. 47.

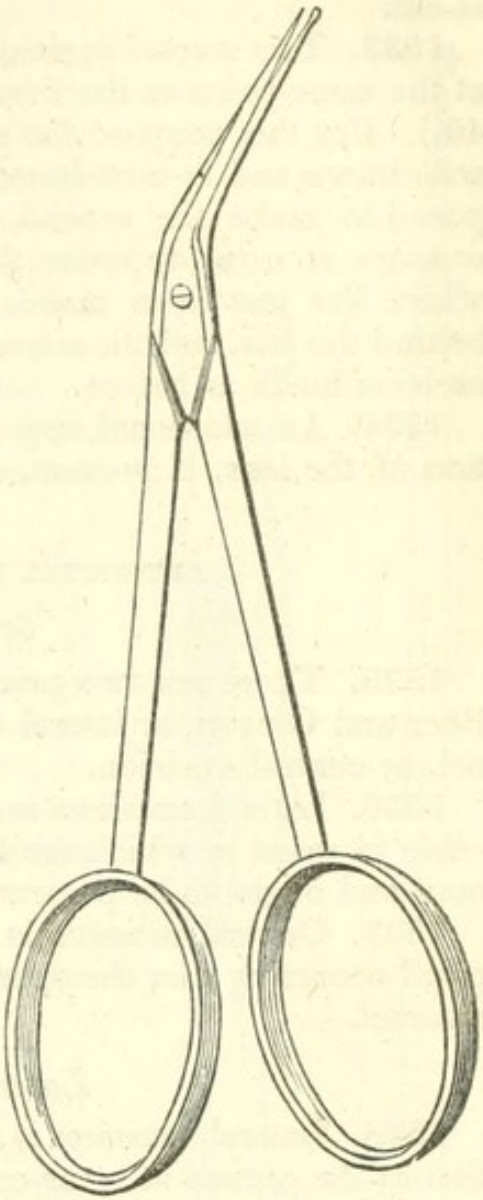


1526. The two incisions in this operation are made when the iris is not on the stretch, and when there is reason to suppose that the substance of the iris is not so healthy as to contract sufficiently to cause a single incision to gape, and thus to form a pupil which shall remain permanently open.

1527. If the iris were healthy and stretched enough, so that there was reason to suppose that a single incision would gape sufficiently, the operation through the sclerotica is to be preferred,—except when it is intended to extract the lens at the same time, whether cataractous or still clear, or when the circumstances of the case require that the incision for the new pupil should be vertical, as Janin made it, instead of horizontal; it not being easy to make a vertical incision in the iris by the

operation through the sclerotica. When a single vertical incision is made, it should be on one or other side of the centre of the iris, in order that the radiating fibres may be cut across.

Fig. 48.



1528. *The instruments required for the operation* are an extraction knife and a pair of Maunoir's scissors. The other instruments employed in extraction should also be ready, (s. 1317.)

1529. Maunoir's scissors are extremely fine, when closed, not so thick as a common probe, bent sideways at an obtuse angle, the blade corresponding to the convexity, sharp at the point for piercing the iris, the other blade probe-pointed that it may admit of being easily and safely pushed through the anterior chamber.

1530. The operation comprehends the following steps:—

1531. *First step.—Section of the cornea.*—This is to be made at the outer and lower part or the lower part of the cornea, as for extraction of the cataract, but to the extent only of about one-fourth of the circumference of the cornea, unless it is contemplated to extract the lens or an opaque capsule, when the section should be to the extent of one-third of the circumference.

1532. *Second step.—Introduction of the scissors and incision of the iris.*—The surgeon introduces the scissors closed under the flap of the cornea, and when the point has arrived at that part of the iris where the incision is to be commenced, —the situation of the natural pupil or near the margin of the iris according to circumstances,—he opens them, thrusts the sharp-pointed blade through the iris, and pushes them on, the sharp-pointed blade through the posterior chamber, the probe-

pointed blade through the anterior chamber, the iris between them, to the part of the opposite margin of the iris where the incision is to terminate. By now closing the scissors, which should be done sharply, the iris interposed between the blades is cut.

1533. The second incision is now to be made, commencing at the same point as the first, but divaricating from it, (figs. 44, 45.) For this purpose the scissors, still kept closed, are to be withdrawn and re-introduced in the direction in which it is proposed to make the second incision. When the point of the scissors is now opposite the commencement of the incision which has just been made, the sharp-pointed blade is passed behind the iris, and the scissors pushed on, then closed, and the incision made as before.

1534. An additional step which may be called for, is extraction of the lens, if present, or of an opaque capsule.*

ARTIFICIAL PUPIL BY EXCISION.

(Iridectomy.)

1535. There are two principal plans of excision, viz., that of Beer and Gibson, or lateral excision, and that of the first Wenzel, or central excision.

1536. Lateral excision is the more important, as it is applicable to cases in which the lens is transparent, and in which it may and ought to be preserved so.

1537. Central incision is applicable only in cases of closed pupil occurring after the operation for cataract, or combined with cataract.

Lateral excision.

1538. Lateral excision is performed by making a small section of the cornea at some convenient part of its circumference, seizing with a forceps the piece of iris which protrudes, and snipping it off, taking care to include the pupillary margin of that part of the iris. If the iris does not protrude spontaneously, the portion to be snipped off is drawn out with a blunt hook or the forceps, care being taken not to injure the crystaline body.

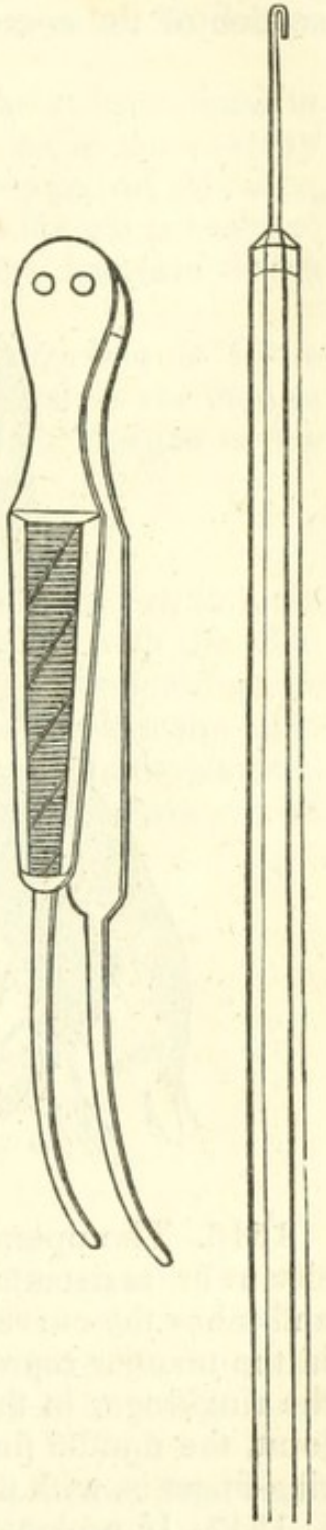
1539. The cases in which lateral excision is applicable are cases of central opacity of the cornea, to such an extent as to

* If after the section of the cornea is made, the iris should protrude, advantage is to be taken of this to make a pupil by excision rather than by incision.

cover the pupil, even when dilated by belladonna, in which the iris and pupil are either natural, or the former, but partially adherent to the cornea, and the latter partially contracted;—the lens being still clear.

1540. The conditions necessary for lateral excision are:—1st, a sufficient extent of clear cornea at that part of its circumference, near where the pupil is to be made, to allow for any opacity which may result from the cicatrice of the corneal incision, and that enough of clear cornea may remain opposite the new pupil; 2d, the iris sufficiently free from adhesions to admit of a portion of it protruding or being drawn out through the corneal incision, in order to be excised.

Fig. 49. Fig. 50.



1541. The eyelids are secured in the same way as in the operation for cataract, during the first step or section of the cornea, but during the second step, or excision of the piece of iris, both eyelids must be secured by the assistant, or one eyelid by one assistant, the other by another, as the operator requires to use both hands.

1542. *The instruments required for the operation are:—*

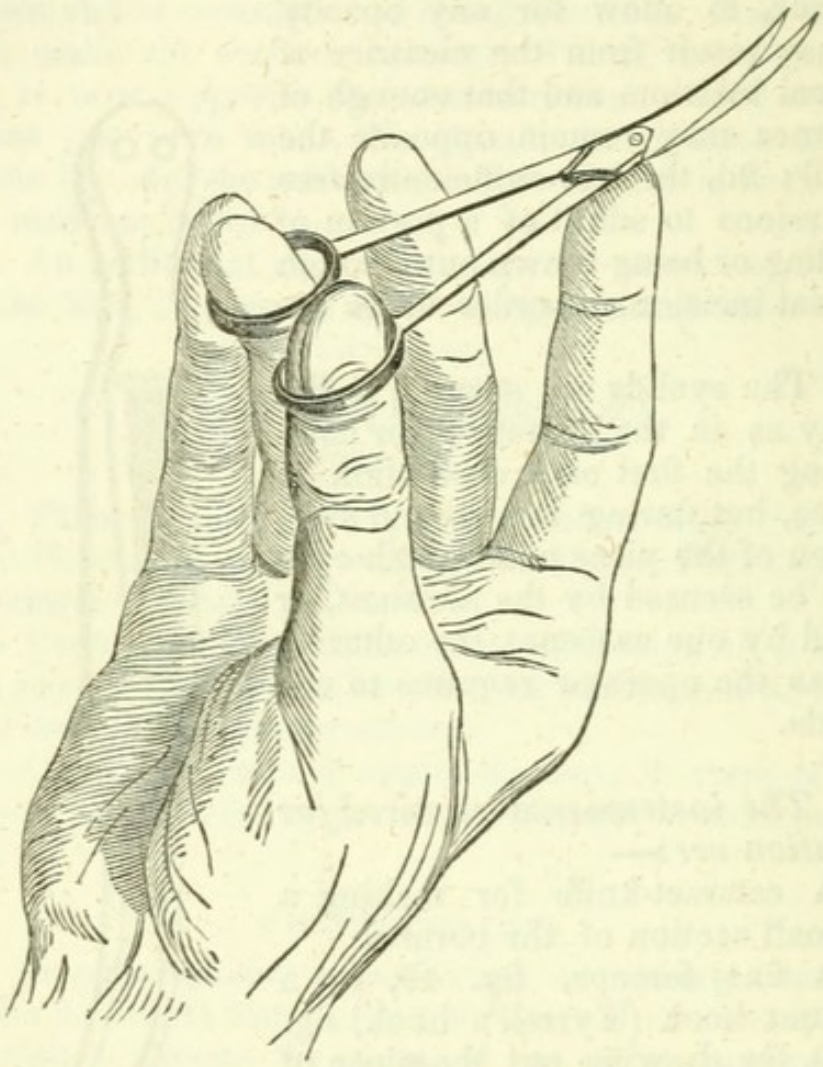
1. A cataract-knife for making a small section of the cornea.
2. A fine forceps, fig. 49, or a blunt hook (Tyrrell's hook) fig. 50, for drawing out the piece of iris to be excised, if the iris does not protrude spontaneously; if it does, the forceps is used for laying hold of it.
3. A pair of curved scissors for snipping off the piece of iris, fig. 51.

1543. Lateral excision comprehends the following steps:—

1544. *First step.—Puncture or section of the cornea.*—This is to be made close to the sclerotica, and to the extent of one-fourth of the circumference of the cornea.

1545. *Second step.—Excision of the piece of iris.*—The gush of aqueous humours which takes place on completing the section of the cornea will perhaps cause prolapsus of the iris.

Fig. 51.



1546. The operator, leaving the eyelids in charge of his assistant or assistants, exchanges the knife for the fine forceps, and takes the curved scissors in the other hand, holding them in the manner represented in figure 51, the thumb in one ring, the ring-finger in the other, the point of the fore-finger on the joint, the middle finger on the branch in the ring of which the ring-finger is, with their convexity towards the eye, ready for use.

1547. If prolapsus of the iris has already spontaneously taken place, it is seized with the forceps, raised up, and a portion, including the pupillary margin, snipt off. If the prolapsus

has not taken place, and cannot be made to do so by gentle pressure, the operator carefully introduces the blunt hook, and catching the iris by its pupillary margin, draws it out and snips it off. If the forceps is used for drawing out the iris, it must be made to lay hold of it very cautiously at a little distance from the pupillary margin—close to the junction of the larger with the smaller circle of the iris.

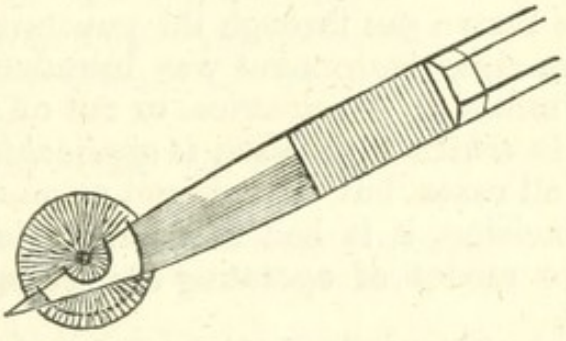
1548. The size of the new pupil should be at least equal to that of the natural pupil in its middle state. As to the quantity of iris to be cut off, in order to obtain a new pupil of this size, it is to be remembered that if the structure of the iris is healthy, even when but a small piece is snipt off, the aperture which results will be of considerable size.

1549. What of the iris may remain protruding is to be gently pressed back with the curette. The eyelids are then to be closed, rubbed over the cornea, and suddenly opened to the light.

Central excision.

1550. As performed by Wenzel, this consisted, 1st, in making a half section of the cornea as for extraction, with the additional manœuvre of so puncturing and counter-puncturing the iris with the point of the knife in its passage through the anterior chamber, that in the act of cutting out, a semicircular flap of the iris was formed. This flap of the iris was then cut off

Fig. 52.



with a small pair of scissors, introduced through the incision of the cornea. If cataract existed, it was extracted at the same time.

1551. The cases in which Wenzel thus operated, were cases of closed pupil, the lens either having been previously removed by operation, or still remaining but cataractous. Of the operation, however, it is to be observed, that not more is effected by

it than is or may be by Maunoir's operation by incision, in which the section of the cornea is much smaller. Hence Maunoir's operation is preferable.

ARTIFICIAL PUPIL BY SEPARATION.

(Iridodialysis.)

1552. This operation consists in detaching the iris from its ciliary connection at some convenient part, and drawing it aside, so as to provide a passage for the light. It may be performed through the sclerotica or through the cornea. Performed through the cornea, as it now always is, the lens, if clear, may be preserved so.

Fig. 53.

Separation through the cornea.

1553. When the iris is in a healthy state, an opening made by separation, may remain permanent, in consequence of the contraction of the iris, as is shown in cases of accident, in which, by a smart stroke on the eye, the iris has been detached at some part of its ciliary connection. But in the cases in which separation is designedly had recourse to for the purpose of making an artificial pupil, the permanency of the opening cannot in general be calculated on, in consequence of alterations in the structure of the iris, produced by the disease which occasioned the necessity for the artificial pupil.

1554. In order, therefore, to ensure the permanency of a new pupil made by separation, the ciliary margin of the detached portion of iris is drawn out through the puncture of the cornea by which the detaching instrument was introduced, and, either left there, to be united in the cicatrice, or cut off.

1555. *Cases in which separation is applicable.*—Separation is applicable in all cases, but as it is not so good an operation as excision or incision, it is had recourse to in those only in which these two modes of operating are inadmissible. The cases are:—

1556. 1st. Such extensive central opacity of the cornea, that the clear circumferential part is too small to admit of being encroached on by the opacity which might result from the cicatrice of an incision made for lateral excision; or without the clear cornea being so very limited, if it be situated at the upper or nasal side of the cornea, where excision cannot well be performed.

1557. In the cases now mentioned, the iris and its connec-

tions being natural, separation is more easy and more successful than in the cases next to be mentioned, and, although the new pupil might remain permanent, without strangulating the detached portion of iris in the puncture of the cornea, or cutting it off, it is nevertheless proper, for the sake of certainty, to add the one or other of these acts to the simple separation.

Fig. 54. Fig. 55.

1558. 2d. Extensive central opacity of the cornea and adhesion of the pupillary margin of the iris to it, in which in consequence of the narrowness of the circumferential portion of cornea remaining clear, the opacity of a cicatrice cannot be risked for Maunoir's operation, and in which not even incision through the sclerotica promises anything, in consequence of the morbid state of iris behind the clear part of the cornea, or in consequence of the situation of that part; or when, although incision might be otherwise admissible, the lens is clear, and it is desirable to preserve it so.

1559. As considerable pain attends separation, the assistant must secure the head well, to prevent any sudden movement by which the operator might be made to detach more of the iris than necessary.

1560. *Instruments for the operation.*

1. Jæger's keratome, fig. 54, or Beer's cataract-knife.

2. A simple hook,* fig. 55.

* Instead of a simple hook, various complex instruments have been invented and recommended. Of these the principal are:

Reisinger's *double hook*.—This is composed of two delicate hooks, united like the branches of a forceps, and so corresponding with each other in size and direction, that when the instrument is closed like a forceps, the two hooks form but a single one. The instrument thus admits of being used, not only as a double hook, or as a single hook, but also as a forceps.

Graefe's *coreoncion*.—This consisted originally of a simple hook, provided with a guard which could be slid towards its point, or withdrawn from it, by means of a ferrule on the handle. At the opposite end of the instrument, there was a small knife for

1561. The steps of the operation are:—

1st. Puncture of the cornea by which to introduce the hook.

2d. Introduction of the hook, through the puncture of the cornea, into the anterior chamber.

3d. Hooking and detachment of part of the iris. And,

4th. Prolapsus of it through the corneal puncture.

1562. *Puncture of the cornea.*—This should be about one-tenth of an inch in length; the place where it should be made, which is an important point to determine, depends principally on the part of the iris to be detached, but in some measure also on the state of the cornea, for the incision ought, if possible, to be made at a part of the cornea where there is no adhesion of the iris.

1563. For example, if the iris is to be detached at the nasal side, and the cornea, even though opaque, is free from adhesion to the iris, and admitting of being cut in the middle, the puncture may be made there, fig. 56; but if the middle of the cornea is not in such a state, then the puncture must be made either above, fig. 57; or below, fig. 58;

Fig. 56. Fig. 57. Fig. 58.

making the opening in the cornea. Graefe afterwards changed the simple hook for a double one made of hardened gold. He also added a spring by which the guard could be carried towards the point of the double hook, which was at the same time closed.

Schlagintweit's *iriankistron.*—This is an instrument very similar to Graefe's simple *coreoncion*, the principal difference being, that in the former the guard is received by the concavity of the hook, whereas in the latter it meets the point.

Langenbeck's *coreoncion.*—This consists of a silver-tube, like a pencil-case, which serves as the handle, and fixed to one end of it a fine gold tube about one inch and a quarter long. A steel wire, terminating in a fine hook, is enclosed within the gold tube, and being fixed within the handle of the instrument somewhat as a pencil is in a pencil-case, it admits of being protruded by touching a knob on the side of the handle. By means of a spiral spring within the handle, it is again drawn back. In this closed state the concavity of the hook is received by the edge of the golden tube, and its point thus kept so guarded that it is not apt to catch or wound any part by accident.

It is to be remarked, that these and analogous instruments, called by different names, are quite unnecessary to the dextrous surgeon, and in the hands of an awkward person are not so manageable as the simple hook or forceps.

It is unnecessary to give figures of the instruments.

Again, if there be nothing limiting the puncture of the cornea to any particular place, but if the new pupil can be obtained only by detachment of the upper or lower part of the iris, then the puncture in the cornea, will require to be made as in fig. 59; or as in fig. 60.

Fig. 59.

Fig. 60.

1564. The opening in the cornea is made by simple puncturation with the keratome or cataract-knife, but, at the same time, care is to be taken to make the opening as wide within as without, otherwise the prolapsed piece of iris will not be so readily retained. Another precaution should be to let as little of the aqueous humour escape as possible.

1565. *Introduction of the hook.*—Having made the incision in the cornea, the operator lays aside the knife for the hook. This he holds, like a cataract needle, and introduces the hook, convexity foremost, and flatways through the opening in the cornea, and in the direction of its axis, into the anterior chamber. The hook being fairly in the anterior chamber, the handle of the instrument is to be inclined so far backwards, that its blade may come to be parallel between the iris and cornea. This being arranged, the instrument is to be pushed on through the anterior chamber, the sharp point of the hook being, if anything, rather towards the iris than the cornea, to the ciliary circumference of the part of the iris to be detached. Before attaining this point, a little of the extremity of the hook disappears behind the margin of the sclerotica.

1566. *Hooking and detachment of part of the iris.*—Having thus gained the ciliary circumference of the iris, the handle of the instrument is to be so far rotated and inclined, that the point of the hook may be directed fairly against the iris, and fixed into it, and that as close to the ciliary circumference as possible.

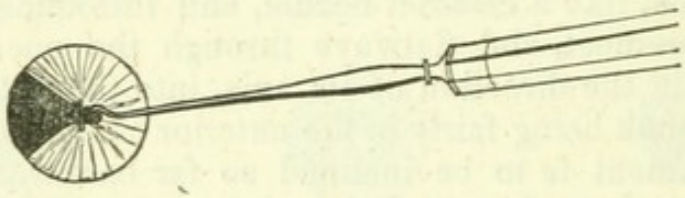
1567. The iris being hooked, the instrument is to be rotated and inclined, so that it may be brought back to the position it was in before the iris was hooked. A steady and sustained, but gentle pull or two is now to be made, until the iris begins to separate. When this takes place the instrument is to be rotated

half on its axis, so that the iris may be the more securely hooked. If this manœuvre be attempted before separation has commenced, the iris, being often diminished in the cohesion of its texture, will only be torn, and the hold of it by the hook altogether lost. By now continuing to pull the instrument slowly and steadily, separation goes on.

1568. *Prolapse of the separated portion of the iris through the corneal incision.*—When the hook arrives with the hooked part of the iris at the puncture in the cornea, some nice manipulation is required to bring it out without letting the iris slip away. The essential point is to press back the lip of the corneal puncture, which is behind the blade of the hook, in order to make the puncture gape.

1569. As much of the iris at least is to be prolapsed as will suffice to secure its retention in the corneal wound, and as much more as may be necessary to make the new pupil of proper size. In order to the retention of the prolapsed iris, it is to be drawn to one or other end of the puncture, and jammed there between its lips.

Fig. 61.



1570. If it be necessary, in order to obtain a proper sized pupil, to draw more of the iris out than is actually necessary for its being retained in the corneal incision, the superabundant part should be cut off. This may happen when the state of the eye has rendered it necessary to make the incision of the cornea nearer the margin where the new pupil is to be, than was above indicated.

1571. When the prolapsed iris cannot be retained between the lips of the corneal incision, somewhat more should be drawn out, and the whole cut off (*Iridectomedialysis*).

1572. During the detachment of the iris a considerable effusion of blood generally takes place into the aqueous chambers.

1573. As the pain is very great, an opiate should be given to the patient after the operation.

1574. If the case in which separation is had recourse to, be complicated with cataract, division or displacement may, ac-

cording to the nature of the cataract, be performed after recovery of the eye from the separation. Extraction is not admissible; the state of the eye, which rendered it necessary to have recourse to separation, being in general such as to forbid extraction.

OPERATIONS FOR AGAIN RENDERING THE NATURAL PUPIL AVAILABLE.

Restoration of the pupil to its natural position by abscission.

1575. If the pupil is dragged by a small synechia anterior, from its natural situation to opposite an opaque part of the cornea, and if it appears that were the adhesion destroyed, the pupil would come to be opposite a clear part of the cornea, the operation to be adopted is simply the abscission of the adhesion. This is effected by means of a needle cutting on the edges and increasing in thickness. It is passed through the cornea into the anterior chamber slantingly, in order that the aqueous humour may not escape, and the adhesions cut. In doing this, great care should be taken not to injure the lens. Injury to the lens may be readily avoided if the aqueous humour has not been allowed to escape, but not easily if this accident has occurred.

Dislocation of the pupil to opposite a clear part of the cornea.

(Operation of Adams and Himly.)

1576. This is effected by prolapsing a portion of the iris through a puncture of the cornea, and so dragging the pupil away from the opaque middle part to opposite the still clear circumferential part of the cornea. The puncture of the cornea is made with an iris-knife, or the point of a cataract-knife, close to the sclerotica, and should be about one-tenth of an inch in extent. Through the puncture a blunt hook is introduced, the iris caught by its pupillary margin, drawn out, and left strangulated in the opening of the cornea, in order that it may become adherent in the cicatrice.

[We have performed this operation by another, and, we conceive, preferable method. This consists in puncturing the cornea with a cataract knife, and then incising that coat to the extent of one-sixth or one-fourth of its circumference, by a rapid cut, so as to cause the sudden evacuation of the aqueous humour. With the gush of this fluid the iris is prolapsed and is strangulated in the wound. If the cataract knife be properly constructed and the incision in the cornea be skillfully made,

this operation will rarely fail, and the danger of wounding the capsule of the lens, with the hook, is obviated. [2d Am. ed. of Lawrence's Treatise on the Eye, p. 455.]

1577. *Treatment after operations for artificial pupil.*— This should be the same in general as after operations for cataract. The patient is to be kept in bed, his eyes protected from the light, cold applied if necessary, and the antiphlogistic regimen observed.

1578. Inflammation generally arises, most frequently internal, sometimes external. According to the form and severity of inflammation, so must be the treatment.

1579. If the lens has been removed, the patient will, of course, require cataract glasses when he comes to use the eye. When the lens is still present, the patient may not require any glass, or he may find his vision assisted either by a concave or by a convex glass. When the new pupil is very much to one side, a slightly convex glass has in several instances been found useful.*

INDEX OF THE DIFFERENT MORBID STATES OF THE EYE, IN WHICH VISION MAY BE RESTORED BY THE OPERATION FOR ARTIFICIAL PUPIL, AND OF THE PLAN OF OPERATING, OR MODIFICATION OF IT ADAPTED TO EACH PARTICULAR STATE.

STATE OF THE EYE.	PLAN OF OPERATION.
1580. Cornea principally affected, the iris and pupil either natural, or the iris otherwise healthy in structure, adherent to the cornea, to the degree either of synechia anterior or partial staphyloma, the pupil being more or less dragged and contracted. The lens and capsule sound, or the lens not present.	
1. Central incurable opacity of the cornea, of such a size as to cover the pupil, even when dilated by belladonna; iris and pupil quite natural; lens sound.	1. Dislocation of the pupil, if the opacity is not very extensive; but lateral excision, if more extensive, and if the clear part of the cornea be towards its outer and lower margin; or

* Rau, die Krankheiten, &c., der Regenbogenhaut, vol. ii. p. 215; Bern, 1845.

STATE OF THE EYE.	PLAN OF OPERATION.
	separation, if the circumferential clear cornea be very narrow, and at its nasal side.
2. The opacity of the cornea not so extensive, but contraction of the pupil to a greater or less degree, and dragging of it behind the opaque part of the cornea, in consequence of synechia anterior or partial staphyloma; the lens sound.	2. Reduction of pupil to its natural situation by abscission, if the synechia be small and appears likely to admit of being readily divided. Otherwise, lateral excision, unless the clear portion of cornea be very small or situated towards the inner and upper part, when separation is to be had recourse to.
3. Cases in which the pupillary margin of the iris is adherent to the cornea, either wholly or to a considerable extent; the iris, otherwise sound in structure, much on the stretch.	3. Incision through the sclerotica, if the lens is no longer present. If, on the contrary, the lens be still present and sound, and if the nasal side of the cornea be that which is the clearest, the operation by separation should be had recourse to, but if the new pupil admits of being placed opposite the lower and outer part of the cornea, then such a mode of operating as the following, which was recommended by Mr. Tyrrell, may be adopted. He introduced his broad needle, cutting on each edge to the extent of one-fifth of an inch, through the margin of the cornea into the anterior chamber, and pierced with it the iris close to its adhesion to the cornea, being careful not to pass the point of the instrument backward, for fear of wounding the capsule of the lens. Having thus made a very small opening in the iris with the

STATE OF THE EYE.	PLAN OF OPERATION.
	needle, he withdrew it, and then passed the blunt hook into the anterior chamber, and hooked the iris through the opening previously made in it, and gently withdrew the instrument. In doing this the iris was usually torn from the point caught with the hook, and such a quantity of the membrane brought through the opening in the cornea by the hook as effected a sufficient aperture in the iris; but sometimes only a fissure resulted. Under such circumstances, Mr. Tyrrell made, after the eye had recovered from the first operation, a second opening through the cornea, a little above the centre, and seizing the upper margin of the fissure in the iris with the hook, he drew it to and through the puncture of the cornea, and thus formed a triangular-shaped opening in the iris. "The principal risk in these cases," he remarks, "arises from being obliged to use a pointed instrument to effect an opening in the iris, to permit the passage of the hook, the proximity of the capsule of the lens being so close to the iris, that it is easily injured, when cataract follows."*
1581. Iris and pupil affected, cornea sound, lens clear or opaque.	
1. Simple closure of the pupil from iritis, the lens and capsule supposed to be clear.	1. Lateral excision if possible; if not, separation.

* Practical Work, &c., vol. ii. p. 511.

STATE OF THE EYE.	PLAN OF OPERATION.
2. Closure of the pupil with cataractous lens, and posterior synechia.	2. If the substance of the iris appears to be healthy, and likely to contract when cut, so as to cause the incision to gape; and if the lens be soft, and fitted for division, incision through the sclerotica with division of the lens. If the lens be hard, and requiring extraction, it will be advisable to perform Maunoir's operation by incision, and extract the cataract through the opening. If the iris is not healthy, separation and subsequent displacement of the cataract or central excision with extraction, or the following combination of Maunoir's operation by incision, with excision of the flap of iris, and extraction of the lens, might be had recourse to. Having made the section of the cornea to the extent of one-third of its circumference, two incisions are to be made in the iris with the scissors; but instead of commencing at one point, and divaricating as in the operation above described, they are to commence at different points, and made to converge and terminate at the same point, thus:—

Fig. 62.

If the triangular flap thus formed does not immediately contract and shrivel, it may be

STATE OF THE EYE.	PLAN OF OPERATION.
	drawn out of the wound and snipt off.
3. Closure of the pupil, after the removal of a cataract.	3. This was the kind of case in which Cheselden performed his operation by incision through the sclerotica; and if the texture of the iris has remained tolerably sound, the operation will in general succeed. If the texture of the iris, though not much altered, still appears to have suffered somewhat, it may be advisable to try Maunoir's operation by incision, rather than Cheselden's; but if the texture of the iris be decidedly altered, then excision or separation must be had recourse to.
1582. Partial opacity of the cornea, closed pupil, synechia anterior or posterior, and cataract. This is a combination of all the morbid states above enumerated.	Except in so far as the situation and extent of the clear part of the cornea on the one hand, and the state of the iris on the other, in such cases, necessitates a modification of plan in operating, what has been said in the preceding paragraphs is here applicable.

Section IV.—CONGENITAL DEFECTS OF THE IRIS AND PUPIL.

Congenital absence of the iris.

(Irideremia congenita.)

1583. The whole iris may be congenitally absent, or there may be still some trace of it (*complete or incomplete congenital absence of the iris*).

1584. There is a uniform dark, though not the jet black appearance, behind the cornea, but when the light falls upon the

eye in a certain direction, a dark red reflection from its bottom is observed.

1585. Both eyes have generally been found to suffer from the congenital defect, which in some cases has been complete in the one and incomplete in the other.

1586. Persons affected with absence of the iris do not bear exposure to strong light well, and their vision is imperfect; but, by their habit of keeping the eyebrows depressed and the eyelids half closed, their eyes are somewhat protected from the too great influx of light, and their vision at the same time rendered more distinct.

1587. The eyes may be in other respects perfectly formed, or they may be the subjects of additional malformations.

1588. Cataract in general sooner or later forms; sometimes it already existed congenitally. It often appears tremulous.

1589. Though cataract exists, the vision is still in some degree retained, as the rays of light find a passage to the retina through the *zonula lucida*, which is seen around the circumference of the opaque lens.

1590. In consequence of injury, the greater part of the iris may be detached from its ciliary connection, in which case it shrinks to a small size, and the eye thus comes to appear as if there was incomplete absence of the iris.

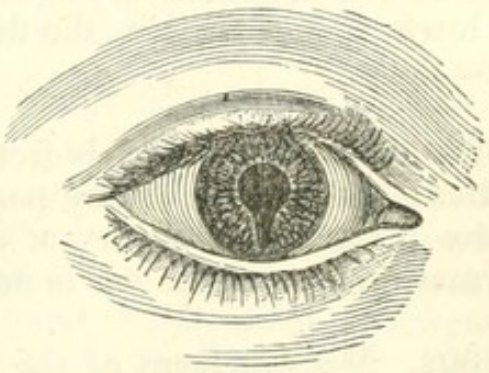
1591. *Treatment.*—The only thing that can be done for cases of congenital absence of the iris is to wear over the eyes, in the manner of spectacles, arched plates of black horn or the like, having transverse slits in them to see through, analogous to the snow eyes of the Esquimaux. If the state of vision require it, concave or convex glasses may be fitted into the slits.

1592. When cataract has formed, and if an operation should be thought advisable, division is the mode of operating to be adopted.

Congenital fissure of the iris.

(Coloboma iridis congenitum—Irido-schisma.)

Fig. 63.



1593. The fissure extends from the pupil towards the ciliary circumference of the iris, and its direction is almost constantly downwards.

1594. In some cases the cleft contracts along with the pupil, though slowly; in other

cases, the power of contraction appears to be confined to the pupil.

1595. Vision is in general unimpaired.

1596. The fissure usually becomes narrow in approaching the ciliary circumference of the iris, but in some instances the opposite disposition has presented itself. In some cases the fissure has been found to implicate the pupillary edge of the iris merely like an angular notch. Again, a peculiar variety of the defect has been met with, viz., consisting of a fissure in the proper substance of the iris only, whilst the uvea remained perfect.

1597. Sometimes one eye alone is affected with congenital fissure of the iris; sometimes both. A case is on record in which there was this malformation in one eye, and in the other a double pupil, like the figure of 8.

1598. In general, the lower half of the eye is less convex than the upper, and apparently less developed. In some cases the whole eye has appeared smaller than natural, the cornea flatter, the pigment deficient, and the eyeball oscillatory. In other cases a complication with cataract has been found to exist, but a considerable degree of vision still remained, as the light penetrated to the retina through the fissure of the iris, and thence through the zonula lucida by the circumference of the lens. In numerous cases, however, the eyeball has appeared quite natural in other respects, and vision good.

1599. The malformation has been observed to be hereditary in families.

1660. In some cases it has been found on dissection that the coloboma iridis was a part of a more extensive fissure, involving both the retina and choroid. Coupling this with the fact, that at a very early period a fissure extends through the retina, choroid, and iris, at the lower part, we are readily led to perceive that congenital fissure, implicating the lower part of the iris, is owing to an arrestment of development. In those cases, however, in which, as is said, the fissure implicated some other than the lower part of the iris, the defect cannot be attributed to this cause.

1661. Fissure of the iris from injury (*coloboma iridis traumaticum*) may occur at any part of the iris, and to any extent. There being usually injury of some other part of the eyeball, the mere fissure of the iris is not the principal part of the case.

1602. Misplacement of the pupil and deformity of it, are

sometimes met with as congenital malformations; as also the existence of more than one pupil, as above noticed (s. 1597).

Congenital imperforation of the iris.

1603. In many works on the Diseases of the Eye, persistence of the pupillary membrane is alleged as a condition sometimes met with requiring an operation for artificial pupil; and as instances, Cheselden's operations are referred to, never any others. Cheselden's operations, however, were not performed in cases of persistent pupillary membrane, but, as above mentioned (p. 284, note), in cases of closed pupil, after the operation for cataract.

1604. Though the pupillary membrane may sometimes still exist at birth, it ere long disappears, and I believe there is no unequivocal case on record, in which it remained permanent and formed an obstacle to vision requiring the interference of art.

CHAPTER IV.

Section I.—ABNORMAL STATES OF THE OPTICAL REFRACTIONS AND ADJUSTMENTS OF THE EYE.

MYOSIS AND MYDRIASIS.

1605. The name *myosis* is given to an unnaturally contracted, that of *mydriasis* to an unnaturally dilated state of the pupil, persisting in opposition to the influences to which the pupil is ordinarily obedient, and independent of morbid adhesions or other organic change.

1606. To understand the nature of myosis and mydriasis, it is necessary, in the first place, to have a clear conception of the conditions on which the movements of the pupil depend.

Conditions on which the movements of the pupil depend.

1607. The pupil is, in dull light, in its medium state, which is about one-fifth of an inch in diameter. It becomes contracted to a smaller size when the light to which the eye is exposed is strong; but, on the contrary, dilated to a larger size when the light is weak. During sleep the pupil is very much contracted. Some time after death it is found of the medium size.

1608. When the pupil is of its medium size the iris is in a state of relaxation; contraction of the pupil to a smaller, and dilatation of it to a larger size, are manifestations of an active state of the iris—the former of its circular, the latter of its radiating fibres. The contractions of either of these sets of fibres having ceased, it is the elasticity of the iris which brings the pupil back to its medium diameter.

1609. The circular fibres of the iris, by which the pupil is contracted, owe their contractile power to the nerve of the third pair, whilst the radiating fibres, by the action of which the pupil is dilated, owe their contractile power to nervous fibres derived from the sympathetic in the neck, and which are communicated to the ciliary nerves through the medium of the ophthalmic branch of the fifth, and its connections with the carotid plexus.

1610. When the nerve of the third pair is paralyzed, there is fixed dilatation of the pupil, from paralysis of the circular fibres of the iris permitting of unrestrained action of the radiating fibres. Besides this effect on the pupil, when the nerve of the third pair is paralyzed, there are ptosis, or falling down of the upper eyelid in consequence of paralysis of the levator palpebræ, permitting of unrestrained action of the orbicularis palpebrarum, and divergent strabismus in consequence of paralysis of the internal rectus, and other muscles supplied by the third nerve, permitting unrestrained action of the external rectus.

1611. When fixed dilatation of the pupil occurs, unaccompanied by ptosis and divergent strabismus, it may be owing to paralysis of that branch only of the nerve of the third pair, which goes to the lenticular ganglion; but in many cases—those especially of amaurosis, in which the pupil moves in concert with that of the opposite sound eye—there is no reason for supposing that the third pair is at all affected. The dilatation of the pupil is most probably owing to spasmodic contraction of the radiating fibres of the iris overpowering the action of the circular ones.

1612. If this be so, the contraction of the radiating fibres may be supposed to be owing, in the amaurotic cases, to reflex action of the nerves on which the contractile power of the radiating fibres depends, called forth by the insensible state of the retina, in a manner analogous to that in which the absence of the excitement by light of the healthy retina calls forth dilatation of the pupil, whilst, in consequence of the same insensible state of the retina, reflex action of the nerves on which the contractile power of the circular fibres depends, is no longer called forth

by the stimulus of light; but in the cases of fixed dilatation of the pupil, in which the retina is quite sensible (mydriasis properly so called), the mode in which the excitement is communicated to the nerves supplying the radiating fibres of the iris must be different. The remote causes are blows on the eye and head, gastric irritation from worms, hardened feces, &c., and these perhaps operate directly through the sympathetic.

1613. By cutting the sympathetic and vagus in the neck in dogs, contraction of the pupil takes place, in consequence of the radiating fibres of the iris being thereby deprived of their supply of nervous influence and paralyzed, whilst the circular fibres of the iris continue in a state of unrestrained contraction. But it is to be observed that as an immediate effect of the section of the sympathetic, dilatation of the pupil may occur in consequence of the irritation of the nervous fibres, excited at the time by the section. Besides paralysis of the radiating fibres of the iris and consequent contraction of the pupil, paralysis of the walls of the blood-vessels of the eye is produced: the consequence of which is inflammatory congestion (s. 200).

1614. Persistent contraction of the pupil, apparently in consequence of spasmodic action of the circular fibres of the iris, occurs in some cases of amaurosis (erethitic cases). The spasmodic action appears to be kept up by the irritable state of the retina, exciting reflex action of the nerves of the third pair, in a manner similar, except in degree, to what occurs in ordinary circumstances by the action of light. In some cases, the spasmodic action appears to be occasioned by irritation of the branches of the ophthalmic of the fifth pair exciting reflex action of the oculo-motor. Perhaps there is, in addition to spasmodic action of the circular, paralysis of the radiating fibres, occasioned by antagonistic reflexion on the nerves supplying them.

1615. The motions of the pupil are involuntary. The power of moving the pupil by an act of the will, which some persons possess, is owing, not to a direct voluntary power they have over the iris, but to the circumstance that they can readily exert the voluntary power of adjustment, which calls forth sympathetic movements of the pupil, as will be explained below (s. 1636.)

1616. It is not by directly exciting the iris, that light calls forth contraction of the pupil, but by exciting the retina and optic nerve, and thereby determining reflex action of the nerve of the third pair. Hence, when the retina is insensible, or cut off by section of the optic nerve from its connection with the brain, or when the nerve of the third pair is cut off by section

from its connection with the brain, the pupil is not influenced by light, but remains fixed in a dilated state.

1617. In some cases of amaurotic blindness, the motions of the pupil under the influence of light are natural. This is explained by supposing that the morbid condition on which the blindness depends, involves only the part of the brain which is the seat of visual perception, and that it is in front of this part of the brain that that condition of structure exists through which reflection takes place, from the optic on the oculo-motor nerve.

1618. In most cases of amaurosis, motion of the pupil is not excited by the light. If, in a case of this kind, one eye only be affected, the pupil remains fixed, as long as the sound eye is covered, but as soon as the latter is exposed to the light, and motion of its pupil thereby excited, motion of the pupil of the amaurotic eye is generally, though not always, likewise excited. This sympathy between the two irides, which is also manifested in the healthy state by motion of both pupils, though one eye only be exposed to variations of light, is explicable by the fact that the optic nerves have each a root in both sides of the brain, and may therefore each be connected in the manner above explained with both oculo-motor nerves.

Myosis.

1619. Myosis may occur uncomplicated with defective sensibility of the retina, but as mere contraction of the pupil does not disturb vision much, except in weak light, it does not usually come under the notice of the practitioner.

1620. Myosis, when it comes under the notice of the practitioner, is generally attended by defective vision—the myosis and the defective vision being equally symptoms of a morbid condition of the retina.

1621. In those cases in which vision is not impaired, myosis appears to be the result of the habitual contraction of the pupil, induced by constant employment of the eyes on minute and brilliant objects, and is, therefore, frequently met with in jewellers, watchmakers, engravers, &c. The circular fibres, from being at first dynamically and temporarily contracted, come at last to be organically and permanently contracted.

1622. In the other cases it appears to be owing to the tonic contraction of the sphincter fibres, in consequence of reflex nervous action, excited by the state of the retina, differing from what is the case in ordinary circumstances only by being long kept up.

1623. *Treatment.*—In cases of myosis of the first kind, bel-

ladonna has not much effect on the pupil; and in cases of the second kind, when it does produce some degree of dilatation, vision is not improved; but, on the contrary, disturbed by it. The principles which should regulate the treatment of such cases, are the same as those laid down for the cases comprehended under Amaurosis.

Mydriasis.

1624. Mydriasis, unaccompanied by any other disturbance of vision than is accounted for by the state of the pupil, viz., dazzling, confusion, multiplication and coloration of objects, especially near objects, in consequence of diminution of the correction of spherical, chromatic, and distantial aberrations, is to be carefully distinguished from the dilatation of the pupil, which is so common a symptom of amaurosis.

1625. That a case is one of simple mydriasis, is ascertained by requesting the patient to look through an aperture, of the ordinary size of the pupil, in a card blackened on the surface next the eye, when he will be able to see objects quite distinctly. Vision is also improved by convex glasses, and is better in dull light.

1626. *Treatment.*—The treatment of mydriasis accompanying ptosis and divergent strabismus, as the consequence of paralysis of the oculo-motor nerve, is discussed below under that head. Simple uncomplicated mydriasis is sometimes removed by irritating applications to the conjunctiva. But before this local treatment is had recourse, to gastric irritation or other disordered states (s. 1612) of which the mydriasis is likely to be a symptom, should be the object of treatment.

MYOPY, OR SHORTSIGHTEDNESS, AND PRESBYOPY, OR FARSIGHTEDNESS.

1627. When the distance at which an ordinary sized type can be read *comfortably* is much less than twelve inches, the vision is said to be myopic; when, on the contrary, it is much greater, vision is said to be presbyopic.

Preparatory to entering on an account of myopy and presbyopy, it will be useful to make some observations on refraction by convergent lenses, and on the adjustment of the eye to different distances.

Refraction by convergent lenses and the adjustment of the eye to different distances.

1628.—The rays of light from very distant objects, though not strictly parallel, are usually assumed to be so. The focus to which such rays are brought by a convergent lens, is called the *principal focus of the lens.*

1629. If rays do not come from such a distant body as to be parallel, but are more or less divergent, then the focus to which they are brought by the lens, is farther off from the lens than its principal focus, viz., at some point between this and infinite distance. This point is nearer the principal focus the more distant the body whence the rays emanated; in other words, the more nearly parallel they are, and *vice versâ.*

1630. The point of an object from which any given pencil of divergent rays emanates, is named the focus of incident rays, and the focus to which these divergent incident rays are brought by the lens is named the focus of refracted rays. These two foci, the focus of incident rays, and the focus of refracted rays, in consequence of the relation between them above pointed out, viz., that when the one is near the other is distant from the lens, are named *conjugate foci.*

1631. From this it will be perceived, that if the refractive media of the eye were incapable of change, either as regards power, or as regards their relative situation to the retina, the rays of light from objects at one particular distance only, would be collected into foci on the retina. Rays from objects farther from the eye than that distance would come to foci, before arriving at the retina, and having crossed, would fall on the retina in circles of dissipation. Rays from objects nearer would not come to foci, except behind the retina, on which therefore they would fall likewise in circles of dissipation.

1632. The result of this would be, that objects could be seen perfectly distinctly only when situated at one particular distance from the eye. But we know that this is not the case. We know that we can see objects *perfectly* distinctly at different distances, within certain limits. Hence the eye must admit of adjustment to different distances, like our optical instruments.

1633. Here the distinction is to be explained between perfect and distinct vision. In perfect vision, the outline, colour and details of the object appear traced with the utmost accuracy, clearness, and strength; and this we have only when the rays of light are brought accurately to foci on the retina. In distinct vision, larger objects are seen so well, that they are readily recognized: the title-page of a book, for example, is readily

read, but there is a want of clearness of outline and strength of tint, and small objects or the details of large objects are very imperfectly recognized; this is owing to the rays of light not falling on the retina in foci, but in small circles of dissipation.

1634. The limits within which the eye can see perfectly distinctly at different distances, in other words, the limits of perfect vision, varies somewhat in different persons, and even in the two eyes of the same person; but in general they may be put down at between nine and fifteen inches. For some distance below nine, or above fifteen inches, the vision may be still distinct, but not perfect.

1635. Though there can be no doubt that the eye is capable of adjustment for vision at different distances, the means by which this is effected have not been unequivocally demonstrated; still as the power of adjustment is lost with the crystaline body, it is very probable that it depends on a change in the position and form of the lens. By a very slight movement of the lens forward, and a very slight increase of its curvature, the eye could be adjusted for near distances, and *vice versâ*.

1636. When the eye is adjusted for near objects, the pupil is contracted, and the axes of the eyeballs converged, and *vice versâ;* but these variations in the size of the pupil and direction of the eyeballs, are merely a concomitant and auxiliary, not an essential condition.

1637. It would be out of place here to enter into any further discussion regarding the supposed mechanism by which these changes are effected.

Shortsightedness.

1638. This is that state of vision in which the person can see objects perfectly distinctly only when they are at a very short distance from the eyes, a distance of nine inches or less.

1639. It is owing either to too great refractive power of the refractive media of the eye, or to the distance of the retina behind the crystaline being too great; so that in either case, the rays of light come to a focus before arriving at the retina, cross and are in a state of dissipation, when they do impinge on that nervous membrane, and therefore form indistinct and confused images.

1640. By bringing the object near the eyes, it is distinctly seen, because the rays from it, which enter the eyes, being now more divergent than when it was distant, are not so soon brought to a focus; in other words, the different points of the object, as foci of incident rays, and the foci to which these rays

are brought in the interior of the eye by the refractive media, are *conjugate foci*, and accordingly, when the foci of incident rays are brought nearer the refractive media, the foci of refracted rays recede from them.

1641. Too great a refractive power of the media of the eye may be owing either to too great convexity of their curvatures, —the curvatures of the cornea and crystaline,—or too great refractive density, or both conjointly.

1642. The situation of the retina at too great a distance behind the crystaline body, may be owing either to a preternatural elongation of the axis of the eyeball, or to the lens being nearer the cornea than usual.

1643. In shortsightedness, the power of adjusting the eye to different distances, is still retained, but within certain limits, thus:—the nearest distance may be from two to four inches, the furthest, from six to twelve.

1644. *Appearances presented by the eyes of myopic persons.* —In many cases there is nothing peculiar to be observed; but frequently the eyes are prominent and firm, the cornea very convex, the anterior chamber deep, and the pupil dilated.

1645. *Peculiarities of the vision of shortsighted people.*—

1st. They see small objects more distinctly than other people, because, from their nearness, the objects are viewed under a larger visual angle.

2d. They see them also with a weaker light, because the objects being near, a greater quantity of rays from them arrive at the eye. Hence, they can read small print with a weak light.

3d. But they can also see more distinctly, and somewhat further off by a strong light than by a weaker one, because the pupil is contracted by the strong light, and all but the more direct rays of light thereby excluded. On the same principle they see at some distance distinctly through a pin-hole in a card; and when they try to view distant objects, they half close their eyelids. The rays of light in these cases have their divergence at the same time somewhat increased by diffraction.

4th. They sometimes see objects beyond the limits of their distinct vision, double, or even multiplied.

1646. *Subjects of shortsightedness.*—This defect of vision seldom occurs in so great a degree before puberty as to be troublesome; when in a great degree in children it may be a symptom of central cataract, (s. 1266.) After puberty, when the eyes come to be used in earnest, shortsightedness is usually

first discovered to exist, and it may go on gradually increasing, especially if the person uses his eyes much in reading, and on minute objects; hence, the greater frequency of shortsightedness among the educated classes, and those whose occupation is with minute work. Myopy sometimes occurs in old persons, whose vision was previously good for ordinary distances.

1647. *Treatment.*—To persons whose occupation is with minute objects, shortsightedness, unless in a very great degree, is rather an advantage, as they are enabled to observe all the details of their work very accurately; and in the ordinary exercise of vision, the use of concave glasses is a ready and simple help.

1648. When a tendency to shortsightedness manifests itself in young persons, and especially if the future occupation of the person is to be of a kind requiring good vision for distant objects, much exertion of the eyes on minute work should be avoided, and the eyes exercised on large and distant objects.

1649. Concave glasses help the vision of shortsighted persons for distant objects, simply by increasing the divergence of the rays of light before they enter the eye, so that they may be less speedily brought to foci than they would otherwise have been, in consequence of the increased refractive power of the media of the eye; or, supposing the refractive power of the media of the eye not increased, but the distance of the retina behind the lens increased, that they may be brought to foci at a greater distance behind the lens than they would otherwise have been, in order to correspond with the greater distance of the retina behind the lens.

1650. Concave glasses are made of different degrees of concavity, the shallower being those adapted for the slighter degrees of shortsightedness, the more concave for the greater degrees.

1651. When very shortsighted, a person requires to use concave glasses, not only to be enabled to see distant objects, but also for reading with, in order to avoid the necessity of stooping. Less shortsighted people use glasses only to be enabled to see distant objects.

1652. The focal length of the concave glass which a person will require to see objects at more than two hundred or three hundred yards distance, should be about equal to the distance at which he can see to read distinctly an ordinary type with the naked eye—six inches for example.

1653. The focal length of the concave glass which a very shortsighted person will require to see to read at a convenient distance, is determined thus:—Suppose he sees to read with

the naked eye at the distance of six inches, and desires to be able to read at the distance of twelve, the one distance is to be multiplied by the other, and the product, seventy-two, divided by the difference between the two distances, viz., six. The quotient twelve, is the number of inches the focal length of the glass required should be.

1654. But when a person finds it necessary to have recourse to glasses for shortsightedness, he should go to an optician, and select two or three pairs which appear to assist his vision best; or send for two or three pairs of about the focal length, which, according to the above calculation, he thinks will suit him, and try them leisurely at home for a day or two before fixing his choice on one particular pair.

1655. The following are the circumstances which should guide him in his choice:

The glasses should be the lowest power which will enable him to distinguish objects as he wishes, quite readily and clearly, and at the same time comfortably. If they should make objects appear small and very bright, and if in using them the person feel his eyes strained and fatigued, or if he becomes dizzy, and if after putting them aside the vision is obscure, they are not fit for his purpose—they are too concave.

1656. Having once fitted himself, a person should not too hastily change his glasses, although they may appear not to enable him to see quite so clearly as when he first used them.

1657. A glass to each eye should always be employed; vision is by this clearer, and its exercise less fatiguing to the eyes, than when a glass to one eye only is used. The use of a glass to one eye only is in fact very detrimental, especially to the opposite eye.

Farsightedness.

1658. With this state of vision the person can see objects distinctly only when they are at a very considerable distance from the eyes; in reading, for example, he holds the book at arm's length.

1659. Farsightedness being in almost all respects the converse of shortsightedness, the best way of discussing it here will be simply to reverse the account above given of shortsightedness, and which will therefore stand thus:

1660. Farsightedness is owing either to diminished refractive power of the refractive media of the eyes, or to the distance of the retina behind the crystaline body being too short; so that in either case the rays of light tend to come to a focus at a point

behind the retina, on which, therefore, they impinge in circles of dissipation, and form indistinct and confused images.

1661. By removing the object from the eyes, it comes to be distinctly seen, because the rays from it which enter the eye, being now less divergent than when it was near, are more quickly brought to a focus; in other words, the different points of the object as foci of incident rays, and the foci to which these rays are brought in the interior of the eye by the refractive media are *conjugate foci;* and accordingly, when the foci of incident rays are removed from the refractive media, the foci of refracted rays come nearer them.

1662. Diminished refractive power of the media of the eye may be owing to diminution of the convexity of their curvatures, flattening of the cornea and crystaline. As to refractive density, there is probably an increase rather than a diminution of it, but this appears to be more than overbalanced by the diminution of curvature.

1663. The situation of the retina too near the crystaline may be owing either to a preternatural shortening of the axis of the eyeball or a receding of the lens from the cornea.

1664. In farsightedness, the power of adjusting the eye to different distances is much weakened. In this respect farsightedness differs from shortsightedness, in which the power of adjustment is still retained. In farsightedness it may be said that the habitual adjustment of the eye is for distant objects, and that in trying to read, for example, the power of adjustment is exerted to the utmost, hence the fatigue and confusion of vision which soon ensue.

1665. *Appearances presented by the eyes of farsighted people.*—In many cases there is nothing peculiar to be observed; but frequently the eyes are sunk, the cornea flat, and of small diameter, and the pupil contracted.

1666. *Peculiarities of vision of farsighted people.*

1. They see small objects indistinctly at every distance, because when near, they are out of focus, and when removed from the eye somewhat, they are seen at a small visual angle and with little light. By increasing the light, they see better. Hence, they do not see so well by candle-light as before, and when attempting to read by candle-light, they place perhaps the candle between them and the book held at arm's length.

2. They see large and distant objects very distinctly.

3. In most presbyopic persons, Dr. N. Arnott has ascertained that double vision in the eyes singly exists in a slight degree.

1667. *Subjects of farsightedness.*—Farsightedness seldom occurs except in persons who have passed middle age, and in them it is so common, that it is to be viewed as a natural change in the state of the eye. As it occurs in young persons, it will be spoken of under the head of *Asthenopy*.

1668. *Prevention and treatment.*—Though instances have occurred of persons who have been long presbyopic, recovering their former vision, and thereby being enabled to lay aside the use of their spectacles, recovery from presbyopy is not to be calculated on, but this is of small moment, as vision can be so perfectly assisted by means of spectacles.

1669. Something, however, may be done in the way of preserving the sight by avoiding over-exertion of the eyes in reading and other minute work, especially by artificial light, at the time of life when farsightedness, with diminution of adjusting power, usually comes on.

1670. Convex-glasses help the vision of far-sighted people for near objects, by diminishing the divergence of the rays of light before they enter the eye, so that they may be more speedily brought to foci than they would otherwise have been, in consequence of the diminished refractive power of the eye; or, supposing the refractive power of the eye not diminished, but the distance of the retina behind the lens diminished, that they may be brought to foci at a less distance behind the lens, than they would otherwise have been, in order to correspond with the diminished distance of the retina behind the lens.

1671. Convex-glasses are made of different degrees of convexity: the least convex being those adapted for the slighter degrees of farsightedness, the more convex for the greater degrees.

1672. To see distant objects, far-sighted persons do not, in general, require convex-glasses. It is most commonly to enable them to read and do minute work that far-sighted people use spectacles.

1673. If it is only at a *very great* distance that a person can see distinctly, the focal length of the convex-glass which he will require to enable him to read will be equal to the distance at which he wishes to see to read.

1674. If he is not so very far-sighted, but can see small objects distinctly at twenty inches distance, for example, the focal length of the convex glasses, which he will require to enable him to read at twelve inches distance, is determined by multiplying the two distances together, and dividing the product, 240,

by the difference between them, viz. 8. The quotient 30, is the focal length in inches of the glasses required.

1675. But when a person finds it necessary to have recourse to glasses for far-sightedness, he should go to an optician, and select two or three pairs which appear to assist his vision best, or send for two or three of about the focal length, which, according to the above calculation, he thinks will suit him, and try them leisurely at home for a day or two, before fixing his choice on one particular pair.

1676. The following are the circumstances which should guide him in his choice:—The glasses should be of the lowest power which will enable him to see objects distinctly as he wishes, and at the same time comfortably. Glasses which make the objects appear larger than natural, and strain and fatigue the eyes and cause headache, are not adapted to his case—they are too convex. It is usually found that glasses the next degree more convex are required for work by artificial light.

1677. The alteration in the eye on which the far-sightedness depends, generally goes on to increase with age, hence, it is necessary, after a time, a few years, to change the glasses first chosen for others more convex. In regard to this exchange it is to be observed, that it ought not to be too hastily had recourse to, nor, on the other hand, too long delayed. The same feeling of necessity which first prompted to the use of glasses, will indicate the necessity of change.

1678. It is a not uncommon notion that glasses of certain focal lengths are adapted to certain ages, but this is erroneous. Still, though the choice of glasses cannot be determined by the mere age of the person, there is a certain average relation between the age and the focal length of the convex glass required, which is expressed in the following table.

Age in years.—	40,	45,	50,	55,	60,	65,	70,	75,	80,	85,	90, 100.
Focal length in inches.—	36,	30,	24,	20,	16,	14,	12,	10,	9,	8,	7, 6.

1679. *Reading Glass.*—This is a double-convex lens, broad enough to permit both eyes to see through it. It is used for the purpose of magnifying the object; whereas, convex spectacles are used merely to render objects distinct at a given distance, without magnifying them as above mentioned.

Cylindrical Eye.

1680. Mr. Airy has written an account* of one of his own

* Transactions of the Cambridge Philosophical Society, quoted in the Encyclopedia Metropolitana, article LIGHT, p. 398, § 359.

eyes, which he ascertained to refract the rays to a nearer focus in a vertical than in a horizontal plane. This would take place, he remarks, if the cornea, instead of being a surface of revolution, in which the curvature of all its sections through the axis must be equal, were of some other form, in which the curvature in a vertical plane is greater than in a horizontal. This is, in fact, the natural form of the cornea, but in the instance of Mr. Airy's eye, existing, perhaps, in an exaggerated degree so as to disturb vision.

1681. With such unnatural conformation of the eye, a point appears a line of a certain length; a circle an oval; everything being seen elongated in one direction. The cylindrical deformation has been met with oblique, so that a square appeared a parallelogram.

1682. The defect is remedied by glasses which, to the healthy eye, would make a line of the same length appear a point—which would, in fact, shorten all objects in the same degree and in the same direction, as they are lengthened by the defective eye.*

1683. Each case of cylindrical eye being thus more or less peculiar, lenses must be specially prepared for it; and it is evident that this demands both skill and intelligence on the part of the optician. The general principle on which the glass is shaped, Mr. Ross informs me, is this: one side of the lens is made a portion of a cylinder, of the same diameter as the cylinder cornea, having its axis, however, placed at right angles to that of the latter. The other side of the lens is made plane, convex, or concave, to suit the condition of the eye irrespective of its cylindricity.

Unequally refractive state of the two eyes.

1684. The two eyes may be in different degrees myopic or presbyopic. Though in either of these cases the use of concave or convex glasses of a different focal length for each eye is theoretically indicated, it is not in practice found to answer. It generally gives rise to such confusion of sight and actual pain that it is soon abandoned.

1685. Again, one eye may be myopic, and the other presbyopic. In this case a concave glass for the former and a convex one for the latter are theoretically indicated, but they are found practically as inefficient as glasses of different focal lengths in the preceding cases.

* On the Use and Abuse of Spectacles, by Andrew Ross, Optician, London.

Loss of power of adjustment.

1686. The eye may fall into a state in which the vision is neither myopic nor presbyopic, and in which the power of accommodation being lost, convex glasses are required to see near objects, and concave glasses to see distant objects.

Chromatic vision.

1687. The coloured vision to be noticed here must be distinguished from that dependent on subjective excitement of the retina to be considered below, in Section I. of the next chapter, (ss. 1736, et seq.)

1688. Although the eye, strictly speaking, may not be perfectly achromatic, it is so in the healthy state to all intents and purposes; but in certain morbid states, its optical parts may become so suffused and deranged as to decompose the light, and make objects appear as if surrounded by the colours of the rainbow, thus:

1st. In puromucous inflammation of the conjunctiva, films of mucus suffusing the cornea give rise to the appearance of irridescence around objects (s. 458).

2d. When there is defective adjustment of the eye, and when, consequently, the rays of light do not fall in foci on the retina, vision, at the same time that it is thus rendered indistinct, and even multiplied, may appear slightly iridescent. Hence iridescence around objects is seen when the adjusting power of the eye is disturbed by passion, mental abstraction, sleepiness, the action of belladonna, mydriasis. Hence, also, persons who have one eye myopic and the other presbyopic often see colours when they look at very near or very distant objects with both eyes, because one eye only is adjusted to the distance of the object.

Diplopy and polyopy with one eye.

1689. In consequence probably of the refractive media of the eye not having perfectly regular curves, diplopy and polyopy with one eye occur, as just mentioned, when the eye is not adjusted to the distance of the object looked at; hence short-sighted people see distant objects, and farsighted people near objects, double or multiplied with one eye as well as iridescent.

1690. But vision of one eye may be double or multiplied independently of defective power of adjustment to distance, in consequence of partial opacity of the cornea, or, more generally, partial opacity of the lens or its capsule. The action of these morbid states is well illustrated by Scheiner's experiment,

which consists in looking at a pin, for example, through two pinholes in a card, placed so close to each other as to be included within a space equal to the diameter of the pupil. The pin appears double, except when held at a certain distance—that of perfect vision with the naked eye.

*Asthenopy, or weaksightedness.**

1691. *Subjective symptoms.*—An incapacity to exercise vision on near objects, as in reading, sewing, and the like, for any length of time. The objects are at first seen distinctly, but the eyes soon become tired and painful—the pain extending to the head—and the vision growing confused.

1692. If the eyes are closed, and rest given to them for a few minutes, vision may be again exercised, but in a short time the eyes will again become fatigued and the vision confused. Both eyes are in general equally affected.

1693. The vision of distant objects is not disturbed, and by the use of convex glasses the exercise of vision on near objects may be much assisted.

1694. *Objective symptoms.*—The eyes may appear dull and heavy, and are perhaps directed towards objects in a weak indecisive manner, but in general they present no positive appearance of disease. The pupils are quite lively.

1695. *Age.*—Asthenopy commences in childhood or youth, and may continue throughout life; but it is seldom met with originating in the middle period of life.

1696. *State of health.*—The subjects of the affection often, but by no means always, labour under general nervous debility—the result sometimes of general disease.

1697. *Causes.*—There is often no evident cause. A very frequent cause is pure over-exertion of the eyes, as in students, artists, clerks, engravers, watchmakers, tailors, sempstresses, &c., especially by artificial light, together with want of sleep, want of exercise in the open air, &c. The complaint sometimes occurs as a sequela of inflammation of the eye, especially scrofulous, external and internal. Injuries of the fifth nerve in the circumorbital region, and affections of the brain, are sometimes followed by asthenopy. Losses of blood, seminal losses, and the like, excite the affection apparently by occasioning general nervous debility.

1698. *Nature of the complaint.*—Asthenopy appears to consist in debility of the apparatus by which the eye is adjusted for the vision of near objects, together with an irritable state of

* Mackenzie in Edin. Med. and Surg. Journal, No. 156.

the retina, connected in some manner with tendency to internal congestion of the eyes.

1699. *Diagnosis.*—Asthenopy is principally to be distinguished from presbyopy, night-blindness, and amblyopy, or incomplete amaurosis.

1st. *Presbyopy.*—Presbyopy sometimes occurs in children, and might be confounded with asthenopy, as the two have this in common, that distant objects are seen without straining of the eyes, whilst in asthenopy during a paroxysm as well as in presbyopy, near objects are not. Presbyopy is, however, distinguished from asthenopy in the circumstance, that by rest the eyes do not acquire the power of distinguishing near objects.

2d. *Night-blindness.*—Asthenopy is in many cases most troublesome during the use of artificial light, and even approaches to night-blindness in the suddenness of its attacks, and the degree of imperfect vision which attends it.

3d. *Amblyopy, or incomplete amaurosis.*—In amblyopy there is constantly present an indistinctness of sight extending to all objects large and small, distant and near; in asthenopy indistinctness of sight comes on only after the eyes have been exerted on near objects. In amblyopy the patient sees best after having fixed his eyes for some time on the object he examines; in asthenopy, on the contrary, vision fails them.

1700. *Prognosis.*—This is, on the whole, unfavourable, especially if the complaint is of long standing, if it has originated in an ophthalmia, injury of the fifth nerve, or of the encephalon. Less unfavourable when it has arisen under other circumstances, provided what appears to be the exciting cause admits of removal. Asthenopy, though it has become confirmed, rarely passes into amblyopy, and is not likely to end in blindness.

1701. *Treatment.*—The first thing in the way of treatment is the avoidance, or removal by appropriate means, of any cause which may appear to be in operation, such as over-use of the eyes, seminal losses, &c.

1702. If the complaint appear to have resulted from previous inflammation of the eye, injury of the fifth nerve, or some affection of the brain, an alterative course of treatment with counter-irritation may be tried.

1703. Rest to the eyes, the occasional application to them of the cold douche, good diet, exercise, country air, sea-bathing, and the like, must in general constitute a leading part of the treatment of asthenopy.

1704. When the patient requires to employ his eyes on near

objects, he has no other resource than to use convex glasses, which, in some cases, must be of the very lowest power only; but it would be advisable for the patient, if his occupation requires much use of the eyes, to change it if possible for one of an opposite kind.

1705. *Complications.*—Asthenopy is often complicated with some other affection. It may be complicated with the effects of some one of the ophthalmiæ; with myopy or presbyopy; with muscæ volitantes; sometimes oscillation of the eyes, and not unfrequently strabismus, with amblyopy or incomplete amaurosis. Persons blind of one eye are not unfrequently affected with asthenopy in the other. One eye may be incompletely amaurotic, the other asthenopic. When asthenopy is complicated with amblyopy the vision is at all times more or less obscure, but on reading, &c., it soon becomes still more so, recovering, however, after a little rest.

Section II.—VISION OF OBJECTS IN AND ON THE EYE.*

1706. Under certain circumstances, one may see objects in or on his own eyes. The appearance constitutes what is commonly known by the name of *muscæ volitantes.*† Under this name, however, certain other morbid appearances are often also included, which are not owing to the visual perception of any object in or on the eye, but are entirely subjective; are owing, for example, to insensible spots of the retina. Such appearances as the latter have no real motion, but apparent motion only, depending on that of the eye; hence they are distinguished by the name of *fixed muscæ* from the former appearances, which present real as well as apparent motions.

* Mackenzie, in Edin. Med. and Surg. Journal, No. 164.
† Spectra, Scotomata, Myodesopia, &c.

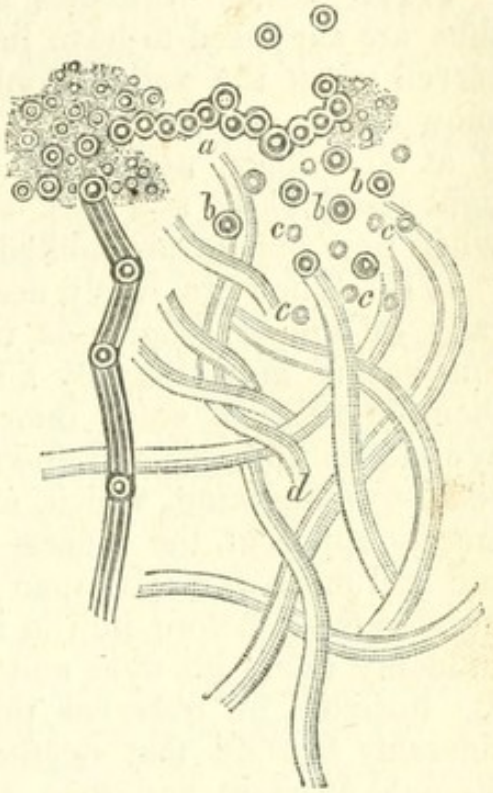
A. VISION OF OBJECTS IN THE EYES.

Common muscæ volitantes.

(Floating muscæ—Entohyaloid muscæ.)

1707. Muscæ volitantes appear to the patient who has made no particular examination of them, under the form of blackish motes, or of a thin gray film, like the wing of a fly, or of semi-transparent gray threads, like spiders' web, but if viewed attentively against the clear sky, a white wall, or the like, they are recognized to be made up of appearances such as the following:—1st. A convoluted string of beads, or a convoluted transparent tube, containing in its interior a row of beads smaller than its diameter, except here and there where one larger than the rest is seen occupying its whole diameter, the end of the string or tube sometimes presenting a dark knobbed extremity, as if formed by an aggregation of the beads composing the string, or contained within the tube (fig. 64, *a*); 2d. Insulated beads, some of which, and these the more frequent, have a well-defined outline (*b*)—others, and these rarer, have an indistinct outline (*c*); and, 3d, a parcel of flexuous round watery-looking or spun-glass-like filaments with dark contours, often divided inferiorly into truncated branches (*d*).

Fig. 64.



1708. These different appearances may be seen altogether, the beaded appearance on one side of the parcel of watery-looking filaments, and interspersed here and there the insulated beads, one or two of the well-defined of which often appearing as if attached to the outside of the beaded tubes; or some one of the appearances may be seen principally or exclusively.

1709. According as the distance of the object against which the muscæ volitantes are viewed is greater or less, they appear larger or smaller.

1710. Vision is not affected by floating muscæ. Between

the several portions of the muscæ and by the side of them, the eye still sees everything with perfect distinctness. Even the portions of the retina, over which the shadows which cause the appearance of the muscæ fall, are found by the patient, when the corpuscles ascend out of the field of vision, to be perfectly sensible.

1711. Muscæ volitantes are often detected suddenly, and thus are supposed to have just occurred. They are most observed when the patient looks at the clear sky, a thin cloud, snow on the ground, a white wall, or the like. They are not, if at all, noticed under the opposite circumstances of a dull light and looking at a dark object. They are not much seen when near objects are looked at.

1712. They are rarely seen in the axis of vision, but generally to one or other side, or above or below. The patient thus seeing them only by a side glance, finds it difficult to fix them in order to study their appearance. They move as the eye moves upwards and downwards, or from side to side; but besides this motion, which, as dependent on that of the eye, is merely apparent, the muscæ have a real motion of their own, and still more extensive than their apparent motion. Thus, if, from looking before him in a horizontal direction, the patient suddenly raises his eyes and fixes them on some object above the horizon, he observes that the muscæ fly upwards considerably beyond that degree of elevation, and even beyond the field of view, and then come sailing down before him till they disappear below.

1713. Besides the motions of ascent and descent, the muscæ volitantes under consideration present lateral movements, although less marked, as well as changes in the relative positions of their several parts.

1714. *Nature of floating muscæ.*—Hitherto a very common opinion as to the nature of floating muscæ has been, that they are subjective sensations, depending on some intrinsic change of state of the optic nervous apparatus, thus confounding them with fixed muscæ; but that they are truly objective sensations, occasioned by the presence of particles in the interior of the eye, but extrinsic and in front of the retina, throwing their diffracted shadows on the retina, admits of mathematical demonstration.

1715. But without entering minutely into the matter, the proposition may be easily demonstrated thus:—Hold between a convex lens and the white surface on which the image of the light falls, some small object, as a pin. When this is near the lens, its shadow is not seen on the white ground, but when it

is brought nearer and nearer the white surface, its shadow appears more and more distinctly.

1716. The particles, moreover, appear to be of normal occurrence in the eye, for the appearance of floating muscæ may in general be seen by any person by simply looking through a small aperture in a card at the clear sky, or through the eye-glass of a compound microscope at the flame of a candle two or three feet distant, or simply by bringing the eyelids towards each other, and looking at a lighted candle.

1717. On contemplating the spectra thus brought into view, viz., the beaded filaments, the distinct and indistinctly defined globules, and the watery-like filaments, called by Dr. Mackenzie respectively the *pearly spectrum*, the *distinct insulo-globular spectrum*, the *indistinct insulo-globular spectrum*, and the *watery spectrum*, it is observed that they are situated in different planes, one behind the other, "that they never mingle with one another, so as to change the order in which they stand before the eye; but the pearly spectrum always appears the nearest, then the sharply-defined insulo-globular, then the obscurely-defined globules, and farthest away the watery threads."

1718. *Seat of the particles, the presence of which occasions muscæ volitantes.* This admits of being mathematically demonstrated to be in front of the retina, in or behind the vitreous body, but at the same time it appears that it is different for the different kinds, being very near the retina for the pearly spectrum, and farthest from the retina for the watery spectrum.

1719. *Nature of the particles, the presence of which occasions floating muscæ.*—This has not yet been with certainty determined. In the vitreous humour (as also in the aqueous) there is contained a great number of corpuscles, most of them resembling lymph corpuscles, though smaller, being between 1-4000th and 1-5000th of an inch in diameter; but it appears from the calculations of Brewster, Mackenzie, and Ruete, that the size of the particles, the presence of which occasions floating muscæ, is much greater than this. The corpuscles demonstrable in the vitreous humour are lighter than the fluid itself; in this respect agreeing with the corpuscles in the vitreous humour, which occasion muscæ volitantes, the latter, as appears from their movements, being lighter than the fluid in which they are suspended.

1720. Muscæ volitantes are often seen by persons without any particular notice of them being taken, as they are indistinct, present themselves occasionally only, and are therefore not troublesome.

1721. They are seen most distinctly, and are therefore most troublesome, when there exists an irritable state of the retina, with weakened irradiation, (s. 1743, et seq.) Such a state of the retina may therefore be viewed as the condition on which floating muscæ considered as a disease depend.

1722. Dilution of the images of external objects favours, distinctness, on the contrary, prevents the perception of muscæ. Hence, when the person is short or farsighted, they appear less evident to him when he uses the glasses fitted to render his vision distinct. This appears to be owing to the stronger impression of the external objects making up for the weakened irradiation, so that the weak impression of the objects of the muscæ is more readily effaced.

1723. The pupil of an eye affected with muscæ volitantes is generally contracted, even when the eye is myopic.

1724. *Exciting causes.*—Over-use of the eyes on minute objects. Inflammatory diseases of the eyes, external as well as internal. The seeking for them in experiments. Intemperance. Febrile diseases. Influenza. Disease of the heart. Want of sleep. Dyspepsia. Abdominal congestion. Hysteria. Hypochondriasis. Morbid sensibility of the system generally, arising from pressure of business, anxiety, and distress of mind. All these causes appear to operate in the same manner, occasioning a congested state of eyes, and weakened irradiation of the retina.

1725. When a hypochondriacal person once detects muscæ volitantes, he takes such frequent notice of them that they become to him more and more troublesome.

1726. *Prognosis.*—Though floating muscæ may occur along with incipient cataract or amaurosis, they have no connection with either of these complaints. Their occurrence, therefore, is of itself no indication that either cataract or amaurosis is taking place. If, however, there be along with the appearance of muscæ a failure of vision, and if that failure be not attributable to myopy or presbyopy, which may be ascertained by a concave or a convex glass not improving vision, then cataract or amaurotic amblyopy may possibly exist.

1727. In uncomplicated cases, the muscæ may indeed increase in numbers, but very slowly, and never to such an extent as to interfere with the distinctness of vision in any very troublesome degree. But sometimes the muscæ remain stationary, or even become less.

1728. As they depend on the vision of objects naturally ex-

isting in the eye, in consequence of a morbid sensibility of the retina, whatever tends to promote or relieve this will have the effect of promoting or relieving the muscæ.

1729. *Treatment.*—The removal or abatement of the exciting cause, if it can be detected, is the first thing to be looked to. Rest to the eyes, if they have been overstrained, relaxation from business, quiet to the mind. When the stomach and liver are out of order, mercurial alteratives, followed by tonics, regulated exercise, and change of air. Cold applications to the eyes, such as the cold douche bath (s. 111) twice or thrice daily for five or ten minutes, is the most important local application.

Spectrum of the vascular ramifications and network of the retina.

1730. This may be seen by means of the following experiment, which, from having been first pointed out by Professor Purkinje, of Breslau, is commonly called the experiment of Purkinje. It consists in shading, without closing, one eye, and looking straight forward with the other, whilst a lighted candle (the room being otherwise dark) is moved up and down close to the eye on the temporal side. In a short time a magnified spectrum of dark ramifications and anastomoses, on a light ground, appears floating before the eye, moving in a direction opposite to the movements of the candle.

1731. In this experiment those parts of the retina covered by the ramifications of the central vessels not being so much excited by the light as the rest of the membrane, do not retain the impression so long as until the return of the candle; hence the appearance of dark ramifications in the field corresponding to those parts.*

Circulatory spectrum.

1732. An appearance of grayish watery-like particles darting in every direction before the eyes, somewhat like the circulation in the web of the frog's foot under the microscope, may be seen by a healthy eye, by gazing at the clear sky for a short time. This appears to be an objective sensation, produced probably

* A spectrum of the vessels of the retina is, in certain states of the eye, seen independent of external light—light on a dark ground; but this is owing to pressure on the retina by the vessels. Being thus a subjective phenomenon, it belongs to the head of *photopsy*.—See next chapter. The appearance above referred to in s. 407 is similar to the vascular spectrum, but is owing to insensibility of the retina, from the pressure and opacity occasioned by the congestion and exudation in inflammation of the vascular layer of the retina. This, therefore, also belongs to the next chapter—to the head of *fixed muscæ*.

by the shadows on the retina of the blood corpuscles circulating in its vascular layer.*

B. VISION OF OBJECTS ON THE EYES.

Muco-lachrymal muscæ.

1733. Sometimes, though rarely, appearances are seen like opaque round spots, surrounded by a halo, which occasionally seem to run together, and again divide, and which slide downwards, but re-ascend after every nictitation.

1734. These appearances seem to depend on spectra, produced by the layer of mucus and tears, with minute globules of air, on the cornea. They are therefore called by Dr. Mackenzie muco-lachrymal muscæ volitantes.

CHAPTER V.

AMAUROTIC AFFECTIONS.

Section I.—INTRODUCTION.—ABNORMAL EXCITEMENT OF VISUAL SENSATIONS.

1735. In amaurotic affections, various visual sensations, though not in themselves unnatural, are apt to be excited unnaturally. As such sensations are important as symptoms, it is necessary to study them; but previously to doing so, the circumstances attending their natural occurrence must in each case be taken into consideration.

Sensations of light and colour, independent of external light, excited by internal influences operating on the optic nervous apparatus.†

1736. In the unexcited condition of the optic nervous apparatus, there is darkness before the eyes, but in the excited condition, light and colour are seen.

* When one stoops and then suddenly rises, the appearance of showers of lucid globules before the eyes is of a different nature, being a subjective sensation, excited by pressure on the retina by the determination of blood. So also is an appearance similar to that above described, except that the particles are lucid. The appearance of lucid spectra, therefore, belongs to the head of *photopsy*.—See next chapter.

† Photopsy and Chroopsy.

1737. The agent by which the optic nervous apparatus is usually excited, is the principle of light; but an excited condition, and consequently the sensations of light and colour, may be called forth by other influences, such, for example, as pressure. And it is to be observed, that whatever may be the stimulus which excites the optic nervous apparatus, no other sensations than light and colour can be called forth in it.

1738. As nervous primitive fibres are throughout their whole course physiologically the same, it is indifferent what part of the optic nervous apparatus be excited, in order that luminous sensations may be perceived—whether the retina itself be irritated, the fibres of the optic nerve in the orbit irritated or cut, or whether the cerebral part of the optic nervous apparatus be pressed on by congestion or tumour. As, moreover, the activity of nervous fibres is always manifested at their peripheral extremities, so in whatever part the optic nervous apparatus be excited, the luminous sensation which results is always referred by the sensorium to the periphery; not only to the periphery, however, but as in natural vision to without the body—(*projection outwards*).

1739. A familiar example of a luminous spectrum of the kind under consideration is that which, on pressing the eyeball, is seen projected outwards, and on the side opposite to that where the pressure is applied.

1740. Other examples are—a spectrum of the vessels of the retina, *light on a dark ground*, which, in certain states of the eye, is seen, and which is owing to pressure on the retina by its vessels in a state of congestion;* the appearance of a shower of lucid globules before the eyes on suddenly rising from a stooping posture, from the disturbance in the circulation in the optic nervous apparatus thereby occasioned.

1741. Analogous appearances of fiery scintillations, flashes of light, and coloured corruscations, occurring spontaneously, are symptoms of irritation or excitement of some part of the optic nervous apparatus—cerebral or ocular,—from inflammatory congestion; when ocular, from inflammatory congestion of the choroid, as above mentioned (s. 408), rather than from inflammatory congestion of the retina. As such inflammatory congestion may end in amaurosis, so the luminous and coloured spectra are symptoms of incipient amaurosis. They may continue to exist, however, after all visual sensibility is lost.

1742. Sensations of colour of the kind just considered are to

* The difference between this and the spectrum in Purkinje's experiment is above explained.—See note, p. 327.

be distinguished on the one hand from those which depend on an optical derangement in the eye itself, whereby its achromatism is destroyed, (ss. 1687, et seq.,) and on the other from accidental or complementary colours, considered in the next article but one.

Reciprocal action of the different parts of the retina on each other's sensations.

1743. *Participation of the different parts of the retina in each other's sensations or irradiation of sensations.*—Any one fibril of a sensitive nerve may be in action alone. But it is possible for fibrils in a state of activity to communicate a similar state to neighbouring ones. This, which is effected at the central extremities of the fibrils, and of which the result is an extension of the original sensation, is called irradiation of sensations.

1744. The retina is prone to such irradiations of sensations. Thus, if the eye be kept fixed for some time on a small strip of coloured paper, lying on a sheet of white, the strip will after a time vanish for a moment. The circumferential part of the retina is more prone to irradiation of sensations than the middle part, but at the entrance of the optic nerve it is most so; in fact, the well known vanishing of images at this part in Mariotte's experiment is an exemplification of irradiation. It appears to be owing to irradiation that the spectrum of the retinal vessels is not in the ordinary exercise of vision seen.

1745. An insensible spot of the retina, if small, may in consequence of irradiation not be seen, or at least not constantly seen, as a fixed musca.

1746. On the other hand, weakened irradiation, which is an accompaniment of diminished sensibility of the retina, allows of small insensible spots of the retina to be more readily seen, as fixed muscæ; and appears to be the condition on which ocular spectra and complementary colours from retention of retinal sensations to a morbid degree, as well as muscæ volitantes (s. 1721), depend.

1747. *Excitement of opposite conditions in contiguous parts of the retina.*—A state of activity of one part of the retina, instead of exciting a similar, may excite an opposite state. Thus, as is well known, the brighter the light, the deeper the shadow. Another example is presented by the following experiment:—A small strip of gray paper lying on a sheet of red, after the eye has been fixed on it for some time, appears of a green colour, the complementary colour of the red ground.

1748. In accordance with this law, an insensible spot of the retina, if large, occasions more distinctly the appearance of a black spot in the field of vision, or a fixed musca, the brighter the light.

Spectra consequent to impressions on the retina and complementary colours.

1749. In the natural state, the sensations of the retina remain a short space of time after the impression which occasioned them has ceased to act. Hence, an image of an object may continue to be seen for some seconds after the eyes have been turned away from looking at it. This phenomenon is, in general, most readily observed in twilight; in daylight the impression of the object on the retina requires to have acted more intensely, and a longer time to produce the effect.

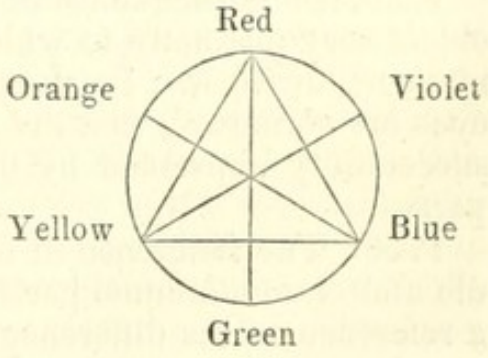
1750. The spectrum appears when the eyes are directed to the sky, projected in the distance and of gigantic size.

1751. The spectrum is seen differently, according as the eyes, when turned away from the object, are darkened or directed to an illuminated surface. In the former case, the lights and shadows are the same as appeared at the time of regarding the object; in the latter, they are the reverse.

1752. If the object from which the impression has been derived is coloured, the spectrum is coloured, also, but differently, thus:—If the eye be fixed on a red-coloured object for some time, and then turned away from it, a spectrum of the object will continue to be seen, but instead of a red, of a green colour. If, on the contrary, the object looked at be green, the spectrum will be red; again, if blue, the spectrum will be orange; if orange, the spectrum will be blue; if yellow, the spectrum will be violet; if violet, the spectrum will be yellow.

1753. From this it is seen that the colour of the spectrum is always that which being added to the colour of the object looked at, makes up the sum of the three prismatic colours, yellow, red, and blue, which by their combination form white light; hence, the name complementary which has been given to the colour of the spectrum.

Fig. 65.



1754. In the annexed figure the primitive colours yellow, red and blue, are placed at the angles of the triangle, the compound colours, orange, violet,

and green, at the intermediate points. The primitive colour and the compound one, which thus stand opposed, viz., yellow and violet, red and green, blue and orange, are complementary of each other.

1755. A spectrum is very readily produced, by looking at the setting sun. If, on turning the eyes away they are darkened, the colour of the spectrum is at first luminous white; it then changes to yellow, and from that runs through the different colours of orange, red, violet, blue to black, when the spectrum ceases. If, on the contrary, the eyes are directed to a white surface, the spectrum is at first black, then blue, which colour is succeeded by violet, red, orange, yellow, until the spectrum, becoming white, is no longer distinguished.

1756. In certain morbid states of the retina, even although vision be much impaired, the sensation remains after the impression a much longer time than natural; hence arise illusions of vision from the spectrum and complementary colours. In such a case, for example, if the person, after his eye has rested on some small and near object, the tassel of a blind for example, should accidentally look towards the sky, he will see a magnified image of it; but not aware of the cause, he is astonished by what appears to him, a gigantic female-looking figure in the air.

Section II.—IMPAIRMENT AND LOSS OF SENSIBILITY OF THE OPTIC NERVOUS APPARATUS, OR AMAUROSIS IN ITS VARIOUS DEGREES.

1757. The sensibility of the retina is greatest in the region of the yellow spot, (not in the situation of the foramen centrale, as shown by Herschel, but to one or other side of it.) From thence the sensibility diminishes towards the ora serrata.

1758. In consequence of this, we see only that part of an object very distinctly to which the axes of the eyes are at the moment directed. In examining an object, the axes of the eyes are so moved, that the central region of the retina may be successfully impressed by the rays of light from its different parts.

1759. The difference in the degree of sensibility of the middle and circumferential parts of the retina may be illustrated by a reference to the difference in the degree of sensibility of the

skin of the lips for example, and the skin of the cheeks. Whilst the points of the two legs of a pair of compasses, when separated a very short distance from each other, are applied to the skin of the lips, the mind distinguishes the two impressions; but when applied to the skin of the cheek, there is no distinct perception of two points, but a sensation as if one impression only were made.

1760. As impressions on the less sensitive skin of the cheek are perceived as if smaller than impressions on the more sensitive skin of the lips, so objects seen by the less sensitive circumferential part of the retina appear smaller than when seen by the most sensitive middle part; or, *cæteris paribus*, an imperfectly illuminated object appears smaller than one brightly illuminated.

1761. In amblyopy, objects appear smaller than natural, owing perhaps to the defective sensibility of the retina (*amaurotic micropy*).

Temporary hemiopy.

1762. The following is an account of Hemiopy, by Dr. Wollaston, as it occurred in his own person. "I suddenly found, after violent exercise, two or three hours before, that I could see but half the face of a man whom I met; and it was the same with respect to every object I looked at. In attempting to read the name JOHNSON over a door, I saw only SON; the commencement of the name being wholly obliterated to my view. The loss of sight was towards my left, and was the same, whether I looked with the right eye or the left. This blindness was not so complete, as to amount to absolute darkness, but was a shaded darkness, without definite outline. The complaint was of short duration, and in about a quarter of an hour, might be said to be wholly gone, having receded with a gradual motion from the centre of vision obliquely upwards towards the left."

1763. More than twenty years subsequently, a similar attack occurred again, without Dr. W. being able to assign any cause whatever, or to connect it with any previous or subsequent indisposition. "The blindness," says he, "was first observed, as before, on looking at the face of a person I met, whose *left* eye was to my sight obliterated. My blindness was in this instance the reverse of the former, being to *my right* (instead of the left) of the spot to which my eyes were directed; so that I have no reason to suppose it in any manner connected with the former affection. * * * On this occasion the affection, after

having lasted with little alteration for about twenty minutes, was removed suddenly and entirely by the excitement of agreeable news respecting the safe arrival of a friend from a very hazardous enterprise."

1764. Such cases are not uncommon. I have myself twice experienced an attack. The first occurred some years ago in returning from a walk before dinner, one hot day in summer. I felt exhausted, languid, and slightly giddy, but in other respects quite well. After dining and drinking a glass of port wine and water, the hemiopy became somewhat alleviated, but did not entirely go off until after tea, having continued two or three hours. The second attack occurred some months ago, in consequence of gastric derangement.

1765. In some persons, the affection is of frequent occurrence, coming on along with indigestion, headache and nausea, but going off in a few hours.*

1766. Admitting the doctrine of corresponding parts of the two retinæ as modified in the manner explained in the next chapter, and admitting the structural condition of their correspondence to be, in addition to semi-decussation of the optic nerves, some continuity between the fibres of the corresponding sides of the retinæ, we may, with Dr. Wollaston, consider the proximate cause of hemiopy to be some temporary affection of the brain at the origin of one or other optic nerve.

1767. *Treatment.*—According as hemiopy depends simply on fatigue or gastric derangement, so must the treatment be regulated.

Night-blindness.†

1768. Indistinct vision, recurring regularly at night, is sometimes met with as a congenital and habitual infirmity; there are instances of its having prevailed as an epidemic. Most frequently it is met with as an occasional complaint, especially in warm countries and warm latitudes at sea.

1769. In the beginning of the complaint the patient is still able to see objects a short time after sunset, and perhaps to see

* The case of a friend of his, which Dr. Wollaston describes, does not appear to be of this kind, but a case of common incomplete amaurosis. The blindness came on after the patient had suffered severe pain in his head for some days, about the left temple, and towards the back of the left eye; his vision became considerably impaired, attended with other symptoms indicating a slight compression on the brain.

† Cæcitas nocturna. The words *hemeralopia* and *nyctalopia* have been differently used by authors; some expressing by hemeralopia night-blindness, and by nyctalopia, day-blindness; whilst others have employed the words in an opposite sense.

a little by clear moonlight, and he can see distinctly by bright candlelight. Vision, however, becomes more and more imperfect at night, so that after a few days the patient can no longer discriminate the largest objects after sunset or by moonlight, &c.; and after a longer lapse of time, he ceases to see any object distinctly by the brightest candlelight.

1770. The pupils move naturally during the day, but after sunset they become dilated, and contract sluggishly on exposure to light. Sometimes they are considerably dilated, both by day and night. In cases of long duration the pupils are often contracted, and there are evident manifestations of intolerance of light.

1771. *Causes.*—The principal causes of night-blindness appear to be fatigue and exposure to the strong light of the sun and gastric derangement; lunar influence is also considered to operate as a cause.

1772. Congenital night-blindness has been known to affect more than one member of the same family. An instance of this kind has come under my own notice. A most remarkable history of a hereditary night-blindness, which has prevailed in one family for two centuries, has been recorded by M. Cunier.*

1773. *Prognosis.*—Under proper treatment, the prognosis may be always favourable. The duration of the disease is generally from two weeks to three or six months. If, however, it be neglected or mistreated, vision may become imperfect in the daytime as well as at night. In some cases, the disease has terminated in total blindness.

1774. Europeans who have been once affected with night-blindness, are particularly liable to a recurrence of the complaint as long as they remain in tropical climates.

1775.—*Treatment.*—The remedies to be first had recourse to are those adapted for the removal and alleviation of any general complaint, of which the night-blindness may be symptomatic. If gastric derangement, for example, emetics and purgatives are to be prescribed. If after the removal or alleviation of the general complaint, the night-blindness has not of itself gone off, a succession of blisters to the temple has been found a most efficacious remedy.

[Dr. Wharton has cured some cases, simply by excluding the patient from the light. Mercury, turpentine, and cauterizations of the cornea, have been each employed with beneficial results. See 2d Am. ed. of Lawrence's Treatise on the Diseases of the Eye.]

* Annales de la Société de Médecine de Gand, 1840.

1776. In some cases it may be advisable to take blood by cupping or leeches from the neighbourhood of the eye. During the treatment the eyes are to be kept shaded, and occasionally bathed with cold water.

Day-blindness.

1777. The photophobia, which persons accustomed to dark residences, albinos, and children labouring under scrofulous ophthalmia, experience when exposed to strong daylight, does not merit the appellation of day-blindness, understood as the counterpart of night-blindness. In this sense it does not certainly appear that there is any such disease as day-blindness.

Fixed Muscæ.

1778. These appearances never change their position, either in regard to each other or to the optic axis. Their motion is thus merely apparent, depending on the motion of the eyeball. But it often requires some attention and power of observation on the part of the patient, to distinguish what is real from what is apparent motion.

1779. Fixed muscæ vary in number, size, and form. At first semi-transparent, they afterwards become black, or at least dark. They appear in reading, like blotches on the paper, but when the eyes are directed to a distant object, they appear so large that they cover it perhaps. Fixed muscæ are most distinct in bright light, in darkness they are not seen. If confined to one eye they are most distinct when the other eye is closed.

1780. Fixed muscæ are owing to insensible spots of the retina. The insensible spots are apt to increase in size gradually until the whole retina is overspread with insensibility—total amaurosis.

1781. The spot is sometimes in the centre of the retina, and the appearance seen is that of a dark spot in the middle of the field of vision. This may gradually become broader and broader, until objects are no longer seen, except when situated to a side.

1782. The appearance of a skin with veins in it, above referred to, (s. 407,) differs from the vascular spectrum as seen in Purkinje's experiment, inasmuch as it is owing to insensibility of the retina from the pressure and opacity occasioned by the congestion and exudation in inflammation of its vascular layer. It therefore belongs to the present head of fixed muscæ.

1783. The insensible spots of the retina on which the appearance of fixed muscæ depends, constitute partial amaurosis; their further consideration therefore comes under that head.

AMAUROSIS.*

Amaurosis considered nosologically.

1784. Amaurosis is impairment or loss of vision from paralysis of the optic nervous apparatus.

1785. *Different degrees of amaurosis.*—Amaurosis is said to be *incomplete* or *complete*, according as the sensibility for visual impressions is impaired merely, or quite lost; and *partial* or *total* according as the impairment or loss of sensibility affects a part only, or the whole retina.

1786. In incomplete amaurosis, the patient's field of vision is obscured as if a gauze or cloud were interposed between him and the objects looked at.

1787. In partial amaurosis, the obscurity may involve the centre or the circumference of the field, or some one side only; or it may be limited to a mere spot, or to several spots dispersed throughout the field. Objects are thus seen or not, according to the part of the field of view in which they are situated; or if large enough to occupy the whole field, their circumferential or central part only is seen, or one half only (*visus dimidiatus*), or a part here and there (*visus interruptus*). When the insensibility is limited to a spot or spots merely, the appearance of fixed muscæ is occasioned, (s. 1778, et seq.)

1788. *Peculiarities of amaurotic vision.*—Vision is often better one day, worse another; sometimes better in the morning, sometimes in the evening; sometimes better after meals, sometimes worse.

1789. The amaurotic person generally sees an object indistinctly, until such time as he has steadily fixed his eyes on it, (*visus increscens.*) Sometimes, however, by moving the object before him, he sees it better than when at rest.

1790. Objects sometimes appear smaller, (*amaurotic micropy,*) (ss. 1760-61.)

1791. The patient usually sees better in strong light, but in some cases better in dull light. Sometimes he is intolerant of light, even when the amaurosis is complete.

1792. In some cases the patient sees distant objects better than near; in other cases again, near objects better than distant; and sometimes he sees objects multiplied with one eye, and iridescent: the flame of a candle, for instance, spreading out into rays, and surrounded by coloured halos.

* Gutta serena of the Arabians, in contradistinction to *gutta opaca*, the name they gave to cataract.

1793. *Subjective visual sensations.*—Photopsy, chroopsy, and the undue retention of impressions, giving rise to ocular spectra and accidental colours, are frequent attendants on amaurosis. The gauze or network seen in the light may still be visible in the dark; but instead of being gray or black, it is of a silvery or gold colour.

1794. *Common subjective sensations.*—Uneasy feelings or actual pain in the eye, may or may not have been, or be present. Dryness of the eyes and nostrils is sometimes felt.

1795. Double vision, confusion and distortion of objects sometimes occur early in the disease, from some degree of attending strabismus. A similar disturbance of vision may occur without evident strabismus or loss of correspondence of the axes of the eyeballs, but in consequence of loss of correspondence of the vertical and horizontal diameters of the eyeballs, from disturbance of the harmonic action of the oblique muscles. The nature of such disturbance of vision is ascertained by closing one eye, whereupon vision with the other is improved.

1796. *Objective symptoms.*—The defective and disturbed vision may be the only symptoms present. There may be no objective symptom, even the staring appearance of the eyes, and their want of power to converge on an object with precision, may be absent in incipient cases. In general, however, there are objective symptoms enough to indicate the nature of the affection, and to confirm the patient's statements.*

1797. The pupil is more or less dilated, and if not quite immovable, its movements are limited and slow. This, although one of the most characteristic appearances presented by the amaurotic eye, is not constant. In cases in which one eye only is affected, the pupil often moves quite naturally, consentaneously with the pupil of the healthy eye; but if this latter eye be covered, whilst the amaurotic eye is examined under the influence of different degrees of light, then the pupil of the amaurotic eye is found to remain dilated and fixed, uninfluenced by the degree of light. Sometimes again, in complete amaurosis of both eyes, the pupils are as obedient to changes in the degree of light, as in health, (s. 1617.)

1798. Besides the peculiarities of the pupil just considered, there may be deformity of it from greater dilatation towards some one or other side, or even a displacement of the pupil, and the iris may be inclined towards the cornea, or its pupillary margin reverted backwards from the cornea.

* The general aspect of the amaurotic patient is above sketched, (s. 9.)

1799. Sometimes the pupil is much contracted, (s. 1614.)

1800. There is often an appearance as if opacity behind the pupil, deep seated, analogous to the appearance in glaucoma, but pale, and not so well marked. It is to be remarked, however, that this appearance in an equal degree, may sometimes be seen in elderly persons, whose vision is quite good; and on the other hand, numerous cases of amaurosis, and this of the most complete kind, present no such appearance of opacity, but a clear black pupil.

1801. In uncomplicated amaurosis, the catoptrical lenticular images are distinct.

1802. Congestion of the conjunctiva, or, on the contrary, great paleness of it, lachrymation or dryness of the eyes, too great hardness, or too great softness of the eyeball, increased prominence, strabismus or paralytic luscitas, and rolling of the eyes, may, in different cases, be accompaniments of amaurosis.

1803. *General symptoms.*—Symptoms of intracranial disease often attend amaurosis, such as pain in the head, constant, intermittent, or periodic, and varying in seat, extent and nature; vertigo, tinnitus aurium, tendency to coma, sleeplessness, &c.

1804. The digestive organs are sometimes deranged, sometimes not.

1805. The pulse may be strong, or weak, or natural.

1806. Such are the principal symptoms which may attend amaurosis. Some, it will be observed, are altogether the contrary of others, so that not one alone can be admitted as pathognomic, scarcely even the defective vision itself.

1807. These differences in the phenomena depend partly on differences in the nature of the morbid condition on which the paralysis depends, partly on the development of that morbid condition. For the same reason the invasion and progress of the disease differ in different cases.

1808.—*Invasion and progress.*—The invasion of the amaurosis may be sudden or gradual. In the former case, vision may be at once wholly lost, or nearly so; in the latter case, it may be only after a time that the vision is seriously impaired. In some cases, the impairment of vision remains at a certain stage without advancing, in other cases it continues to increase, the obscurity thickening and spreading, until the whole field of vision is obliterated to the sense, the perception of light lost, and the amaurosis complete.

1809. Except when the cause is of a purely local nature, both eyes generally become affected; one eye first, perhaps,

and by and by the other. The blindness being complete and total in one eye, some degree of vision may be still retained in the other.

1810. *Constitution, and previous diseases of the patient.*—Amaurotic patients are met with of all constitutions, and are found to have been the subjects of very different diseases, and yet these diseases will often appear to have had some connection, either as cause, or as themselves depending on the same cause with the amaurosis, and may still require to be taken into consideration along with the present state of general health of the patient, in determining the kind of treatment to be had recourse to.

1811. The diseases the previous existence of which is often found to have some connection with the amaurosis, either as cause, or as depending themselves on the same cause, are, scrofula, syphilis, gout, rheumatism, dyspepsia, hypochondriasis, hysteria, apoplexy, epilepsy, paralysis, phrenitis, typhus fever, &c.

1812. In some cases the disease is found to occur in connection with disturbed menstruation, pregnancy, hysteria, hemorrhoids, and again to disappear entirely, but again to occur, and then perhaps to remain permanently.

1813. *Causes.*—The paralysis of the optic nervous apparatus, on which amaurosis depends, may be the result of morbid conditions of that apparatus, differing both as regards nature and seat.

1814. As regards nature, they may be congestion or inflammation, and its consequences; nervous exhaustion; or pressure by neighbouring parts. As regards seat, this may be in the retina, or the optic nerve, or the cerebral portion of the optic nervous apparatus.

1815. *Diagnosis in general.*—Amaurosis, in its incipient stage especially, ought to be carefully distinguished, for this is in general the only stage at which treatment is likely to be of much avail.

1816. The affections from which amaurosis requires to be distinguished are principally:—Cataract, mydriasis, myopy, presbyopy, asthenopy, muscæ volitantes, night-blindness, glaucoma. See those different articles.

1817. Amaurosis is, however, often complicated with some one or other of these affections.

1818. The distinction of incipient amaurosis from incipient cataract, is of especial importance, as supposing incipient amaurosis mistaken for incipient cataract, it might be allowed

to go on unchecked, under the impression that ripening of the cataract was taking place. The patient would thus be deprived of all chance of the benefit which might be derived from treatment in rescuing him from irretrievable blindness.

1819. *Prognosis.*—The prognosis in a decided case of amaurosis is most unfavourable. The disease, when it comes on suddenly, even when complete blindness is present, is not unfrequently relieved or cured, if it has not already existed long. The disease which has come on gradually, accompanied by pains in the head, is more hopeless in general, as in this case the cause most usually is material disorganization of some part of the optic nervous apparatus; whereas, sudden cases may be owing to some congestion, extravasation, or exudation, admitting of removal by timely treatment. But often, nothing of this can be determined beforehand, to assist the prognosis, or regulate the treatment.

1820. The prognosis is decidedly bad, when the eyeball is either preternaturally hard or soft, or affected with cataract; or if the disease is hereditary, or complicated with epilepsy, paralysis of some part indicating affection of the brain, &c.

1821. In cases in which one eye only is affected, there is reason to fear for the other.

Amaurosis considered pathologically.

1822. *Seat of the morbid conditions of which paralysis of the optic nervous apparatus may be the result.*—The retina, the optic nerve, or that part of the brain with which the optic nerve is connected, may be together or separately the seat of the morbid condition on which the amaurosis depends. If the retina only be affected, it cannot receive the impression which should be transmitted by the optic nerve to the brain;—if the optic nerve only be affected, it cannot transmit the visual impression from the retina to the brain;—if that part of the brain with which the optic nerve is connected, be alone affected, the sensorial power to take cognizance of the visual impressions transmitted by the optic nerve is lost.

1823. Thus, the general result is the same, whether the different parts of the optic nervous apparatus be affected together or separately. Notwithstanding this, it is of importance practically to determine as accurately as possible the seat of the morbid condition, on which the loss of vision in any given case depends.

1824. *Nature of the morbid conditions of which paralysis of the optic nervous apparatus may be the result.*—In the first

place, it is to be observed, that paralysis of the optic nervous apparatus, like paralysis of other parts of the nervous system, may occur without any morbid condition, the nature of which is appreciable, either by particular symptoms during life or by anatomical examination after death. Generally, however, there are symptoms and other circumstances of the case during life, or appearances after death, sufficient to account for the paralysis. In regard to appearances after death, however, it is to be observed that many of the morbid conditions in which the optic nervous apparatus has been found in cases of amaurosis, though of themselves very efficient causes of paralysis, and irremediable, are not to be viewed as standing in the relation of original cause of the paralysis, but rather as the effect or, at the least, as the coincident effect of the morbid condition which was the immediate cause of the paralysis. To such morbid conditions may be referred, hardening or softening of the brain, of the optic nerve or retina, atrophy, thickening or optic enlargement (which may be followed by atrophy).

1825. The morbid conditions, acting as the immediate cause of paralysis of the optic nervous apparatus in amaurosis, are in their nature essentially the same as those which act as the immediate cause of paralysis of other parts of the nervous system, and may be referred to the two principal heads of intrinsic and extrinsic.

1826. *Intrinsic morbid conditions of the optic nervous apparatus acting as causes of its paralysis in amaurosis.*— These may be at first inflammation or simple congestion of some part or the whole optic nervous apparatus, and as effects of this, exudation of serum or lymph, or extravasation of blood. Or the opposite condition of a defective supply of blood to the parts followed by marasmus.

1827. These morbid conditions, it is to be observed, may not be confined to the optic nervous apparatus, but extend to the brain generally, in which case the amaurosis will form a point of inferior consideration.

1828. *Morbid conditions extrinsic of the optic nervous apparatus acting as causes of its paralysis in amaurosis.*— These operate by *pressure* on the optic nervous apparatus. To them belong abscesses of the brain, hydrocephalic collections, tumours, &c. of the brain or its membranes, aneurismal affections of the cerebral or ophthalmic arteries, exostosis, &c. of the bones of the cranium or orbit, abscesses in the orbit, tumours in the orhit, or in the neighbouring cavities and sinuses of the skull or face, affections within the eyeball, as inflam-

mation of the choroid, hydrophthalmic collections, and the like.

1829. Eventually the pressure may produce organic change of the optic nervous apparatus.

1830. It will be observed that many of these morbid conditions are of such grave importance in themselves, that the amaurosis produced by them forms but a secondary consideration in the case.

1831. Both intrinsic and extrinsic morbid conditions of paralysis in amaurosis may coexist. Examples readily suggest themselves. To take one from the eyeball, besides inflammatory or simple congestion of the retina, there may be a similar state of the choroid producing pressure on the retina.

1832. *Morbid conditions of the retina on which the paralysis in amaurosis may depend.—Intrinsic.*—Vascular congestion of the retina or choroid, or both, simple or inflammatory, acute or chronic, and, as the consequence of it, degeneration of the structure of the retina, (see Posterior Internal Ophthalmia,) thickening, atrophy, softening, adhesion between the retina and choroid, &c. Injuries, whether direct wounds, or the lesion, whatever its nature may be, produced by concussion, or by a sudden glare of intense light, or by over-exertion of vision.

1833. *Extrinsic, but still seated within the eyeball.*—Inflammation or congestion of the choroid and its consequences. Subsclerotic dropsy, subchoroid dropsy, vitreous dropsy, hemophthalmus, displaced lens. Inflammation of the choroid may thus act, both by producing disorganization of the retina, and giving rise to pressure on it.

1834. The morbid conditions extrinsic to the retina and seated without the eyeball, are, for the most part, the same as the extrinsic morbid conditions to which the orbital portion of the optic nerve is subjected.

1835. *Morbid conditions of the optic nerve on which the paralysis in amaurosis may depend.—Intrinsic.*—Direct injury of the optic nerve.—Congestion, simple or inflammatory, and as effects, general or partial induration or atrophy,—thickening of the sheath and exudation between it and the nerve. Tumours attached to or contained within the sheath or involving the substance of the optic nerve, including medullary or melanotic disease. Aneurismal enlargement of the central artery of the retina while within the optic nerve. Extravasation of blood in the same place.

1836. *Extrinsic.*—These necessarily come under two sepa-

rate heads, viz., those to which the orbital, and those to which the intracranial portion of the optic nerve is subjected.

1837. The latter will come under the more general head of extrinsic morbid conditions affecting the intracranial portion of the optic nervous apparatus; the former therefore alone fall to be enumerated here.

1838. Inflammation and abscess in the orbit; exostosis of the orbital bones; tumours in the orbit or neighbouring cavities; fractures of the anterior part of the base of the skull or of the orbit.

1839. *Morbid conditions of the intracranial portion of the optic nervous apparatus on which the paralysis in amaurosis may depend.—Intrinsic.*—Injuries—concussion, laceration; congestion—simple or inflammatory, and its effects, hardening or softening, hypertrophy or atrophy, abscess, &c.; apoplexy; scrofulous tubercles; tumours of different kinds; hydatids.

1840. These morbid conditions may implicate other parts of the brain at the same time.

1841. *Extrinsic.*—Fracture of the cranium with depression or extravasation of blood in the situation of the intracranial portion of the optic nervous apparatus; exostosis of the bones of the cranium in the same situation; tumours of the dura mater; inflammation of the membranes of the brain, and its consequences, adhesions, thickenings, depositions of serum, lymph, pus, &c.; hydrocephalus, superficial or ventricular; tumours of the brain, implicating the optic nervous apparatus by pressure, such as enlarged pituitary, or pineal gland; aneurism of one of the encephalic arteries.

1842. Of these different morbid conditions, it is to be observed, that many of them are well marked and recognized forms of disease in the pathological sense, the amaurosis being at once recognizable as a symptom merely. Others, again, are not so recognizable during life, and the blindness being the prominent symptom, the case is said to be one of amaurosis in the nosological sense.

1843. *Causes of the different morbid conditions of the optic nervous apparatus in amaurosis.*—These may be said to comprehend the remote causes of disease in general, in addition to such as act on the eyes in particular.

Amaurosis considered therapeutically.

1844. The nature of the morbid condition on which the amaurosis depends, and the causes which may have excited that morbid condition, are points which must be ascertained

before any rational mode of treatment can be determined on. In numerous cases, however, it must be confessed that these points cannot be satisfactorily ascertained; the treatment adopted must, therefore, be partly empirical and partly founded on general indications.

1845. The different morbid conditions on which amaurosis may originally and essentially depend are, it has been above seen, referable to the three following principal heads :—

1. Congestion of the optic nervous apparatus and its effects.
2. Exhaustion of the optic nervous apparatus.
3. Pressure on some part of the optic nervous apparatus.

1846. These conditions, however, it is to be observed, may be more or less mixed up with each other, or one may supervene on the other; hence, according as one or other appears to be in operation at the time, so must be the treatment.

1847. *Amaurosis from congestion of the optic nervous apparatus.*—The disturbance of vision consists at first of the appearance of a thick gauze or mist, stretched between objects and the patient; increased after meals, or in consequence of any bodily effort or mental excitement. This goes on increasing until the amaurosis is total.

1848. The dimness of vision is ushered in, and accompanied by intolerance of light, photopsy, and chroopsy.

1849. The patient has a feeling of distention of the eyeballs, as if they were increased in size.

1850. The pupil is at first contracted and sluggish; eventually it becomes dilated. The contracted state of the pupil appears to be owing to the irritation of the optic nervous apparatus, exciting the action of the nerves governing the contraction of the pupil—reflex action being as yet unimpaired; but subsequently, when the retina becomes insensible, reflex action is arrested, and the pupil becomes dilated.

1851. The iris inclines towards the cornea in consequence of the fullness of the eyeball, which is hard and sensible to the touch, and perhaps unduly prominent. The conjunctiva is at the same time somewhat injected.

1852. In addition to the state of vision and of the eye now described, there are symptoms of cerebral congestion, headache, giddiness, restlessness, or sleepiness, with flushed face, hot skin, and throbbing of the arteries of the head.

1853. The robust and the feeble may be equally the subjects of this form of amaurosis. It is most common in middle age.

1854. The causes to which congestive amaurosis has been

attributed are very various. Exposure of the eyes to strong heat and light in those who work before large fires, &c. Over-exertion of the sight. Forced exertions of the body while stooping the head, especially in plethoric or drunken persons. Pregnancy. Sudden suppression of discharges—the menstrual, perspiratory, hemorrhoidal, purulent, &c. Gastro-hepatic, or gastro-intestinal irritation, as in dyspepsia, scybala, worms. Irritation of the nerve of the fifth pair. Passions of the mind. Fevers. Organic disease of the heart.

1855. *Prognosis and treatment.* The cases of amaurosis under consideration, if early seen, are in general those in which treatment may be undertaken with most hope of advantage, provided—and this is the first point to which attention must be directed—the causes just enumerated can be avoided, removed, or mitigated.

1856. The plan of treatment is, first, the general antiphlogistic plan above described (s. 421 et seq.), consisting principally of bleeding and mercurialization, and afterwards the tonic and alterative, together with counter-irritation (s. 440).

1857. If the disease has already fallen into a torpid and chronic state, the tonic and alterative plan of treatment, with counter-irritation, may be the only one admissible.

1858. *Amaurosis from exhaustion of the optic nervous apparatus.*—The blindness is at first incomplete and partial. A gray cloud or network, flickering before the eyes in some one direction, only gradually spreading and increasing until the whole field of vision be obscured. Vision is improved after meals, and in consequence of any agreeable excitement, but rendered worse under the opposite circumstances.

1859. Vision is better in bright light; therefore the blindness may simulate night-blindness. There is no photopsy, nor any complaint of fullness or pain in the eyes.

1860. The pupils are generally dilated and sluggish, or immovable; the conjunctiva blanched; the face pallid.

1861. The subjects of this form of amaurosis are generally of an age between puberty and middle life.

1862. Exhaustion of the optic nervous apparatus is often a mere accompaniment of general nervous exhaustion, arising from great loss of blood, or excessive discharge of secretion, as in protracted suckling, seminal losses, especially by onanism, or arising from grief and other depressing passions—from low nervous fevers, fright, &c.

1863. *Prognosis and treatment.*—In the cases depending

on exhaustion of the nervous system, the prognosis is much less favourable than in those depending on congestion.

1864. The plan of treatment fitted for them is the tonic and alterative, (ss. 440–41,) with counter-irritation, in prolonged courses.

1865. It is in this form of amaurosis that strychnia and veratria, endermically applied,* have been much recommended; but their efficacy has not been satisfactorily established. The same must be said of electricity and galvanism, and stimulating vapours to the eyes.

1866. The amauroses which arise from super-excitation occasioned by sudden strong impressions on the retina, such as an intense glare of light falling on the eye, concussion of the eyeball, or a stroke of lightning, and also those arising from overplying vision, appear to depend partly on nervous exhaustion, and partly on congestion. For example, the spot of the retina acted on by a sudden glare of light, or by smart concussion from a blow, is at once rendered insensible, and the result is a fixed musca, which may ultimately go away or remain; or the whole retina may become insensible, though this more generally takes place slowly, as a consequence of supervening congestion or inflammation.

1867. In such a case the treatment should be the same as for congestive amaurosis.

1868. *Amaurosis resulting from pressure on some part of the optic nervous apparatus.*—In the cases of amaurosis resulting from pressure on some part of the optic nervous apparatus, by extravasation of blood, tumours, collections of fluid, &c., the extent and degree of blindness, and of the accompanying subjective visual sensations, differ according to circumstances.

1869. In many such cases the amaurosis is but a secondary consideration, more pressing symptoms of the organic disease being present; in other cases the amaurosis may be the only or principal appreciable symptom.

1870. To this head belongs apoplexy of the eyes, which sometimes occurs suddenly, in consequence of violent exertion.

* Strychnia is usually applied by sprinkling it daily on the raw surface, left by a blister, on the temple, or over the eyebrows, to the quantity of one-eighth or one-half grain at first. This quantity may be gradually increased to as much as two grains; but if spasmodic twitchings occur, the use of the remedy must be intermitted. Veratria is employed in the same quantities as strychnia, but generally in the form of ointment, (gr. v—xxx to ℥i of axunge,) rubbed over the eyebrows, or on the temples.

With general determination of blood to the head, the conjunctiva is found congested, the eyeballs tense, and the pupils dilated and fixed. There may or may not be detected an appearance of extravasated blood in the interior of the eye.

1871. *Prognosis and treatment.*—Except when the cause of pressure is seated in the orbit or in the eye, and is removable by operation, any treatment adopted must be regulated according as the general symptoms agree with one or other of the preceding forms, consisting, in the one case, of blood-letting and mercurialization, in the other of tonics, alteratives, and counter-irritation. When, as is often the case, it cannot be determined what is the nature of the cause of pressure, or even that the case is one of pressure, the treatment must still be regulated by the same principles.

1872. Amaurosis from apoplexy of the eyes, in general readily yields to the treatment above indicated for congestive amaurosis, (s. 1856.)

Section III.—GLAUCOMA AND CAT'S EYE.

GLAUCOMA.

1873. Glaucoma is a name applied to a peculiar greenish opaque appearance, deep behind the pupil, changing its seat according to the direction in which the light is admitted, being always most concentrated on the side opposite the light. This appearance occurs in very different degrees, from a greenish reflection barely discernible to a grass-green opacity.

1874. Hippocrates and the ancient Greeks comprehended under the name of *glaucoma* every kind of opacity which appears behind the pupil. The later Greeks, as Rufus, Galen, Paul of Egina, and others, however, restricted the term to the incurable opacities behind the pupil, while to the curable, they gave the name of *hypochyma*;—the former they supposed to be a disease of the lens, the latter to be a concretion in front of the lens.

1875. Brisseau* appears to have been the first who gave out the opinion, that while cataract, as first shown by Rolfink, Borel, and others, is an opacity of the crystaline body, glaucoma is an opacity of the vitreous.

* Traité de la cataracte et du glaucome, Paris, 1709.

1876. By some the appearance of glaucoma has been supposed to be owing to reflection from the bottom of the eye, in consequence of the morbid state of the retina and choroid, with loss of pigment, which often exists in glaucoma.

1877. It was, however, satisfactorily demonstrated by Dr. Mackenzie, in 1828, that the cause of the glaucomatous appearance resides in the lens.*

1878. The change in the state of the lens, on which the glaucomatous appearance depends, consists in its having become, especially in its central part or kernel, coloured more or less deep amber when viewed by transmitted light, green when viewed by reflected light. The lens usually retains its transparency unimpaired, except in so far as the depth of colour interferes with it, but it may become at the same time more or less opaque.

1879. The proofs adduced by Dr. Mackenzie that the cause of the glaucomatous appearance resides in the lens, are the following :—

1. On removing the lens by operation from a glaucomatous eye, the pupil no longer presents the glaucomatous colour, but appears black, as natural.

2. On dissection of glaucomatous eyes, he found the lens, especially its central part or nucleus, of a yellow, amber, yellowish-red, or reddish-brown colour, when viewed by transmitted light; greenish when viewed by reflected light.

1880. In demonstration of the different degrees of opacity of the lens which may exist in the different stages of glaucoma, Dr. Mackenzie was the first to apply the catoptrical test (s. 1240, No. 13, 14).

1881. Along with a glaucomatous appearance behind the pupil, vision may still be good, or it may be defective or totally lost. In the latter case, the defective vision may be owing in part to the deeply-coloured nucleus of the lens intercepting the rays of light in the manner of cataract, or to actual cataractous opacity co-existing, but in most cases it is owing to complication with insensibility of the retina.

1882. From this it may be inferred, that the glaucomatous state of the lens occurs in diseased states of the eye, essen-

* M. Sichel, of Paris, has lately laid claim to this discovery, but even according to his own showing, his observations date only as far back as 1831, whereas Dr. Mackenzie's were recorded twice before that date, viz., first in 1828, in the Glasgow Medical Journal, and again in 1830 in the 1st edition of his Practical Treatise.

tially different from one another. Hence, if we take glaucoma as a genus, the principal species are as follows:—

1. *Simple glaucoma.*
2. *Glaucoma with cataract.*
3. *Chronic glaucoma with amaurosis.*
4. *Chronic glaucoma with amaurosis and cataract.*
5. *Acute glaucoma with amaurosis.*

Simple glaucoma.

1883. Here we have the glaucomatous appearance behind the pupil, but the eye, in other respects, appears quite healthy, —the cornea clear, the pupil lively, the consistence of the eyeball normal, and vision—with the exception that it may be presbyopic or myopic,—good.

1884. Simple glaucoma is of frequent occurrence in old people. It continues for life, but does not necessarily become complicated either with cataract or amaurosis.

*Simple glaucoma with cataract.**

1885. In this species of glaucoma, the green reflection from the glaucomatous nucleus of the lens, is seen somewhat obscured by the cataractous whiteness of the surface. The retina is sound, but, as is usual at the advanced period of life when this species of cataract occurs, the vitreous body is more or less dissolved.

1886. This form of glaucoma does not essentially differ from the kind of hard cataract above noticed, (s. 1224.)

1887. *Treatment.*—As was first pointed out by Dr. Mackenzie in 1828, the operation for cataract may be performed with success in cases of simple glaucoma with cataract.† But this is the only species of glaucoma in which an operation for the removal of the lens is admissible. The operation may be by extraction or reclination, according to the circumstances of the case, (ss. 1310, 11.)

Chronic glaucoma with amaurosis.

1888. This, which is the species of glaucoma generally taken as the type of the disease, is identical with chronic arthritic posterior internal ophthalmia, (s. 891, et seq.)

1889. The eyeball is hard to the touch from dissolution of

* Simple glaucomatous cataract—green cataract in the limited acceptation.

† M. Sichel claims having first pointed out this also; but with no greater justice than in the case of the discovery that the glaucomatous colour behind the pupil is owing to the state of the lens.

the hyaloid, and superabundance of vitreous humour. The sclerotica is attenuated and dark-looking; the white of the eye pervaded by varicose vessels; the cornea often slightly nebulous and rough; the iris pale and inclined towards the cornea; the pupil, at first limited and sluggish in its motions, becomes dilated—generally ovally dilated—and fixed; the peculiar glaucomatous appearance behind the pupil well marked.

1890. Vision is impaired or lost.

1891. In addition to the defective vision, there are muscæ and fiery and coloured spectra before the eyes, and not unfrequently more or less severe pain in the forehead, supra-orbital regions, temples or face, of a rheumatic or gouty character.

1892. Both eyes are usually affected, but one may be less so than the other.

1893. The characters above given (s. 1240), as distinguishing glaucoma from cataract, are those of this form of glaucoma.

1894. The disease is incurable.

*Chronic glaucoma with amaurosis and cataract.**

1895. This is an advanced stage of the preceding form of glaucoma. The eye is now quite insensible to light, but photopsia and pains around the orbit may continue.

1896. The pupillary margin of the iris is perhaps retroverted, and the lens, now become cataractous in its external substance and hypertrophied, protrudes through the dilated pupil into the anterior chamber, and even comes to press on the cornea. The cornea may in consequence ulcerate, and the lens be evacuated with hemorrhage. Eventually the eye becomes atropic and quiet.

Acute glaucoma with amaurosis.

1897. This is identical with acute arthritic posterior internal ophthalmia above described, (s. 891, et seq.)†

* Cataracta glaucomatosa, of Beer.

† Dr. Mackenzie admits two other species of glaucoma. The one which he calls *opalescent glaucoma*, he formerly described in his Practical Treatise, (p. 777, 3d edit.,) as one form of cat's eye. The glaucomatous appearance, which is seen only when the eye is viewed obliquely, and seems as if produced by the reflection of light from the front of the crystaline capsule, presents a close resemblance to the reflection from a piece of opal. When the eye is viewed in front, the appearance behind the pupil is merely that of a brownish opacity. Disturbance of vision may or may not co-exist.

The other species he calls *traumatic glaucoma*, having met with it as a consequence of penetrating wounds of the eye. The pupil is contracted and irregular; and, behind it, the glaucomatous appearance is seen of an emerald green colour. The exact seat of this appearance he has not yet been able to determine. Vision is irrecoverably lost.

CAT'S EYE.

1898. This term has been applied to cases of amaurosis, in which there is a reflection from the bottom of the eye similar to that in the cat; but the appearance is by no means characteristic of any one disease of the eye.

1899. Beer, who introduced the term, and who describes cat's eye as the type of his second class of forms of amaurosis, viz., that characterized not only by subjective, but also by objective symptoms, mentions having met with it most frequently in old persons inclined to marasmus, but sometimes in young persons, especially cachectic adults and atrophic children; he had also seen it after injuries of the eye.

1900. The reflection from the bottom of the eye, occurring after injuries, has been above explained, (s. 1160 et seq.), and appears to be quite different from the condition, whatever it may be, which gives rise to the appearance in old persons.

CHAPTER VI.

SECTION I.—LOSS OF CORRESPONDENCE OF THE SENSATIONS AND MOVEMENTS OF THE TWO EYES.

1901. As an introduction to the present subject, the correspondence which naturally exists between the sensations and movements of the two eyes, requires first to be taken into consideration.

Correspondence between the sensations of the two eyes.

1902. It has been above shown (s. 1743, et seq.) that the different parts of the same retina exert an influence on each other's sensations. The two retinæ, it is here to be shown, likewise exert an influence on each other's sensations, but to a much greater and more striking degree.

1903. When the two retinæ are impressed in a similar manner at the same time, the resultant sensation is much stronger than when one eye only is employed. If the impression on one retina be indistinct, whether from suffusion of the transparent media of the eye or from impaired sensibility of the

retina, the indistinctness of vision which results, is not so evident when the other eye is used at the same time, as when the affected eye alone is used.

1904. When the two retinæ are affected in a dissimilar manner at the same time, the mind does not perceive an admixture of the two sensations, but perceives the sensation of one of the retinæ only at the same instant of time. Sometimes the one, sometimes the other. Thus, if one eye be closed, and the other be directed staringly towards the window, for example, by and by it will be found that darkness will now and then momentarily overspread the open eye.

1905. But the phenomenon is observed in a much more marked manner, when a different colour is presented to each eye;* blue to the one, yellow to the other, for example. In this case, an admixture of the two colours, viz., green, is not seen, but either the blue alone or the yellow alone; sometimes the one, sometimes the other, or the blue in part and the yellow in part.

1906. If the dissimilar impressions, it is to be observed, affect parts only of the two retinæ, they are perceived separately, unless the parts of the two retinæ which are simultaneously affected, be their vertices or the various parts equally situated in relation to them on the temporal side of the one retina and on the nasal side of the other, or on the upper parts or the lower parts of the two retinæ. These parts are therefore called corresponding or identical parts.

1907. This may be illustrated by viewing two different coloured wafers, thus:—Place the wafers one on the right hand, the other on the left, at such a distance from each other, that their centres may be about one inch and three-quarters from each other. Hold a board (the board of an octavo book for instance) between the eyes in front of the nose, and look at the wafers in such a way, that the right hand one is seen by the right eye only, and the left hand one by the left eye only. The two wafers are soon seen as if to approximate, and then to run into one or to cover the one the other. This is owing to the eyes so moving that the images of the two wafers come to be projected on corresponding or identical parts of the two retinæ.

1908. It thus appears that dissimilar impressions on corresponding parts of the two retinæ cannot be perceived by the

* A different colour may be presented to each eye by looking through glasses of a different colour at a white object.

mind at the same instant of time, but only the one sometimes, the other sometimes; though, if the impression on the one retina be much the stronger, it decidedly predominates over, or excludes that on the other.

Single vision with two eyes.

1909. An object viewed with both eyes is seen single only when the optic axes intersect at some point of the object, when the centres of revolution of the two eyes coincide, and when their horizontal and vertical diameters are respectively parallel. Besides the object at which the optic axes meet, other objects to the side of it appear single, provided they are situated in, or within certain limits only, out of an imaginary circular line, or rather spherical surface, called the *horoptor*, which runs from the point of intersection of the optic axes through the points of intersection of the lines of visual direction in the two eyes.

1910. The correspondence in the direction of the axes, the coincidence of the centres of revolution, and the parallelism of the horizontal and vertical diameters of the two eyes depend on the normal action of the muscles of the eyeballs, which will be considered below.

1911. It is in order that the images of the objects may be simultaneously projected on identical or corresponding parts of the two retinæ, that the correspondence in the direction, &c., of the two eyes is necessary; for a single visual perception from a simultaneous impression on each retina results only when that impression affects corresponding or identical parts of the two membranes, (s. 1906.) If other parts of the two retinæ than these be simultaneously impressed, the object is seen double.

1912. Whether the faculty by which a single visual perception results from the simultaneous affection of certain parts of the two retinæ be connate and dependent on the organization of the optic nervous apparatus, or whether it be a mere matter of experience or association, is a question.

1913. The former view is that which appears best grounded, but the organic condition on which the faculty depends, has not been exactly determined. In a general way, however, it may, as above observed, (s. 1766,) be said to consist in the semi-decussation of the optic nerves and some continuity between the fibres of the corresponding sides of the two retinæ.

1914. The corresponding parts of the two retinæ have been commonly considered to be, or, at least, have been called *points*.

As thus understood or expressed, however, the doctrine is not quite correct; for it has been shown by Mr. Wheatstone,

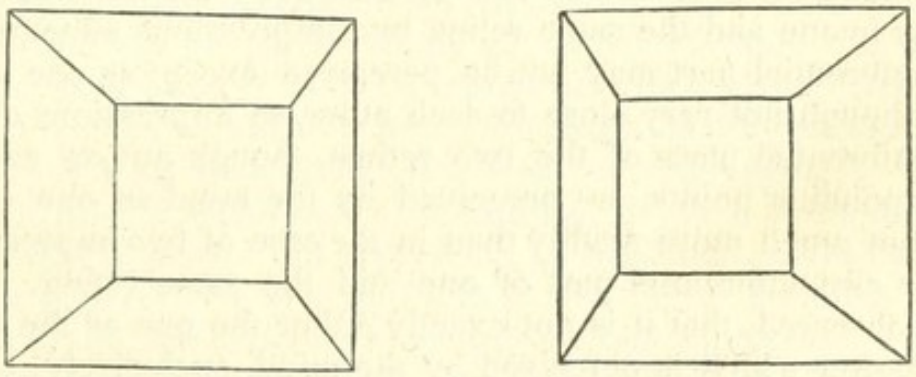
1st, That images, differing in magnitude within certain limits, but in other respects similar, if projected on parts of the two retinæ, as nearly correspondent as may be, coalesce and occasion a single perception.

2d, That in viewing an object of three dimensions, while the optic axes converge, obviously dissimilar pictures are necessarily projected on the two retinæ, and yet the mind perceives but a single object, though not exactly like either of the pictures on the retinæ. This fact is beautifully illustrated by Mr. Wheatstone's experiment of simultaneously presenting to each eye, instead of the object itself, its projection on a plane surface as it appears to that eye.

1915. For this experiment Mr. Wheatstone invented an instrument which he calls a *stereoscope*. It consists of two plane mirrors, with their backs inclined to each other at an angle of ninety degrees, near the faces of which the two monocular pictures are so disposed, that their reflected images are seen by the two eyes, each looking into one of the mirrors, in the same place.

1916. The experiment may be sufficiently well made by viewing the subjoined figures,—the dissimilar perspectives of a truncated four-sided pyramid, in the same manner as the experiment with the wafers above described; viz.:—

Fig. 66.



Fixing the right eye on the right-hand figure, and the left eye on the left-hand figure, hold between the eyes in front of the nose the board of an octavo book. The two figures will be seen to approximate, and then run into one, representing the skeleton of a truncated four-sided pyramid in bold relief.

1917. From this experiment, Mr. Wheatstone has inferred too much, when he thinks that it overturns the doctrine of

corresponding parts of the two retinæ—a doctrine which was held by Newton, Reid, Wollaston, and which is held by the best physiologists of the present day. Still it is, as above stated, not exactly in accordance with the doctrine as commonly expressed. The following observations, however, I believe, will be found to reconcile Mr. Wheatstone's experiment with the doctrine of corresponding points.

1918. It has been above shown (s. 1757, et seq.), that the degree of sensibility of the vertex or middle part of the retina is greater than that of the circumferential part; and in illustration of this, reference was made to the difference in the degree of sensibility of different parts of the skin as demonstrated by the circumstance whether the mind distinguishes two impressions made on the skin close to each other, as two or as one only.

1919. In consequence of the correspondence and sympathy of the two retinæ with each other, above shown, it would be a sufficient condition for the perception of an object, if one part only—a half, for example, of its image were projected on the temporal side of one retina, the other half on the nasal side of the other retina. This shows that the two retinæ may be in a manner viewed as constituting one sensitive surface.

1920. Hence, as in one and the same retina two impressions, affecting the vertex or middle part, are still perceived by the mind to be two, though very minute and close to each other, so, unless impressions on the middle parts of the two retinæ be on corresponding points, they are perceived by the mind as two. But as in one and the same retina two impressions affecting the circumferential part may not be perceived except as one only, even though not very close to each other, so impressions on the circumferential parts of the two retinæ, though not on exactly corresponding points, are perceived by the mind as one only; and that much more readily than in the case of two impressions on the circumferential part of one and the same retina. It is to be observed, that it is not exactly either the one or the other impression which is perceived by the mind exclusively, but is in some measure a mean of the two.

1921. Thus, though the mind perceives separately affections of neighbouring non-corresponding points of the two retinæ situated in or near their vertex at the same instant of time, it does not perceive separately affections of the circumferential parts of the two retinæ, resulting from impressions on neighbouring non-corresponding points. The distance between the

neighbouring non-corresponding points which are impressed, it is to be observed, being with certain limits.

1922. In Mr. Wheatstone's experiment, it is that part of the object at which the optic axes intersect, the image of which is projected on the middle parts of the two retinæ. Now, of the perspectives of the objects which are projected on the two retinæ, this is the only part which is similar for the two eyes. It, therefore, falls on corresponding points, the condition necessary for a single visual perception, from an affection of the middle parts of the two retinæ.

1923. It is, on the contrary, those parts of the object out of the horoptor, the image of which, necessarily dissimilar for the two eyes, is projected on the circumferential parts of the retinæ —the very parts, affections of accurately corresponding points of which is not, as above seen, a necessary condition for a single visual perception.

1924. According to this, if, when reference is made to the correspondence of the circumferential parts of the two retinæ, the expression *corresponding or identical compartments* be substituted for *corresponding or identical points*, and if the latter expression be employed only when reference is made to the correspondence of the middle parts of the two retinæ, then the doctrine of corresponding parts of the two retinæ, so far from being overturned, is confirmed and illustrated by Mr. Wheatstone's experiments, as I showed several years ago,* and as has also been shown in Germany by Bruecke† and Tourtual.‡

1925. *Visual perception of the three dimensions of space.* —All that can be perceived of an object of three dimensions by means of one eye may be represented on a plane surface, but it is not so in regard to what can be seen of it by means of the two eyes with their axes in a state of convergence. In the former case, a *semblance* of solidity or depth is seen, and this is all that a picture can represent; in the latter case, solidity or depth is perceived as *actually* as it may be by the touch of two fingers, and this is what a picture cannot represent. This is owing to the position of the two eyes, by which each is fitted to receive on its retina a different perspective of the object.

1926. The mode in which this is effected by the two eyes is essentially analogous to the mode in which the third dimension

* Proceedings of the Royal Society for 1839–40, and article Diplopia, Cyclopædia of Practical Surgery.

† Muller's Archiv. for 1841.

‡ Die Dimensionen der Tiefe im freien Sehen und im stereoscopischen Bilde. Munster, 1842.

is perceived by the touch. With the mere surface of the point of one finger we can take cognizance of length and breadth only, but with two fingers we can perceive thickness also. The two fingers admitting of being applied to different parts of the object, receive impressions of different perspectives, as it were, of it.

Natural double vision with two eyes.

1927. It is to be remarked, that we do not see with the two eyes every object single; and the reason is, that the more projecting, for example, an object is, the more is some part of it out of the horopter, and therefore the more dissimilar are its perspectives to the two eyes. Now, when the pictures on the two retinæ are very dissimilar, the parts which ought to coalesce occupy places far beyond the limits at which points of the two retinæ are influenced by each other; and therefore an object such as a needle, for instance, looked at with one end directly towards us, is seen bifurcated or double.

*Correspondence in the movements of the two eyeballs.**

1928. A correspondence in the direction of the optic axes, coincidence of the centres of revolution, and parallelism of the vertical and horizontal diameters of the two eyes, it has been above shown, are necessary conditions, in order that the images of objects may be simultaneously projected on corresponding points and parts of the two retinæ; that they are therefore the remote conditions on which single vision with the two eyes depends. In the course of the movements of the eyeballs, these conditions must therefore be preserved.

1929. The eyeball lies balanced, as it were, in the orbital capsule, and the movements which it is made to execute by the action of its muscles are revolutions merely around a certain point in its interior, the situation of which in the orbit always remains the same when the movements of the eyeballs are natural.

1930. As the eyeball revolves in all directions, it has three axes, on which it is made to revolve by its six muscles, in as many different primary directions.

1931. Suppose the six muscles of the eyeball in a state of equilibrium by which the pupil is directed exactly forwards, and the optic axis is horizontal; then:—

1st. The axis of revolution for the rectus externus and

* Ruete, Lehrb ch der Ophthalmologie für Aerzte und Studirnede, Braunschweig, 1845.

internus is vertical, and coincides with the vertical axis of the eye. These muscles turn the pupil outwards or inwards.

2d. The axis of revolution for the rectus superior and inferior, inasmuch as these muscles proceed to the globe in the direction of the optic nerve, which intersects the optic axis at an angle of about twenty degrees, extends obliquely from before and inwards, somewhat backwards and outwards, and intersects the optic axis at an angle of about seventy degrees. The pupil is thus turned by the rectus superior upwards and somewhat inwards, by the rectus inferior downwards and somewhat inwards.

3d. The axis of revolution of the obliqui likewise extends horizontally through the eyeball, but nearly from the outer margin of the cornea backwards and inwards, and intersects the axis for the superior and inferior recti at an angle of about seventy-five degrees. Around this axis, when the optic axis is horizontal and directed forwards, the superior oblique turns the eyeball in such a way that the pupil is directed downwards and outwards, and the inferior oblique turns it in such a way that the pupil is directed upwards and outwards. The annexed figure (67) represents these circumstances.

The oblique muscles turn the eyeball in the direction above indicated, only when the pupil is previously directed straight forwards and all the muscles are in a state of equilibrium. But if, for example, the internal and inferior recti have previously directed the pupil downwards and inwards, then the superior oblique turns it still more inwards.

1932. The four recti are antagonists of the two obliqui; the recti muscles pull the eyeball back, the obliqui forwards. The eyeball is in the sound state thus balanced.

1933. If one of the four recti muscles be cut, the eyeball protrudes somewhat. When one of the oblique is cut, the eyeball sinks deeper in the orbit.

1934. The two obliqui, with the external rectus, are antagonists of the superior, inferior, and internal recti.

1935. By the mechanism just mentioned, assisted by the orbital capsule, the eyeball is balanced in such a way that when all the muscles are in equilibrium the optic axis is directed horizontally forwards.

1936. The four recti rotate the eyeball in the vertical and horizontal directions. The obliqui keep the vertical diameter of the two eyes always parallel though not vertical—a condition necessary for single vision.

1937. The internal rectus muscle of one eye, and the exter-

nal rectus of the other, usually act together, so also do the superior recti of the two eyes and the inferior recti.

1938. But when required for the purposes of vision the two internal recti act together, and so also may the two external

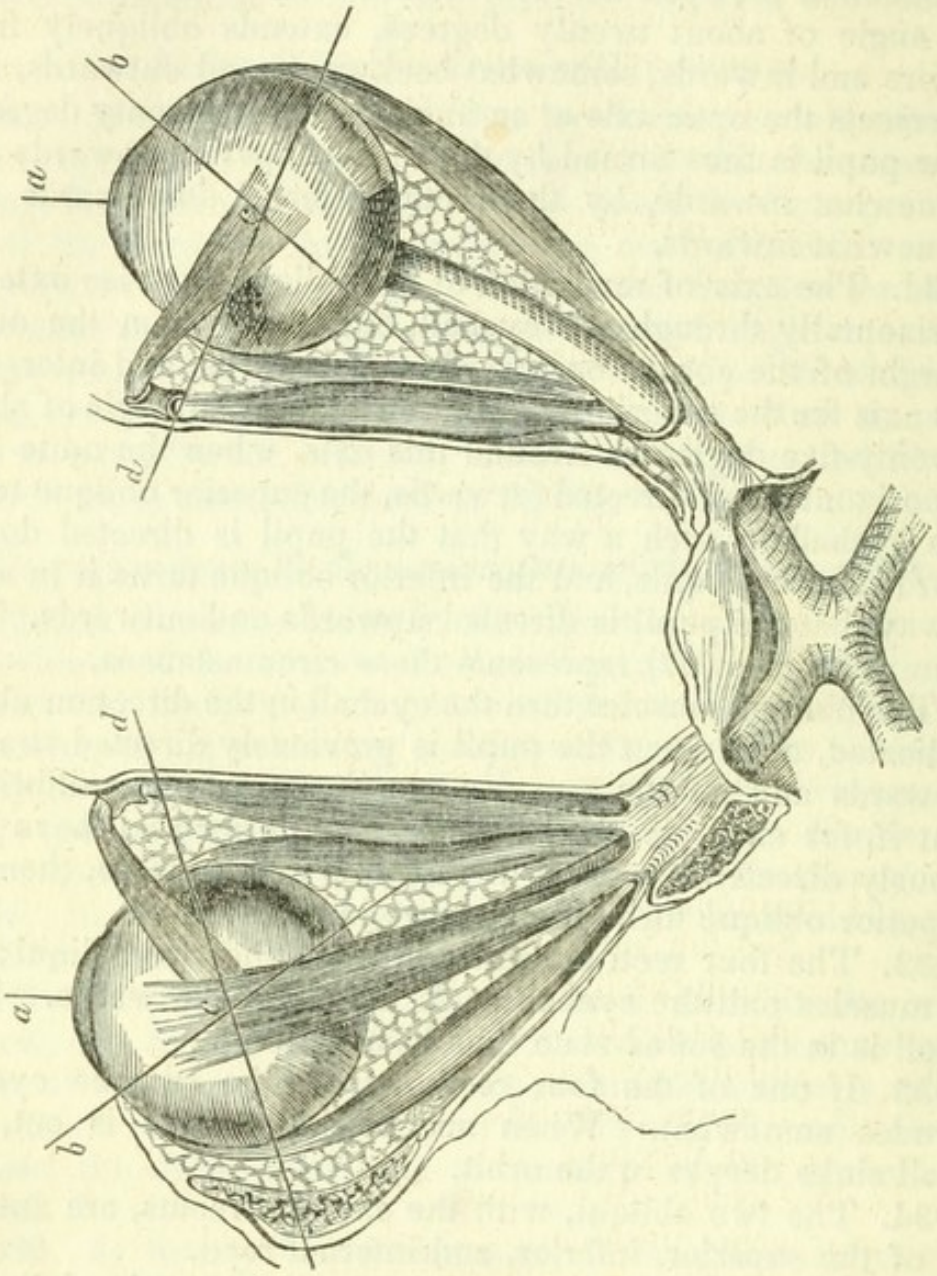


Fig. 67.

(From Ruete.)

The muscles seen from above are in a state of equilibrium; *a. a.* the parallel optic axes; *c. c.* the centres of revolution; *b. b.* the axis of revolution for the oblique muscles; *d. d.* the axis of revolution for the superior and inferior recti.

recti in bringing the eyes from a state of strong convergence to a state of parallelism, but not of divergence.

1939. In short, the different muscles of the two eyeballs act in various combinations, sometimes as fellows, sometimes as antagonists, according to the manner in which the eyes require to be directed to receive the images of the object looked at, on corresponding parts of the two retinæ.

LOSS OF CORRESPONDENCE IN THE SENSATIONS OF THE TWO EYES.

Diplopy or double vision with two eyes.

1940. The conditions on which single vision, as well as natural double vision with the two eyes depends, having been premised, we are prepared to enter upon the study of morbid double vision with two eyes.

1941. *In limine*, it may be observed, that double vision with two eyes is altogether different in its nature from the double or manifold vision with a single eye above considered, the latter being owing to irregular refraction. A case of double vision with two eyes is at once distinguished by closing one eye, when objects will be seen single.

1942. Where, from any cause, there is a loss of the natural correspondence of the optic axes, the coincidence of the centres of revolution, and the parallelism of the vertical and horizontal diameters of the two eyes, the parts of the two retinæ on which images of the same object are simultaneously projected, are not corresponding parts; therefore, in accordance with what has been above said, the sensations arising from the two impressions are separately perceived by the mind, and the consequence is double vision.

1943. Double vision with two eyes is thus in itself not a disease, but the natural result of derangement of those conditions on which single vision depends. The proximate cause of the derangement alluded to is, most frequently, paralysis of some one or more of the muscles of the eyeball; but it may be some morbid production in the orbit, or the like, displacing the eyeball.

1944. The two images in diplopy are often distinguished into true and false, or real and imaginary; but such a distinction is improper, as the image perceived by the displaced eye although it may be less distinct, is not more false or imaginary than the other, both being equally the result of sensation produced by the impression of rays of light on the retinæ.

1945. That one of the two images is more distinct than the

other, is owing to the circumstance, that in one eye the impression is made on the central part of the retina, which is more sensible than any other; while in the opposite eye, the impression falls on a part of the retina which, according to the degree of deviation of the eye from its right direction, is more or less distant from the centre. The adjustment of that eye, moreover, which receives the impression on the centre of its retina, corresponds with the distance of the object looked at. The other eye, not being so adjusted, its image besides being indistinct, is surrounded by an iridescent halo (s. 1688, 2d.)

1946. The relative position of the two images depends upon the direction and degree of the deviation of the eyes. As sometimes the deviation of the axes or centres and diameters of the eyes exists only when the person looks in particular directions and at certain distances, so does the double vision in such cases take place only when the patient looks in those directions, and at those distances; thus, if the abductor muscle of the right eye be palsied, the patient sees single on looking to the left, but double on looking to the right.

[Where the deviation is in the horizontal axis of the eyes, a horizontal line appears double, whilst a vertical line is seen single; on the contrary when the deviation is in the vertical axis, a vertical line appears double, whilst a horizontal one is seen single. Sometimes the double lines are parallel, at others divergent. If the head be held erect and the line be moved, horizontally or vertically as the case may be, the double images will be found to approach or recede accordingly as the line approaches or recedes from a certain point, and in some cases at one point the two images unite—double vision ceasing. Examples of all these conditions of vision have come under our observation.]

1947. When double vision is owing to deviation of the optic axes, the misdirection of the two eyes may exist in various degrees, from an evident squint to a scarcely perceptible cast.

1948. When, on the contrary, double vision is owing to deviation of the vertical and horizontal diameters of the two eyeballs from parallelism, in consequence of abnormal action of the oblique muscles, there is no deviation of the optic axes, and, consequently, no squint or cast.

1949. The double vision from deviation of the optic axes is less perceived by the patient when this is great than when it is slighter, because in the latter case, the two retinal sensations are about equal in force, in consequence of the images of the

object being projected on parts of the two retinæ not differing much in sensibility.

1950. As in double vision from deviation of the vertical and horizontal diameters of the two eyes, the images of the object are equally projected on the central parts of the two retinæ, so the two retinal sensations do not differ in force; hence the two sensations contend, as it were, to attract the mind's attention, and the object appears as if oscillating with velocity before the eyes, the consequence of which is great confusion of perception when the two eyes are open, and sometimes vertigo. As the person in this state can exercise vision only when he closes one eye, the affection has been named *Monoblepsis*.

1951. When the non-correspondence of the two eyes is very slight, the two images seem partially to overlap each other. This appearance not being recognized as a phenomenon of double vision, is sometimes described under the name of *Metamorphopsy*.

1952. The irregular or impeded action of the muscles of the eyeball, giving rise to diplopy, may be owing to an affection of the muscles themselves or of their nerves, or it may be owing to disease or injury of the brain, or to drunkenness, or fear, or to derangement of the *primæ viæ*, &c. But this is not the place to discuss those various primary affections on which the derangement of the action of the muscles of the eyeballs depends. It is enough here to explain the nature of diplopy with two eyes, in order that, as a symptom in any particular disease, it may be appreciated at its due value.

LOSS OF CORRESPONDENCE IN THE DIRECTION AND MOVEMENTS OF THE TWO EYES.

Strabismus, or squinting, and luscitas, or immovable distortion of the eyeballs.

1953. Strabismus and luscitas are equally characterized by loss of the natural correspondence of the optic axes; but in the former, this is owing to want of harmony in the movements of the eyes, not to loss of motive power, for the squinting eye becomes straight and capable of being directed to any object when the other eye is closed; whilst in the latter, it is owing to one eye being fixed more or less immovably in one direction, in consequence either of paralysis of the muscle moving the eyeball in the opposite direction, or of organic contraction and ad-

hesion of the muscle, &c., of the side to which the eyeball is turned.

1954. The following are the principal forms of strabismus:—

1. *Strabismus convergens;* 2, *strabismus divergens;* 3, *strabismus sursumvergens;* 4, *strabismus deorsumvergens.*

1955. Of these different forms, by far the most frequent is *strabismus convergens.*

1956. *Strabismus divergens,* though rare, is next in frequency.

1957. *Strabismus sursumvergens* and *strabismus deorsumvergens* are very rare.

1958. It is to be remarked that the affected eye is not always turned exactly inwards, outwards, upwards, or downwards, but may be inclined in the intermediate directions; sometimes in a state betwixt strabismus sursumvergens and strabismus convergens, and sometimes betwixt strabismus sursumvergens and strabismus divergens.

Strabismus convergens.

1959. *Objective characters.*—In convergent strabismus, the pupil of one eye is habitually more or less turned towards the nasal canthus, whilst the other eye looks straight forward and is capable of being directed to the various objects on which the person fixes his regard. It is only when the habitually well-directed eye is closed, that the inverted eye becomes straight and falls under the command of the patient to be turned in any direction; but as soon as the former eye is again opened, the person loses all command over the other, and it falls back into its original state of inversion.

1960. When the habitually well-directed eye is covered it squints, while the previously squinting eye becomes properly directed.

1961. The strabismus which passes to the previously well-directed eye when this is covered, is called *alternating strabismus convergens,* the appellation of *double strabismus convergens* being confined to cases in which both eyes are habitually more or less turned in at the same time; one cornea perhaps being more than half hid in the inner canthus, while the other has a slight inclination inwards.

1962. In some cases of alternating strabismus, the patient has the power, immediately and voluntarily, to direct either eye properly; but while this is done, the other falls into the state of inversion.

1963. In other cases the habitually squinting eye becomes

straight, and the opposite eye squints without the will of the patient; and while both eyes are open, there is power to direct properly one eye only.

1964. Alternating is much more frequent than double convergent strabismus. In regard to the relative frequency with which the right or the left eye is turned in, it appears that the left eye is rather more prone to be so than the right.

1965. *Subjective symptoms.*—The vision of an eye affected with convergent strabismus is usually imperfect. An early symptom is double vision, though of this the patient does not continue long sensible. It is, however, always found, that if the *vision of both eyes is tolerably good*, and the *attention is fairly fixed on their sensations*, single objects held directly before the face are seen double.

1966. The double vision usually attending strabismus is owing to the circumstance that non-corresponding parts of the two retinæ are impressed by the rays of light proceeding from the same object (s. 1942).

1967. The image seen by the properly directed eye appears clearer than the other; which is owing not only to that eye being the stronger, but especially to the circumstance that in it the impression is made on the central part of the retina, which is more sensible than any other; besides, that the adjustment of the properly-directed eye corresponds with the distance of the object looked at (s. 1945).

1968. The image of the affected eye is clearer, and, in consequence, the diplopy more striking, the less the *cast* of the eye; hence the double vision will be noticed by the patient before the misdirection of the eye attracts the attention of those about him. Double vision ceases in many cases, because the impression on the sound eye is much more vivid than that on the distorted one; and we know by experiment, that of impressions dissimilar in force on the two eyes, the mind perceives the stronger, to the exclusion of the weaker.

1969. *Causes.*—The remote causes to which strabismus is in different cases attributed, or attributable, are very various. They are such as the following:—Convulsions during infancy, difficult dentition, hooping-cough, measles, small-pox, worms, injuries and diseases of the head, fright, anger, injuries, inflammation, and other diseases of the eyes, such as opacities of the cornea, imitation, and a habit of misdirecting the eyes.

1970. Most commonly, strabismus has its origin in early life; indeed, many of the diseases just enumerated as remote causes of the affection, are diseases of early life.

1971. In many cases no cause at all can be assigned.

1972. *Is defective vision of one eye a cause of strabismus?*—In most cases the vision of the squinting eye is imperfect; but, it may be asked, is this cause or effect, or are not the defective vision and strabismus both effects of one and the same cause?

1973. As both eyes have a tendency, the one to turn in, while the other remains straight, imperfect vision of one eye will operate as a cause of rendering the squint habitual in that eye, for the reason that, as one eye only can be directed straight at one time, it is naturally the stronger eye which is so. In this case it is to be remarked, however, that the imperfect vision is not the cause of the squint itself; it is merely the cause of determining it to one eye rather than to the other. The justness of this view is illustrated by the fact, that by binding up the stronger eye, and strengthening the weaker by exercise, the strabismus will shift from the latter to the former.

1974. Supposing defective vision of one eye to have some causal connection with the origin of strabismus itself, it can scarcely ever be the efficient cause, as much more frequently all degrees of defective vision of one eye exist without the occurrence of strabismus; and blind eyes are not more prone to squint than sound ones.

1975. *Proximate cause.*—Whatever be the remote cause of strabismus, there can be no doubt that its proximate cause consists in some affection of the muscles of the eyeball. The question which this conclusion naturally suggests is, what is the nature of the affection of the muscles of the eyeball?

1976. The various remote causes of strabismus which have been remarked, such as imitation, affections of the mind—anger, fear, &c.,—disease of the brain, intestinal canal, and other parts, together with the circumstance, that it may occur occasionally only, and the phenomena of strabismus in general, all point to the muscular affection being owing to perverted nervous action.

1977. In strabismus convergens, is it the action of the adductor or abductor which is at fault? If the adductor, it must be in a state of tonic spasmodic contraction, with this peculiarity, that the spasm goes off when the other eye is closed, and immediately returns when it is again opened; and with this further peculiarity, that on closing the previously well-directed eye, the spasm comes on in it at the same time that it goes off in the habitually squinting one.

1978. Is it the abductor which is at fault? The abductor is

certainly not paralyzed, for on closing the habitually straight eye, it evidently exerts its proper function; but, as soon as the latter is again opened, the abductor is no longer able to support the eye in its natural direction, so that the distortion immediately returns. If the abductor be in fault it is obvious that the fault, whatever it is, is transferable from the muscle of the one eye to that of the other.

1979. It has been inferred from the eye not always turning out to the external canthus, on the section of the internal rectus muscle, that the external rectus was paralyzed, but it appears that the action of the inner fibres of the upper and lower recti, which are advantageously inserted for the purpose, are in general sufficient to restrain the everting action of the external rectus (s. 1931, 2d).

1980. Organic change of the affected muscle, or contraction of surrounding parts, may, however, supervene; such as contraction and thickening of the conjunctiva on the side towards which the eyeball is turned, and an hypertrophied state of the muscle, as appears from *post-mortem* examination, but especially from observations made during the operation of dividing the muscle at fault. The strabismus thus merges into luscitas.

1981. It is thus seen that there are two distinct sets of cases of convergent misdirection of the eyes, viz., strabismus and luscitas, and that in the former there is in general nothing abnormal perceptible about the organic constitution of the muscles at fault, whilst in the latter there is somewhere organic contraction. But, between cases which may be called pure convergent strabismus and cases of luscitas, there are gradations in which the patient still has more or less power to turn the eye out.

1982. *Treatment.*—When convergent strabismus is of recent origin, is still purely dynamic, and if its exciting cause can be discovered, and is still in operation, this ought to be the first object of treatment.

1983. In every recent case of strabismus in a young person, where the exciting cause is not evident, it is advisable to prescribe a calomel purge or two, and then an alterative course of mercurial chalk, with an occasional laxative, followed up by tonics.

1984. It is scarcely necessary to say, that whatever prompts to a habit of misdirecting the eyes, whether imitation, trying to look at objects too near the eyes, or otherwise disadvantageously placed, careless employment of the eyes, and the like, must be carefully guarded against.

1985. Exercise of the habitually misdirected eye during two or three hours daily, by covering the other eye, has often been found successful in curing squint. But it is apt to happen that whilst the habitually misdirected eye becomes straight, the previously well-directed one turns in.

1986. When strabismus convergens has become fully established, it resists, as is well known, all treatment such as that above indicated.

1987. *Section of the internal rectus as a means of cure.*—Ocular myotomy appears to have been practised by the celebrated itinerant oculist the Chevalier Taylor, as a means of curing strabismus, about a hundred years ago; but it never came into use as a regular surgical operation, and so was forgotten.

1988. Of late years, however, it has been revived. Suggested by several different persons independently, and tried on the dead body by Stromeyer especially, the operation on the living body was first introduced into actual practice by Dieffenbach.

1989. It has been seen that in pure strabismus, there is in general nothing abnormal perceptible about the organic constitution of the muscle at fault, whilst in luscitas there is either paralysis or organic contraction. Such being the case, the attempt to remedy organic luscitas by operation, every one must admit, was justified by analogy with clubfoot; but certainly the same cannot be said for the operation in pure strabismus. It must be confessed, however, that the operation in cases of pure strabismus has proved more successful than could *a priori* have been expected.

1990. Section of the internal rectus of the habitually misdirected eye alone may be sufficient, but section of the internal rectus of both eyes is generally necessary, as it is found that, if one eye only is operated on, it either still remains inverted, or, if it is rendered straight, the previously well-directed eye is apt to turn in.

1991. The latter circumstance is analogous to that above pointed out, viz., that when the previously well-directed eye is covered, and the habitually inverted one, by being thus called into exercise, becomes straight, the former turns in.

1992. In double convergent strabismus both internal recti should in like manner be divided at the same time.

1993. *Position of the patient, assistants, and operator.*—This is to be arranged as above indicated for cataract (s. 1298, et seq.)

1994. *Securing of the eyelids.*—For securing the eyelids specula have been much employed, but they may be dispensed

with, and the eyelids secured as above recommended for cataract, (s. 1303,) only that this must be done wholly by the assistants, as both hands of the operator are necessarily engaged. One assistant may take charge of both eyelids if there is not a second at hand. There should, however, be an assistant ready with small pieces of sponge, to sponge away the blood, which sometimes flows after the division of the conjunctiva, and collects in the wound.

1995. *Section of the internal rectus.*—The opposite eye being covered, the patient is to be directed to turn the eye to be operated on as much outwards as he can. Whilst he does this, the surgeon, with a toothed forceps held in his left hand, seizes the conjunctiva at about a quarter of an inch from the margin of the cornea on the nasal side, and raises it up in a large transverse fold, which he immediately divides with a pair of straight blunt-pointed scissors, so as to make a free vertical incision through the conjunctiva. This incision may be enlarged with the scissors upwards and downwards, if not at once long enough; but the whole length ought not to exceed one-fourth or one-third of an inch. By this division of the conjunctiva, the tendon of the internal rectus, which is inserted into the sclerotica at about one-sixth of an inch from the margin of the cornea, is exposed.

1996. The next step is to pass a bent probe or blunt hook behind the tendon, between it and the sclerotica, from above downwards; bringing its point, when fairly passed behind the tendon, out through the lower end of the incision of the conjunctiva, by raising its handle.

1997. The tendon of the muscle being thus raised on the hook, the next step is its section, which is effected with the scissors, from below upwards, near its insertion.

1998. If, after this is done, the eye does not admit of being *freely* everted, an exploration of the bottom of the wound is to be made with the hook, in order that if this be owing to any bands of cellular tissue remaining uncut, they may be raised and divided.

1999. The immediate effect of division of the internal rectus of one eye in convergent strabismus, may be, that the axis of the eye becomes directed straight forward, and can be preserved so though the other eye is kept open. If, however, this should not be the case, but the eye still remained inverted, division of the internal rectus of the opposite eye should be forthwith performed

2000. That the axes of the two eyes, though they may appear to do so, do not correspond immediately after the operation,

is shown by the circumstance that double vision has been in most instances an immediate result of the operation, but it has usually gone off sooner or later.

2001. The reason of double vision occurring after, when perhaps it did not exist before, the operation, when the axes of the eyes deviated so much more, appears to be this:—the rays of light from the object regarded by the sound eye, were either not at all received on the retina of the squinting eye, or if so, received in a place considerably removed from the most sensible part, and the impression on which, therefore, was too weak to fix the attention; whereas, after the operation, the rays striking, in the eye operated on, a part of the retina nearer the centre, the sensation is strong enough to attract notice, but, the axes of the two eyes not yet quite corresponding, there is double vision.

2002. It has sometimes been remarked that the vision of the eye became weaker after the operation, but soon improved again. More frequently, considerable improvement in the vision of the eye operated on has been, or has been fancied by the patient to have been, a result of the operation. Generally, however, there is no actual change in the retinal power, and rectification of the squint is all that is gained from the operation.

[This does not entirely accord with our observations. In nearly all the cases of single strabismus which have fallen under our observation, there was a weakness in the retinal power of the affected eye, and in all such upon which we have operated the vision has improved after the division of the muscle. These facts we have determined by careful experiments, so that we could not be misled by the *fancy* of the patient.]

2003. *Unnatural prominence of the eyeball amounting sometimes to semi-dislocation*, has been a common result of the division of the internal rectus. This is owing in some degree to the unrestrained action of the oblique muscles, and cannot be altogether avoided, but there is no doubt that it is in a greater measure owing to too free division of the conjunctiva, division of the muscle too far back, and too great detachment of its cellular connections with the eyeball.

2004. *Eversion of the eye after section of the internal rectus* by the action of the external rectus has much less frequently happened than might have been anticipated. This is owing in a great measure, as above said (s. 1979), to the inverting action of the inner fibres of the superior and inferior recti.

2005. In cases of eversion the eye may eventually turn right. If it does not, division of the external rectus must be had recourse to.

Strabismus divergens.

2006. Strabismus in all respects analogous to convergent strabismus, except that the misdirection of the eye is outwards, is rare.

2007. Divergent luscitas from paralysis of the muscles supplied by the third pair, must not be confounded with divergent strabismus.

2008. The eversion which sometimes occurs after section of the internal rectus for convergent strabismus, inasmuch as the eye can still be moved somewhat from the external angle when the other eye is closed, partakes partly of the characters of strabismus and partly of those of luscitas.

2009. *Treatment.*—The same general treatment and exercise of the eye, above recommended for convergent strabismus, may be tried in recent cases.

2010. Myotomy has not been so successful in divergent as in convergent strabismus. The return of the eye from its state of eversion to a straight direction after section of the external rectus is but very gradual.

2011. Division of the corresponding recti of both eyes at the same time is equally applicable to divergent as to convergent strabismus.

2012. *Section of the external rectus.*—This is performed in essentially the same manner as that of the internal rectus, it being remembered that the insertion of the tendon of the external rectus is as much as a quarter of an inch from the margin of the cornea, and is thinner and more spread out than that of the internal.

Strabismus sursumvergens and strabismus deorsumvergens.

2013. The turning up and turning down of the eyes, comprehended under these names, appear to be rather examples of luscitas, than pure strabismus.

2014. Cases have been met with, in which the eye having been previously directed inwards and upwards, turned right upwards, after the section of the internal rectus, and was brought back to a natural position only by section of the superior rectus.

2015. In reference to section of the superior rectus, it is to be remembered that the insertion of its inner fibres is nearer the margin of the cornea, but that the average distance of the insertion from the margin of the cornea is about a quarter of an inch.

2016. The insertion of the inferior rectus is similar to that of the superior, but not quite so far from the margin of the cor-

nea, being only about one-fifth of an inch. Section of the inferior rectus does not seem ever to be required.

2017. *Treatment and accidents after the operation of ocular myotomy.*—In general, little treatment is required. It is always advisable that the patient should be kept at rest for a day or two after the operation. A cold lotion may be applied to the eye (s. 110), but if pain come on, warm fomentations will be better.

2018. *The accidents which have occurred during and after the operation, are:*—The eyeball cut into and the vitreous humor evacuated. Hemorrhage to a dangerous extent. Inflammation of the conjunctiva with chemosis. Inflammation in the orbit, ending in abscess. Panophthalmitis ending in total destruction of the eye. Convulsive movements of the eyeball. Many of these accidents, however, there can be no doubt, have been owing to a rude performance of the operation.

2019. When a return of the strabismus takes place, the operation may be repeated. Sometimes success has been obtained only after a second or third repetition.

Paralysis of the muscles supplied by the nerve of the third pair.

2020. The muscles supplied by the nerve of the third pair, being the levator palpebræ, the internal, superior, and inferior recti, the inferior oblique and the sphincter fibres of the iris, the result of their paralysis is:

1st. Paralytic ptosis.

2d. Paralytic divergent luscitas, with paralytic ophthalmoptosis.

3d. Paralytic mydriasis.

2021. *Paralytic ptosis.*—This is a hanging down of the upper eyelid over the eye, in consequence of paralysis of its levator muscle permitting of the unrestrained action of the orbicularis palpebrarum. The patient can thus open his eye only by raising the eyelid with his finger.

2022. *Paralytic divergent luscitas.*—When the upper eyelid is raised with the finger, the eye is seen to be everted in consequence of the paralysis of the internal superior and inferior recti permitting of the unrestrained action of the external rectus. The patient is at the same time unable to move the eye upwards or downwards. From the non-correspondences of the two eyes occasioned by the eversion, the patient sees double, and is apt to become giddy if he attempts to walk while he holds the eye open.

2023. *Paralytic ophthalmoptosis* is unnatural prominence of the eyeball in consequence of the paralysis of the internal,

superior and inferior recti allowing of the unrestrained action of the superior oblique.

2024. *Paralytic mydriasis.*—As above explained, this is persistent dilatation of the pupil, notwithstanding exposure to light, owing to the paralysis of the circular fibres of the iris permitting of the unrestrained action of the radiating ones, (s. 1610.)

2025. Paralysis of the nerve of the third pair may be complicated with paralysis of the nerve of the sixth pair, in which case the external rectus being also paralyzed, the eye is no longer turned towards the temple; or it may attend paralysis of the optic nervous apparatus. In this case the defective vision is to be distinguished from that disturbance of vision which is owing merely to the simple mydriasis in uncomplicated paralysis of the nerve of the third pair.

2026. *Causes.*—Paralysis of the parts supplied by the nerve of the third pair sometimes comes on under the same circumstances as rheumatism, viz., exposure to cold and damp. Such cases are properly viewed as being of a rheumatic character.

2027. The cause of the paralysis, however, is often, congestion, extravasation, effusion, a tumour, &c., consequent sometimes to blows or falls on the head, involving the intracranial portion of the nerve. In such cases both nerves are apt to be affected.

2028. Rheumatic paralysis of the parts supplied by the nerve of the third pair soon develops itself after the exposure. Paralysis of the same parts, owing to intracranial disease, may, according to the nature of that disease, come on suddenly or gradually.

2029. *Prognosis.*—Rheumatic paralysis is often cured, though it may yield but slowly. The same may be said of cases apparently owing to some cerebral affection, which have come on suddenly. In slow cerebral cases the prognosis is not only unfavourable, but the paralysis under consideration may be but a comparatively unimportant part of the case.

2030. *Treatment.*—The plan of treatment in the rheumatic cases is the general antiphlogistic (s. 421, et seq.), consisting of bleeding, mercurialization, and counter-irritation. According to the circumstances of the case, bleeding should be by venesection or leeches, or both; the mercurialization should be pushed to decided affection of the mouth; the counter-irritation may be made by blisters to the crown of the head or over the brow. The same plan of treatment is applicable in sudden cerebral cases. But in slow cerebral cases the alterative plan of treatment with counter-irritation is the only one admissible.

Paralysis of the muscle supplied by the nerve of the sixth pair.

2031. Paralysis of the muscle supplied by the nerve of the sixth pair, or the external rectus, is of rarer occurrence than that of the muscles supplied by the nerve of the third pair.

2032. In this affection the eye is inclined towards the nose, and cannot be turned out (*convergent luscitas*); and, of course, in consequence of non-correspondence of the two eyes there is double vision, which, is in this case more felt as the eye continues open.

2033. In respect to *causes, prognosis, and treatment*, what has been said of cerebral cases of paralysis of the parts supplied by the nerve of the third pair, is applicable to paralysis of the external rectus.

Oscillation and nystagmus of the eyeballs.

2034. Oscillation of the eyeball is a to and fro movement of it round its antero-posterior axis, whilst nystagmus is a similar movement round its vertical axis. The former is owing to clonic convulsion of the oblique muscles, the latter to clonic convulsion of the internal and external recti.

2035. These irregular movements are most generally met with attendant on defective vision, from whatever cause, which has existed from birth or from an early period of life,—such as, congenital albinism, congenital cataract, amaurosis,—or general nervous complaints, such as hysteria, epilepsy, chorea, —or evident disease of the brain.

2036. But little can be done by way of medical treatment. Ocular myotomy, which has been wantonly applied to the treatment of so many different affections of the eye, has been applied to the cases under consideration also, and it is said with success.

CHAPTER VII.

DISEASES OF THE EYELIDS.

Section I.—INFLAMMATIONS AND ULCERATIONS OF THE EYELIDS.

Phlegmonous inflammation of the eyelids.

2037. In this inflammation, which more frequently affects the upper than the lower eyelid, the cardinal symptoms, redness, swelling, heat, and pain, are well marked.

2038. The swelling is circumscribed by the border of the eyelid on the one hand, and the margin of the orbit on the other, and may be so considerable as to prevent the eye from being opened.

2039. If resolution does not soon take place, the inflammation goes on to suppuration.

2040. Rarely does the inflammation end in mortification.

2041. *Causes.*—Phlegmonous inflammation of the eyelids is frequently of traumatic origin; but in children, in whom it is most common, the cause is sometimes not very evident.

2042. *Prognosis and treatment.*—If left to itself the abscess usually points and bursts externally; but sometimes on the inside of the lid; sometimes again both externally and internally. When the abscess is thus left to burst, the skin and cellular tissue of the eyelids are apt to be materially injured, the eventual consequence of which will be distortion of the eyelids of various kinds, shortening, eversion, &c.

2043. The treatment best calculated to put a stop to the inflammation, and to prevent injury of the skin and cellular tissue of the eyelid, is a free incision with a lancet transversely through the middle of the swelling. In the purely inflammatory stage, this gives issue to a considerable quantity of blood and fluid exuded into the cellular tissue, relieves tension, and promotes resolution; in the stage of suppuration, it evacuates the matter, and this is usually followed by a subsidence of the symptoms. After the incision, warm fomentations are applied.

2044. The patient is at the same time to be purged and kept at rest.

2045. If the patient dreads the incision, leeches may be substituted in the purely inflammatory stage; and in the stage of suppuration, pointing and bursting of the abscess are to be promoted by warm cataplasms.

Erysipelatous inflammation of the eyelids.

2046. In erysipelas, the redness varies from a pale rose-tint inclining to yellow to a bright scarlet or livid hue, is not circumscribed, and disappears on pressure, but soon returns.

2047. The swelling is not great but diffused. Where, however, there is loose subcutaneous cellular tissue as in the eyelids, there is, in addition, considerable œdematous swelling from copious serous exudation into it.

2048. The pain, which is superficial, and generally not severe, is of a burning character.

2049. *Constitutional symptoms.*—For some days before,

the patient complains of general uneasiness, headache, loss of appetite, nausea, and perhaps vomiting, all of which symptoms cease or are much relieved when the erysipelas makes its appearance.

2050. In erysipelas of the face the eyelids are always involved, but sometimes they are the original seat of the inflammation, especially in cases arising from injury.

2051. Besides lachrymation, there is increased Meibomian and conjunctival secretion, which, in the form of a puro-mucous matter, collects over night along the border of the eyelids, and at the inner canthus.

2052. Erysipelas of the eyelids usually ends in resolution, in which case the redness and swelling subside, and branny scales, consisting of exfoliated epidermis and dried exudation, are thrown off from the surface.

2053. In consequence of serous exudation under the epidermis, vesicles or bullæ are sometimes formed. These by and by burst, and the matter set free, becomes dried into crusts, which, with the branny scales, eventually fall off, leaving the skin in a sound state.

2054. In more violent cases, along with severe pain in the part, and constitutional disorder, the inflammation runs on to diffuse suppuration and mortification of the subcutaneous cellular tissue.

2055. If the erysipelas end in this manner, great distortion of the eyelids may be the result.

2056. *General treatment.*—The best remedy at first is an emeto-cathartic, consisting of one or two grains of tartar emetic, and an ounce or two of Epsom salts, dissolved in two pints of water, and given in the dose of a teacupful every two hours. Whatever other general treatment may be necessary will depend much on the circumstances of the case. The alterative and tonic plan is that which is found most effectual, especially in London. Elsewhere the antiphlogistic plan is considered the best.

2057. *Local treatment.*—In many cases, the erysipelas subsides without any local application.

2058. In severer cases, it is advisable to have recourse to scarification by repeated fine punctures with the point of a lancet, encouraging the bleeding by warm fomentations. This affords great relief even in a few minutes, prevents vesication, and diminishes the risk of suppuration and mortification.

2059. When the inflammation has gone so far that suppuration and mortification are threatened, or if they have already

taken place, free transverse incisions should be made through the skin into the subjacent cellular tissue,* and warm water dressing applied.

2060. By this practice, mischief is averted, or, if it has already begun, arrested by a free outlet being afforded for pent-up matter, and sloughy cellular tissue.

Variolous inflammation of the eyelids.

2061. The variolous eruption on the eyelids has been noticed under the head of variolous ophthalmia (s. 952), with a reference to this place for the treatment calculated to prevent distortion of the eyelids, such as entropium, ectropium, or trichiasis, from bad cicatrices succeeding the pustules.

2062. The plan which is usually recommended for this purpose is to endeavour to check the development of pustules at the edges of the eyelids by touching them in their early stage with lunar caustic; or if the pustules have already formed, by evacuating them by puncture and then applying the caustic.

Carbuncle and malignant pustule of the eyelids.

2063. *Carbuncle* sometimes occurs in the eyelids, especially the upper.

2064. The danger is the same as when it occurs on other parts of the body, and in consequence of the loss of substance occasioned by the sloughing, ectropium is the usual result, supposing the event of the case otherwise favourable.

2065. The treatment is the same as when the disease occurs on other parts of the body, viz., opium to relieve suffering, wine and nourishing diet to keep up the powers of the system, and a free crucial incision into the swelling, followed by the application of emollient poultices, until the slough separates, when granulation and cicatrization are to be promoted in the usual manner, care being taken to obviate contraction as much as possible, (s. 2137).

2066. *Malignant pustule*, which is a gangrenous inflammation of the skin and cellular tissue, most frequently produced by contagion from oxen, horses, &c., their carcasses or their hides, not much known in this country, but common on the continent, sometimes affects the eyelids.

* In making the scarifications and in opening abscesses of the eyelids, MM. Velpeau and Carron du Villards recommend great caution, lest the eyeball should be wounded. The latter mentions his having been three times witness of such an accident. One of the cases was in the person of an unfortunate physician of Malesherbes, M. Benod, who had both his eyeballs evacuated in the attempt of an imprudent *confrère* to open erysipelatous abscesses in the lower eyelids!

2067. The injury to which the eyelid is exposed from sloughing is the same as in carbuncle, but the constitutional symptoms may be still more severe, and the result is often fatal.

2068. The first point of treatment insisted on by those who have experience of the disease is to destroy the infected part by the actual or potential cautery.

2069. The general and local treatment is in other respects the same as in carbuncle.

Ophthalmia tarsi.

2070. This is a chronic inflammation of the tarsal borders of the eyelids, of which there are two principal forms, viz., *catarrhal* and *scrofulous*.*

2071. The former occurs in adults, and principally affects the delicate integument of the tarsal border and the adjoining conjunctiva and skin of the eyelid;—the latter occurs in children, and affects principally the granular structures at the borders of the eyelids and the roots of the eyelashes.

Catarrhal ophthalmia tarsi.

[Chronic catarrhal ophthalmia. Blapharoblenorrhœa senilis. La mitte, or miasmatic ophthalmia of scavengers and night men, &c.]

2072. *Objective symptoms.*—Towards the borders of the eyelids the skin is somewhat red and swollen, the conjunctiva red and villous, and the delicate integument of the border itself more or less excoriated, especially towards the outer angle.

2073. The eyelashes are loaded with Meibomian secretion, and the eyelids become glued together by it over night.

2074. *Subjective symptoms.*—These are itchiness and smarting at the borders and angles of the eyelids, and the sensation of foreign particles in the eye, with some intolerance of light, and lachrymation.

2075. When the complaint has been of long continuance, many of the eyelashes fall out, and some become misdirected, and not unfrequently slight inversion or eversion of the borders of the eyelids takes place,—the former generally from transverse shortening of the border of the eyelids, the latter from contraction of the skin and a sarcomatous state of the conjunctiva (*ectropium senile*).

* These two forms of chronic inflammation of the tarsal borders are generally recognized, but there is great confusion in the names employed to designate them. Some authors employing the name *ophthalmia tarsi* exclusively to the catarrhal form; others, again, exclusively to the scrofulous form, and it is the same in regard to some of their synonymes, sueh as *lippitudo* and *psorophthalmy*.

2076. *Causes.*—This disease, which may be the sequela of a common general catarrhal ophthalmia, or may, from the first, be confined to the tarsus, affects adults chiefly, whose occupation exposes them to cold and damp, to bad air and mephitic vapours, especially if addicted to intemperance in spirituous drinks; or, independent of such conditions, weakly and old persons.

2077. *Treatment.*—If there be much redness and smarting at the borders of the eyelids, it will be advisable to commence the local treatment by the application of two or three leeches to the part, or scarification of the palpebral conjunctiva, if this be very red and villous, and bathing with tepid water; after that the bichloride of mercury lotion (s. 124) may be prescribed, to be used three times a day, and the weak red precipitate ointment (s. 136) at bed-time; the surgeon himself penciling the palpebral conjunctiva every second day with the nitrate of silver solution.

2078. If under this treatment the disease does not appear disposed to subside, it will be useful to apply blisters behind the ears.

2079. Though sometimes an opposite plan is necessary, the general treatment in general requires to be such as is calculated to support the powers of the system, viz., generous diet and tonics; but before having recourse to this, the digestive organs must be carefully regulated by the exhibition of a few alterative doses of mercury followed by mild purgatives.

2080. Sometimes morbid sensibility, from a sunk state of the system, is so great, that the above-mentioned local remedies cannot at first be borne. In this case the belladonna lotion (s. 124) only should be used, and some mild ointment to the edges of the eyelids, with counter-irritation behind the ears, until such time as by the general treatment just indicated the powers of the system are raised, and the morbid sensibility removed, when the irritating applications may be again had recourse to.

Scrofulous ophthalmia tarsi.

(Psorophthalmy, tinea ciliaris, blepharitis scrofulosa, &c.)

2081. *Objective symptoms.*—The eyelids are at their borders somewhat red and swollen, and the eyelashes are loaded with incrustations, consisting of the secretion of the Meibomian glands, and that of the bulbs of the eyelashes, which are poured out in increased quantity, especially over night, so that the eyelids are glued together in the morning.

2082. The palpebral conjunctiva is found, on everting the eyelids, more or less reddened and villous.

2083. There is occasionally a flow of tears, which fall down over the cheek and cause excoriation of it.

2084. When the incrusted matter is removed from the eyelashes, (the manner of doing which is laid down in s. 130,) small vesicles, or pustules, or ulcers, left by them, are discovered at the roots of the hairs.

2085. *Subjective symptoms.*—Of these, great itching at the borders and angles of the eyelids is the most marked; indeed so much so as to have given rise to the opinion, which, however, is quite unfounded, that the disease is psora or itch of the eyelids, hence the name *psorophthalmy*, which has been given to it. Besides the itching, there are heat and occasional smarting.

2086. In an advanced stage of the disease, the eyelids are much thickened and nodulated at their borders, from enlargement of the glandular structures situated there (*tylosis*), the eyelashes are found scanty, many having fallen out and not been reproduced, or succeeded only by dwarfish ones (*pseudocilia*), and misdirected, and closely surrounded at their roots by the crusts covering the ulcers which are now more extensive.

2087. In old and neglected cases, the tarsal border comes to form one with the conjunctival surface in consequence of its posterior edge, which, in the natural state, forms a well-marked line of demarkation between the two, being rounded off, or obliterated, and acquires, like the conjunctiva, a red and sarcomatous appearance.

2088. In such cases, the eyelashes have perhaps all, or mostly all, fallen out (*madarosis*) from destruction of their bulbs, and as no Meibomian secretion can be pressed out, it would seem that the Meibomian apertures are obliterated.

2089. Along with this state of the eye, which is called *blear-eye* or *lippitudo*, there may be some degree of eversion from contraction of the excoriated skin of the eyelids.

2090. The subjects of this form of ophthalmia tarsi, who are generally young persons, often present other evidences of the scrofulous constitution, such as disordered digestion, tumid belly, enlargements of the glands of the neck, cutaneous eruptions, sore ears.

2091. *Causes.*—The disease is seldom primary, but is generally a sequela of some ophthalmia, such as exanthematous, catarrhal, scrofulo-catarrhal, or ophthalmia neonatorum, or it

arises from the spread of some cutaneous eruption to the borders of the eyelids.

2092. Impure air, damp, bad diet, want of cleanliness, and the like, at the same time that they cause or keep up the bad state of general health, aggravate the local disease, and, indeed, added to neglect or bad treatment, are the principal causes which render it inveterate.

2093. *Prognosis.*—Except in cases in which the disease has attained the development above described, (s. 2089,) the prognosis, though on the whole not unfavourable, must be qualified by this, that the cure is likely to be protracted. The supervention of puberty has in general a beneficial effect on the complaint.

2094. *Treatment.*—Being frequently connected with a faulty state of the constitution, it is of great consequence that attention should be directed to the general health.

2095. The employment of alteratives and purgatives will be found useful preliminaries. The state of the skin must also be looked to, and antimonials employed if necessary. Afterwards tonics, together with occasional laxatives.

2096. The diet and regimen above recommended in phlyctenular ophthalmia, (ss. 664, 665,) are equally indicated here.

2097. The first point in the local treatment is, after removing the incrustations from the borders of the eyelids in the manner above directed, to pluck out all those eyelashes at least which are so loose as to yield to the force which can be exerted by means of the finger and thumb grasping them.

2098. This being done, the disease will, in a great proportion of cases, subside under the use of the bichloride of mercury eye-water (s. 124) three times a day; and the application, in the manner above directed, (ss. 130, 131,) of the weak red precipitate salve (s. 136) to the borders of the eyelids at bed-time.

2099. If, however, there are much tenderness and irritability, the only local application, at first, should be tepid water to bathe the eyes, and some mild ointment applied to the edges of the eyelids, whenever the incrustations are removed from the eyelashes, until the irritability be relieved, by general treatment, leeches to the eyelids and counter-irritation behind the ears.

2100. The application of a leech or two, and scarification of the palpebral conjunctiva are indicated, whenever there appears to be much congestion at the borders of the eyelids.

2101. In cases in which there is much ulceration at the roots of the eyelashes, it is a good practice, after removing the crusts and plucking out as many of the eyelashes as can be done with-

out subjecting the patient to much pain, to touch the ulcers with the lunar caustic pencil. This may require to be repeated three or four times at intervals of a few days.

2102. After this the use of the eyewater and salve is to be resumed.

2103. When the disease has become inveterate, any further treatment can only be palliative. It should consist of the occasional use of Janin's ointment (s. 136), and the alum lotion (s. 124); and, when circumstances require it, scarification of the conjunctiva and blisters behind the ears.

Hordeolum or stye.

2104. Stye, as is well known, is a small inflammatory tumour at the edge of the eyelid, attended with more or less heat and pain, and going on to suppuration. It is of a furuncular character. When the abscess bursts, some matter, and afterwards a small slough, are discharged; the swelling subsides, and the part heals.

2105. Stye, according to some, is abscess of the Meibomian glands; according to others, it has its seat in the cellular tissue at the margin of the eyelid. Again, it has been suggested that it has its seat in the capsule and glands of the roots of the eyelashes.

2106. Abscess of the Meibomian glands does occur, and gives rise to an external tumour on the edge of the eyelid like a stye, but on everting the eyelid, the affected Meibomian gland is seen distended with matter, which is not the case in stye. There can be no doubt that the roots of the eyelashes are involved in stye, because the hairs at the part affected fall out in the end, and when we pluck them out, matter oozes from the orifice.

2107. *Causes.*—Those most subject to stye are generally of a scrofulous constitution. Derangement of the stomach is a common exciting cause.

2108. *Treatment.*—At the very commencement, the progress of the disease may sometimes be arrested by an emetic, followed by a laxative, and cold applications to the eye, or by touching the inflammatory swelling with caustic. If, however, the disease has already made progress, warm applications to promote suppuration are to be had recourse to. It is in general better to allow the abscess to burst of itself, but when it is mature, and occasions much uneasiness, relief will be obtained from puncturing it.

2109. According to Dr. Zeis, who is the author of the opinion that the proper seat of stye is the capsule and glands of the roots of the eyelashes, stye is arrested in its progress by pluck-

ing out at once the eyelashes at the part affected. As the eyelashes fall out at any rate, there can be no objection to this on the score of saving the eyelashes; besides they are generally reproduced.

2110. To prevent the recurrence of the disease, attention must of course be directed to that state of general health and those occasional influences on which it appears to depend.

Inflammation and abscess of the Meibomian glands.

2111. Inflammation and abscess of the Meibomian glands simulate, as already said, the appearance of stye externally; but the disease is of rarer occurrence, and its nature is recognized on everting the eyelid, when the affected gland or glands are seen, through the conjunctiva, turgid with yellow matter, which, perhaps, may be made by pressure to ooze out of the corresponding apertures at the border of the eyelid.

2112. By a touch with the point of the lancet, the turgid gland is opened and the matter evacuated.

Syphilitic affections of the eyelids.

2113. Syphilitic ulceration, sometimes primary, more commonly secondary, sometimes affects the eyelids either at their border or on their external or internal surface; in the one case, going on to destroy the whole thickness of the lid, in the other case producing a deep and foul excavation.

2114. As in such cases the ulceration goes on in spite of ordinary local applications, it is of importance to distinguish their nature, in order that by the timely employment of the general treatment for the syphilis, the progress of the ulceration may be arrested.

2115. This being effected, the next point in the treatment is, so to direct the cicatrization, that deformity of the eyelid may be as far as possible prevented.

2116. In the cases of infants affected with syphilis, above referred to, (s. 25,) in which the eyelids and other parts of the face and body are covered with an eruption of flat broad pustules, which break, scab, and spread; the *general treatment* should consist of minute doses of calomel, one half grain to a grain, three times a day; and the *local treatment* of the application to the edges of the eyelids of the weak red precipitate ointment.

Section II.—ABNORMAL POSITION OF THE EYELIDS, MISDIRECTION OF THE EYELASHES, IRREGULARITY AND LOSS OF MOVEMENTS OF THE EYELIDS, &c.

ECTROPIUM OR EVERSION OF THE EYELIDS.

2117. By eversion, the eyelid is necessarily drawn away from the eyeball, its conjunctival surface turned out, and its ciliary margin displaced, downwards or upwards, according as the lower or upper eyelid is the seat of the ectropium. The eyeball, being thus deprived of the protection of the eyelid, is exposed to constant irritation, by which a chronic conjunctivitis is kept up, weakening the eye and giving rise to specks and vascularity of the cornea; in some bad cases, repeated attacks of acute inflammation lead at last to destruction of the eyeball. The conjunctiva of the everted eyelid presents more or less of a villous or sarcomatous appearance; and when it is the lower eyelid which is the seat of the disease, there is usually stillicidium lachrymarum. To these accompaniments of ectropium are to be added a distressing sensation of cold in the eye, and very disagreeable disfigurement.

2118. Ectropium occurs in different degrees, and depends on different causes. It more frequently affects the lower than the upper eyelid. Sometimes both are everted.

Ectropium from excoriation and contraction of the skin of the eyelid, together with a thickened and sarcomatous state of the conjunctiva.

2119. This, the simplest and most common form of ectropium, is usually the result of some chronic inflammation of the conjunctiva or ophthalmia tarsi. It is almost always the lower eyelid which is the seat of this form of the disease. The skin of the eyelid and cheek, excoriated by the discharge constantly dropping from the eye, becomes contracted; the consequence of which is, that the eyelid is drawn downwards and at the same time everted; this displacement from the contraction of the skin, being favoured by a general relaxed state of the tarsus and the detrusion of the thickened and sarcomatous conjunctiva.

2120. In old persons, the relaxation of the tarsus and the thickened and sarcomatous state of the conjunctiva, seem to operate more frequently in the production of eversion than any

contraction of the skin. In consequence of chronic catarrhal ophthalmia, the angles of the eyelids being eroded, the tarsus relaxed, and the conjunctiva at the same time rendered thickened and sarcomatous, the eyelid falls away from the eyeball and becomes everted; and while the contraction of the orbicularis muscle tends to augment the eversion, this becomes more and more confirmed, principally by the increase of the thickened and sarcomatous state of the conjunctiva, and by the gradual accommodation of the eyelid to its changed position.

2121. By long exposure, the epithelium of the everted conjunctiva assumes in a great degree the characters of cuticle; so that the conjunctiva becomes callous, and can now bear, without inconvenience, the contact of external bodies, which before caused irritation and even gave rise to bleeding.

2122. *Treatment.*—As in the form of ectropium just described, there is no actual loss of the skin of the eyelid, as the contraction of it is in general not very considerable, and as the sarcomatous state of the conjunctiva, together with the relaxation of the tarsus of the affected lid, have a large share in keeping up the eversion, means calculated to produce contraction of the conjunctiva, either alone or in combination with means calculated to shorten the transversely elongated tarsus, will in general be found sufficient to restore the eyelid to its natural position.

2123. To produce contraction of the morbid conjunctiva, the repeated application to its surface of the lunar caustic pencil is the most convenient method. The eyelid being everted still more by traction on the neighbouring skin, the caustic is to be pencilled on the conjunctiva in a direction from one angle of the eye to the other, parallel to, but at a little distance from, the ciliary margin of the eyelid. After the application of the caustic, the part is to be wiped with a bit of lint and then pencilled with sweet oil. It is often advantageous to scarify the conjunctiva before applying the caustic. The cauterization may be repeated in the course of three or four days. Instead of lunar caustic, strong sulphuric acid has been recommended for the cauterization of the conjunctiva. It is applied by means of a pencil of wood or bone, care being had in dipping the pencil into the acid that it do not take up so much as to form a drop hanging at its point. The lunar caustic, however, deserves the preference in general; and when it is found insufficient to effect the desired object, it is better to have recourse to the *excision of an elliptical shaped piece of the thickened and sarcomatous conjunctiva parallel to the ciliary margin of the eyelid.*

2124. To effect this, the eyelid being drawn as much as possible away from the eyeball by traction on the neighbouring skin, the diseased conjunctiva is to be pinched up with a forceps and the piece shaved away with a scalpel or a cataract knife, or snipped off with curved scissors. The piece removed must be of such a breadth as appears sufficient in order that when cicatrization is complete, the contraction of the conjunctiva may be neither so much as to invert the eyelid, nor so little as still to leave some degree of eversion.

2125. After cauterization or excision of the conjunctiva, it is well to keep the lid in its proper place by means of strips of plaster and a compress and bandage.

2126. When there is evident transverse elongation of the tarsus, *the excision of a wedge-shaped piece out of the whole substance of the eyelid*, as first practised by Sir William Adams, may, either alone, or in combination with one or other of the means above mentioned, be necessary to restore the eyelid to its natural position. The base of the wedge-shaped piece excised corresponds to the ciliary margin of the eyelid, and must be of such a breadth as will restore that margin to its proper length. The excision should be performed rather towards the external canthus than in the middle of the eyelid.

2127. The breadth of the piece necessary to be excised being duly calculated, the eyelid is to be seized hold of at the place with the forceps, and drawn from the eyeball. Then with a pair of strong straight scissors, the surgeon cuts out the piece at two strokes, the first being made on the left hand side of the forceps, and the second on the right hand side. After the excision of the piece, the eyelid is to be restored to its

Fig. 68.

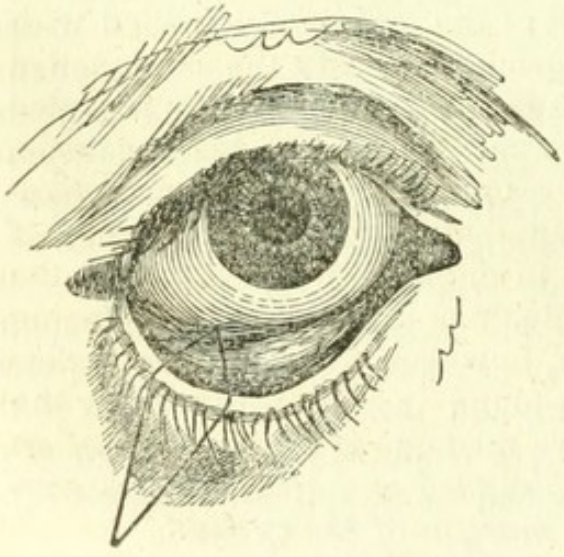
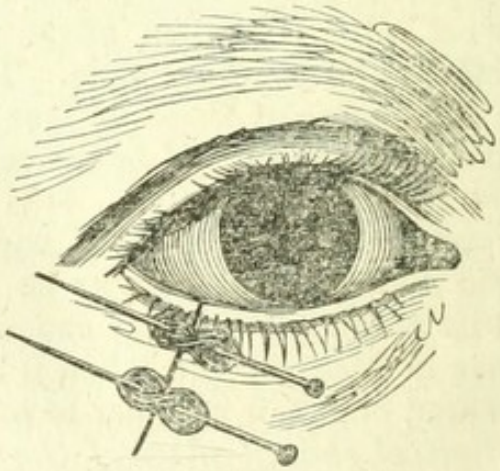


Fig. 69.



proper position, and the edges of the wound united by the harelip suture.

2128. The pins are to be inserted and brought out at some distance, about one-tenth of an inch, from the edges of the wound, and must not implicate the conjunctiva. The first pin introduced should be close to the ciliary margin of the lid, in order to insure evenness at this place. Lastly, the eyelid is to be supported by strips of plaster and a compress and bandage.

2129. The following operation proposed by Dieffenbach is applicable only to the cases of ectropium under consideration. It is to be remarked, however, that it is not better calculated to restore the lid to its natural position than the less complicated methods above described.

2130. The everted eyelid being raised up as far as possible into its place, the surgeon makes a semilunar incision through the skin, corresponding in direction to the curve of the edge of the orbit, and at the distance of about one-third of an inch from the ciliary margin of the eyelid. The extremities of the incision should not extend quite so far towards the nose or temple, as to be opposite the angles of the eye. The flap of skin comprehended by this semilunar incision being dissected up along with the part of the orbicularis muscle corresponding to it, the conjunctiva, the adherent surface of which is now exposed, is to be slit through along the orbital margin of the tarsal cartilage, and in the direction of the external wound. With a forceps the upper cut edge of the conjunctiva along with the orbital margin of the tarsal cartilage is then to be drawn out through the external wound, with the edges of which it is to be united by means of the twisted suture, after the mucous surface of its included part has been rendered raw. By this means the ciliary margin of the eyelid is restored to its natural position.

Ectropium from contraction of the skin in consequence of bad cicatrices, &c.

2131. Ectropium from the contraction of the skin which takes place in consequence of cicatrization, as often affects the one eyelid as the other, and sometimes both, they being equally exposed to the wounds, burns, abscesses and ulcerations, by which the skin and subcutaneous cellular tissue of the eyelids are liable to be destroyed to a greater or less extent. In cases in which the injury of the skin by burn, wound or other cause, has been at the outer angle, this, together with the outer part of both eyelids, is everted.

2132. In the form of ectropium now under consideration,

the eversion is generally very complete, sometimes indeed to so great a degree that the ciliary border of the eyelid, very much elongated, is drawn down upon the cheek or up to the eyebrow, as the case may be. Ectropium of the upper eyelid it is obvious leaves the eyeball much more exposed than ectropium of the lower eyelid.

2133. *Treatment.*—This form of ectropium has exercised the operative ingenuity of surgeons from a very early period, but it is recently only that much success has been obtained. Beer, writing so late as 1817, discusses this form of ectropium in a section entitled "*Of the incurable diseases consequent to the ophthalmiæ.*"

2134. *The operation described by Celsus for lagophthalmus or shortening of the upper eyelid*, consisted in making a semilunar incision through the contracted integuments of the eyelid "paulum infra supercilium . . . . cornubus ejus deorsum spectantibus." The eyelid being set free by the incision, was brought into its natural position and an attempt made to heal the wound thus left by a broad cicatrice. For ectropium of the lower eyelid, he recommends a similar operation, "plagæ tantum," he says, "cornua ad maxillas, non ad oculum convertenda sunt."

2135. This operation, which indeed Celsus recommends only when the loss of skin is inconsiderable,* has been performed over and over again, but it has always been found that the cicatrice gradually contracted until the eversion was as bad or worse than before.

2136. Professor Chelius of Heidelberg has somewhat modified the above operation, and says the results he has thereby obtained have been, even in cases of very considerable shortening of the skin of the eyelid, successful beyond expectation.

2137. *Chelius' operation.*—An incision is made along the whole breadth of the eyelid, and as near its tarsal edge as possible, through the skin. The edges of the wound are to be dissected from the cellular tissue, so far that all tension of the skin may be removed, and the eyelid admit of being readily brought into its natural position. The fibres of the orbicularis are then to be divided by several vertical incisions. When the replacement of the eyelid is opposed by a considerable tumefaction of the conjunctiva, a portion of this membrane is to be removed by the scissors and knife, and the external commissure of the eyelids slit up, to the extent of some lines, in a horizontal direction.

* He acknowledges that when "nimium palpebræ deest, nulla id restituere curatio potest."

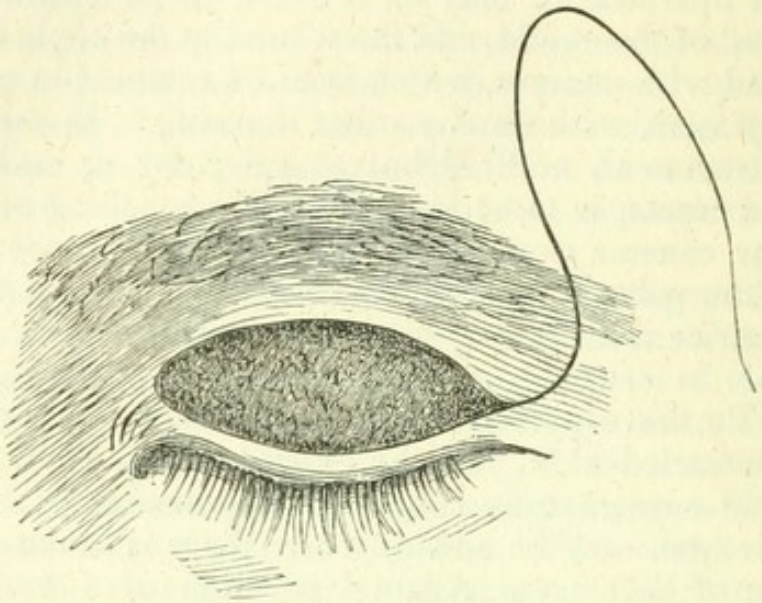
After this, two loops of thread are to be drawn through the skin by means of curved needles, near the tarsal edge of the eyelid, but without wounding the tarsus. These threads are to be fastened by sticking-plaster to the cheek, if the upper eyelid be the subject of operation, to the forehead in the contrary case, so that the eyelid operated on may be retained in its natural position. The wound of the eyelid, and the wound at the angle of the eye, are covered with charpie, which is to be retained in position by strips of plaster, without any other dressing. In the course of the after-treatment, nothing but charpie, dry or smeared with some mild cerate, is to be applied. The touching of the parts with lunar caustic, even when the granulations rise above the edges of the wound, is to be especially avoided, as contraction of the cicatrice is thereby very much promoted.

2138. To the separation of unnatural adhesions or division of the contracted skin, and the extirpation of a portion of the everted and sarcomatous conjunctiva, as described in the preceding method, may be added, when there is much transverse elongation of the tarsus, Adams' excision of a wedge-shaped portion of the whole thickness of the eyelid, as above described. Here it may be remarked, that as, in the cases under consideration, the skin is much shortened, it is necessary in performing the excision to make use of a small scalpel instead of scissors.

2139. *Transplantation of a flap of skin from the temple or cheek.*—When, after the separation of unnatural adhesions, the extirpation of a cicatrice, or the division of the simply contracted skin, the gap left by the reinstatement of the eyelid in its natural position is very considerable, attempts have been made to transplant a portion of skin from some neighbouring part into it. The flap of skin to be transplanted is usually taken from the temple when the upper eyelid is the subject of operation, —from the cheek in the case of the lower eyelid, and is made of a form corresponding with the gap, but of a size somewhat exceeding it, in order to allow for the contraction which subsequently takes place. The flap, previously measured and traced in outline, is raised by dissection, along with as much of the subjacent cellular tissue as possible, but is still left in connection with the body by a slip as broad at least as itself. After all bleeding has ceased, and after removing any clotted blood that may be in the gap in the eyelid, or adhering to the flap, the latter is to be so transposed that it may be adjusted to the former, with the edges of which it is to be fixed by stitches, strips of plaster, and bandage. The wound in the temple or

cheek whence the flap was removed, is to be closed by bringing its edges together with stitches if possible, if not, it is to be allowed to granulate and heal in the ordinary way.

Fig. 70.



2140. The operation by transplantation of the skin has, in the hands of the late Dr. Fricke, of Hamburg, who first performed it, Dr. Mackenzie, and others, been crowned with success, but in several cases it has failed.

2141. Instead of by transplantation, attempts have been made to supply the defective eyelid with skin, by simply sliding that in the immediate neighbourhood into the gap produced by setting free the eyelid, and bringing it into its proper position.

2142. *The Author's operation.*—The following operation I performed with success in eversion and shortening of the upper eyelid, from contraction of the skin consequent to a burn. The peculiarity of the plan consists in the following particulars:—The eyelid is set free by incisions made in such a way, that when the eyelid is brought back into its natural position, the gap which is left may be closed by bringing its edges together by suture, and thus obtaining immediate union. Unlike the Celsian operation, the narrower the cicatrice the more secure the result. The flap of skin embraced by the incisions is not separated from the subjacent parts; but advantage being taken of the looseness of the subcutaneous cellular tissue, the flap is pressed downwards, and thus the eyelid is set free. The success of the operation depends very much on the looseness of the cellular tissue. For some days before the operation,

therefore, the skin should be moved up and down in order to render the cellular tissue more yielding.

2143. A description of the operation is comprehended in the following case:—A woman, aged twenty-four, had her face much scarred. Both eyeballs were quite exposed on account of shortening and eversion of the upper eyelids. On the left side the eversion of the upper eyelid was not so great as on the right. On this side the ciliary margin of the tarsal cartilage corresponded to the edge of the orbit, and the opposite margin of the cartilage occupied the usual position of the ciliary margin; so that when an attempt was made to close the right eye, it was the orbital margin of the tarsal cartilage which was pressed down. There was some degree of shortening and eversion of the left lower eyelid. The patient saw very well with the right eye; but with the left, on account of opacity of the cornea, she did not see well enough to recognize a person. At the age of one year and three months she fell into the fire, and had her face severely burned, which was the cause of the state above described.

2144. Two years before coming under my care, she had an operation performed on the left eye, and derived advantage from it. It is probable, however, that the eversion only had been lessened by the operation, for the shortening of the upper eyelid was still very great.

2145. On the 22d of February, 1836, I operated on the *left* upper eyelid. Two converging incisions were made through the skin, from over the angles of the eye upwards to a point where they met, somewhat more than an inch from the adherent ciliary margin of the eyelid. By pressing down the triangular flap thus made, and cutting all opposing bridles of cellular tissue, but without separating the flap from the subjacent parts, I was able to bring down the eyelid nearly into its natural situation, by the mere stretching of the subjacent cellular tissue. A piece of the everted conjunctiva was snipped off. The edges of the gap left by the drawing down of the flap, were now brought together by suture, and the eyelid was retained in its proper place by plasters, compress, and bandage.

2146. During the healing of the wound, a small piece of the apex of the flap, which had been somewhat separated from the subjacent parts, sloughed. By the 1st of April healing had taken place, and the eversion completely cured. The cicatrice where the part had sloughed was pretty broad. When the bandages were first left off, the eyelid was so elongated, that if the lower eyelid had not also been shortened, the eye would

have been entirely covered. After leaving off the bandages some shortening took place, from contraction not of the cicatrice, but of the skin. Being no longer on the stretch, the skin assumed, as it contracted, more of its natural appearance.

2147. About the middle of March, the *right* upper eyelid was operated upon. The incisions were made in a similar way (fig. 71), except that they did not meet in a point, a space being left between their extremities to the extent of about one-sixth of an inch, which was divided by a transverse cut.

Fig. 71.

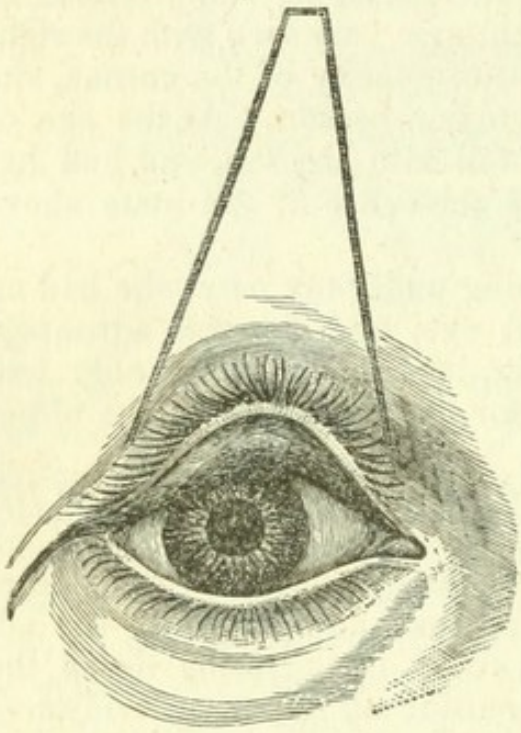


Fig. 72.

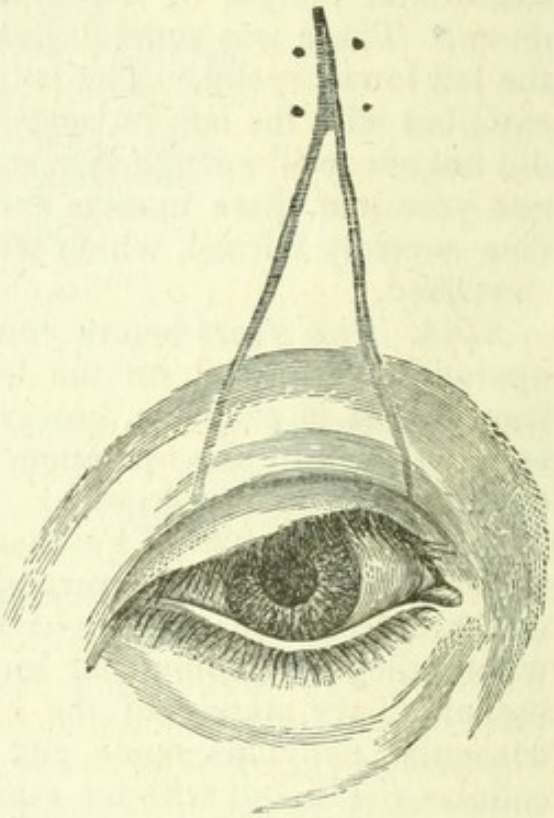


Fig. 72 shows the right eye after the parts had healed; the cicatrice where the gap was, and the marks of the sutures.

2148. By the stretching of the subjacent cellular tissue, I succeeded in drawing down the flap, and thus elongated the eyelid so much that it covered the eye entirely; but in consequence of the long-continued displacement of the tarsal cartilage, the ciliary margin of it did not come into contact with the eyeball. I did not interfere with this state of parts, by attempting any transverse shortening of the lid, but a piece of the everted conjunctiva was removed, and with it a bit of the tarsal cartilage. From the surface of this wound there sprang out a small soft

fungus, which was cut off with the scissors, and the root touched with the lunar caustic pencil.

2149. The above operation was repeated by M. A. Bérard, in 1837, without success, and by M. Velpeau, in 1838, successfully in one case, and unsuccessfully in another, in which erysipelas came on.

2150. *Jäger's operation.*—In cases of ectropium in which the perpendiculur diameter or the breadth of the eyelid is shortened, and the transverse diameter elongated, an operation is performed by Professor Jäger, with the twofold aim of increasing the breadth of the eyelid, and reducing its transverse elongation.

2151. Before proceeding to the operation, the difference in length of the tarsal edge of the everted lid, and of that of the sound one of the opposite eye, is to be accurately ascertained by measurement, in order that it may be determined how much it will be necessary to excise from the margin of the everted lid to reduce it to the same length as that of the sound one.

2152. In operating on the everted upper eyelid, the surgeon takes hold of it about the centre of its edge with a common forceps or hook, and draws it downwards, so as to put on the stretch the cicatrice, by which the eyelid is bound to the margin of the orbit. With a scalpel a transverse incision is now to be made about midway between the margin of the everted lid and the superciliary arch. The incision is to be commenced and terminated in sound skin, and is to be carried through the whole thickness of the eyelid, so as to form a slit through which, when the strip of eyelid comprehending the palpebral margin is drawn down, the eyeball appears. The length to which the incision is to be carried must depend on the circumstances of the case. To avoid the risk of wounding the eyeball, a horn spatula may be inserted between it and the eyelid before making the incision.

2153. The narrow slip separating the natural rima palpebralis from the artificial opening formed by the incision just described, is the part from the middle of which the piece, necessary to be removed in order to reduce the transverse diameter of the eyelid, is to be cut out. The size of the piece is already known from the measurements made before the operation was commenced. With a forceps and scissors the excision is easily effected.

2154. A straight double-edged scalpel is now to be used, for the purpose of separating the integuments from the frontal bone. The upper lip of the wound being seized with the forceps, and

separated a little from the edge of the orbit, the scalpel is to be introduced upwards and slightly outwards between the posterior surface of the orbicularis muscle and anterior surface of the frontal bone. Having been pushed onwards to a sufficient depth, the blade is to be carried with a sawing motion towards the temple and external canthus, and then towards the middle line of the forehead, without enlarging the original wound of the palpebra, transfixing the skin, or injuring the periosteum. By this process the skin and muscle covering the supra-orbital region and the angles of the orbit are separated from the subjacent parts, and rendered capable of undergoing a change in their position. The depth to which the scalpel will require to be carried, and particularly the extent in the transverse direction to which the integuments ought to be detached, must always be proportionate to the loss of the palpebral substance, and to the different degrees of mobility of the frontal coverings.

2155. The wounds are now to be united by the interrupted suture; and first that left by the excision of the piece from the narrow strip of the tarsus is to be united by two sutures. The integuments of the supra-orbital region and angles of the orbit, which have been detached from the subjacent bone, are then to be pressed downwards by an assistant, so as to bring together the edges of the transverse wound of the lid. A stitch is first to be inserted about the middle of the wound, and then, should the upper lip of the wound not much exceed the lower lip in length, lateral stitches may be immediately inserted. If, on the other hand, the upper lip of the wound exceed the lower lip to the extent of forming a fold, this must be removed by the scalpel or scissors, in order that the edges of the wound may be nicely adjusted. The number of stitches required cannot *à priori* be determined.

2156. Coaptation of the wound having thus been effected, the eyeball is covered by integuments drawn partly from the supra-orbital region, but chiefly from the angles of the orbit; the eyebrow, however, will be somewhat depressed, and will not describe so large and convex an arch as before.

2157. The operation upon the lower eyelid consists in first removing a triangular piece, as in the operation of Adams above described, and then detaching the integuments from the margin of the orbit by a process similar to that above described for increasing the perpendicular diameter of the upper eyelid.

2158. The stitches are to be supported by interposing narrow strips of court plaster. The wounds are then to be covered with small pieces of lint; and graduated compresses, corresponding

in size to the circumference of the orbit, are to be placed upon the supra-orbital region, or cheek, according as the operation has been performed for the restoration of the upper or lower lid. Over the graduated compresses long strips of adhesive plaster are to run, being applied in such a manner as to draw the integuments towards the eyelid, and to approximate them to the bone. When the upper eyelid has been operated upon, the adhesive plasters may extend from the nape of the neck to the cheek. A roller may be applied to assist the action of the plasters, if it be deemed necessary. In the after-treatment, nothing is to be omitted likely to promote union by the first intention.

2159. Smart inflammation, requiring active treatment for its removal,—nausea and vomiting, demanding the use of opium and effervescing draughts,—premature removal, from accident, of one or more of the sutures,—and ulceration of the edges of the wounds,—are among the unfavourable occurrences which occasionally supervene to the operation.

2160. In bad cases of ectropium of the upper eyelid, it may be doubted if this operation of Jäger be calculated to effect the desired object with more certainty than the simpler methods already detailed. Certainly, in Jäger's reported case, the cure could have been effected by a much milder operation.

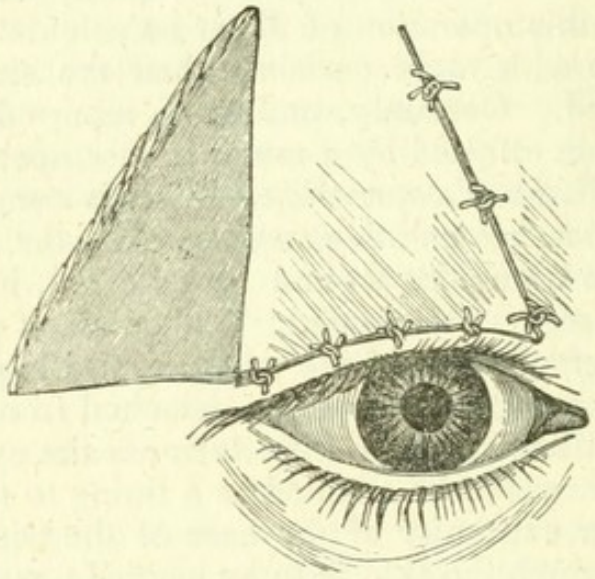
2161. *Dieffenbach's operation.*—This is commenced by extirpating the cicatrice and degenerated skin, the incisions being made so that a triangular wound may be left, having the basis towards the margin of the eyelid. The tarsus, if present, is to be carefully preserved; but, if the whole eyelid is gone, whatever of the conjunctiva remains is to be detached from the margin of the orbit, and dissected up a little towards the eyeball, in order that it may afterwards be adapted as a lining to the new eyelid. From the outer extremity of the base of the triangular wound, an incision through the skin is to be carried towards the temple or cheek, according as the upper or lower eyelid is to be repaired; the length of which incision must be somewhat greater than that of the base of the triangular wound of the eyelid. Beginning at the temporal extremity of this horizontal incision, another is to be made—downwards, if it is the lower eyelid which is to be restored,—upwards, if the upper eyelid. This second incision is to run not quite parallel with the outer edge of the triangular wound, but slightly approximating to its apex, on a level with which it is to terminate.

2162. The flap of skin thus circumscribed is to be raised up by dissection, along with its subjacent layer of fat and cellular

tissue. After the bleeding has ceased, the flap and the triangular wound are to be carefully freed from coagula, and the former so transposed that it may fill up the latter. The flap is now to be secured in its new situation, first by a stitch at the inner angle of the eye. Its palpebral edge is then to be united by four stitches to the tarsus, if present; or, if this has been lost, with the conjunctiva, at its cut margin. Lastly, the inner edge of the flap is united to the skin, forming the inner boundary of the triangular wound by means of the twisted suture. The wound in the temple or cheek, left by the removal of the flap of skin, is to be dressed with charpie; and, over the whole, several strips of adhesive plaster are laid, in order to keep the transposed flap accurately adjusted in its new situation. Cold water dressings are then to be applied.

2163. This method of operating has been successfully followed by Lisfranc, Ammon, Eckström, Blasius, and Fricke.

Fig. 73.



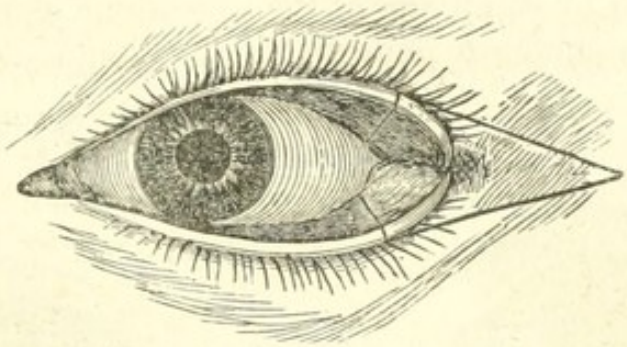
2164. Instead of taking the flap wholly from one side, a part may be taken from one side and a part from the other. The two parts are then to be united in the middle by the hare-lip suture. This is said to be the manner in which Dieffenbach ordinarily performs the operation for ectropium of the lower eyelid.

2165. The above plans of operating may be modified and combined in different ways, according to the circumstances of any particular case.

2166. It has been mentioned, that it sometimes happens that,

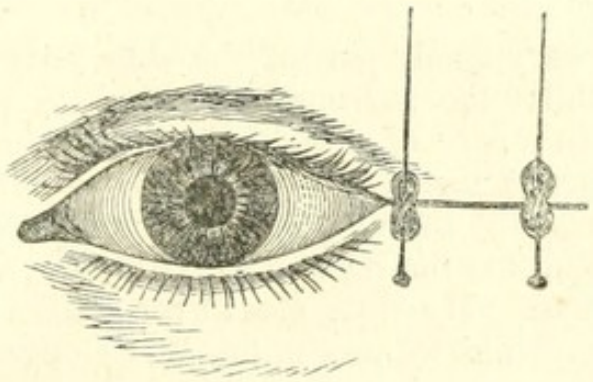
from bad cicatrices, the skin of the temple is much contracted, and the external commissure, together with the outer parts of the lids, everted in consequence. In such a case, Walther excised the tarsal edges of both eyelids where they were everted, together with the commissure and a triangular piece of the neighbouring integument of the temple, the base being towards

Fig. 74.



the eye, and the apex towards the ear (fig. 74). He then united the edges of the wound by two sutures; and the eversion was by this *tarsoraphia* cured (fig. 75).

Fig. 75.



2167. In similar cases, but with more complete eversion of both eyelids, Dieffenbach has made to the above proceeding of Walther the following additions. After the excision of the triangular piece from the outer canthus, a curved incision is carried above the supra-orbital arch; and another, below the lower margin of the orbit, and towards the nose. The two crescentic flaps are then raised; and, after closing the wound in the temple, they are adapted as new lids to the remaining conjunctiva.

Ectropium from caries of the orbit.

2168. When ectropium is complicated with caries of the margin of the orbit, nothing in the way of operation in reference to the ectropium should be attempted, until the disease of the bone is cured. Then, it will generally be necessary, on account of the extent to which the skin of the eyelid has suffered from the carious suppuration and ulceration, to have recourse to the transplantation or transposition of the neighbouring skin, according to some one of the operations above described. It, however, sometimes happens, that, though the eversion is

Fig. 76.

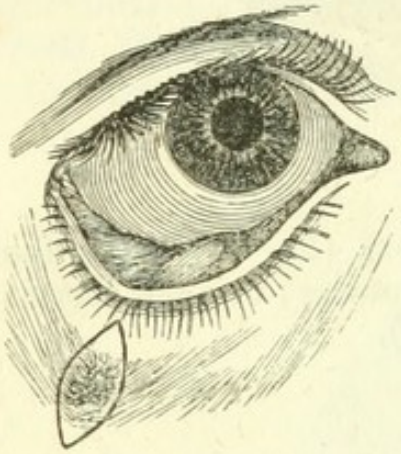
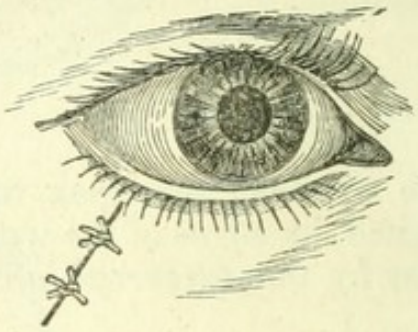


Fig. 77.



considerable, a very small part of the skin only is drawn into the cicatrice, whilst the surrounding skin, still pretty healthy, is puckered. In a case of this kind, Dr. Ammon surrounded the adherent part of the skin by an incision; left it adherent to the bone; detached the neighbouring integuments all round, to such an extent, that the lid was set at liberty, and the patient could shut the eye. He then closed the external wound over the old cicatrice. The lid was in this way elongated, a scarcely observable scar remained, and the disagreeable depression at the edge of the orbit was no longer in view.

Ectropium in purulent ophthalmia.

2169. Eversion of the eyelids sometimes occurs in purulent ophthalmia, in consequence of the great tumefaction of the palpebral conjunctiva (s. 502). The inflammatory œdema of the eyelids, which for a time is excessive, beginning at length to subside, while no proportionate diminution of the swelling of the lining membrane of the lids has as yet taken place, the swollen and granulated conjunctiva loses that counterpoise

which the external swelling afforded it, and is forced outwards by the action of the orbicularis palpebrarum. If the protrusion is not immediately returned, the upper part of the eyelid and the retroverted cartilage act like a ligature on the parts protruded; and, as the swelling increases, the stricture becomes still stronger by the natural, but ineffectual efforts of the orbicularis to bring the tarsus into its proper position.

2170. In the ophthalmia of new-born infants, eversion of the eyelids readily takes place when the child cries, or when the eyes are being cleansed from the discharge (s. 539). The eyelids are easily returned to their proper position, if the attempt be made at once; but, if they are left everted for any time, the continued efforts of the orbicularis, together with accumulation of blood in the protruded conjunctiva, increase the eversion (s. 556).

ENTROPIUM, OR INVERSION OF THE EYELIDS.

2171. Entropium is the converse of ectropium. The free margin of the eyelid with the eyelashes is turned in against the eyeball, which they keep in a state of great irritation by the friction they exert upon it.

2172. The margin of the eyelid may be inverted in part of its extent only, constituting *partial* entropium; more commonly the entropium is *total*. One eyelid only may be affected, or both eyelids together of one eye. Sometimes one eyelid of one eye, and one eyelid of the other; sometimes again both eyelids of both eyes are turned in.

2173. The distress occasioned by the friction of the margin of the eyelid, and the eyelashes against the eyeball when an attempt is made to use the eye, together with the intolerance of light which is usually present in a greater or less degree, forces the patient to keep the eye always closed, or half closed, and as much as possible at rest.

2174. In consequence of the constant irritation which attends entropium, the conjunctiva corneæ become vascular and opaque, and ultimately the whole conjunctiva thickened, dry and cuticular.

2175. *Entropium* is to be distinguished from *trichiasis*, which is attended by the same distressing irritation. In trichiasis, the margin of the eyelid retains its proper position, whilst the eyelashes only are inverted. Entropium and trichiasis, however, not unfrequently coexist.

2176. There are different forms of entropium depending on

different morbid conditions of parts, and therefore requiring different modes of treatment.

2177. Entropium may be owing to—1. Relaxation of the integuments of the eyelid, and spasmodic contraction of the orbicularis palpebrarum muscle when long continued. 2. A contracted and deformed state of the tarsal cartilage.

Entropium from relaxation of the integuments of the eyelid, and spasmodic contraction of the orbicularis palpebrarum muscle.

(Entropium senile.)

2178. In consequence of the firmness and breadth of its tarsal cartilage and the existence of the levator palpebræ muscle, simple relaxation of the integuments of the upper eyelid seldom produces any great degree of entropium; it merely hinders the eyelid from being freely raised, constituting one form of ptosis. It is the lower eyelid which is most generally the seat of entropium from relaxation.

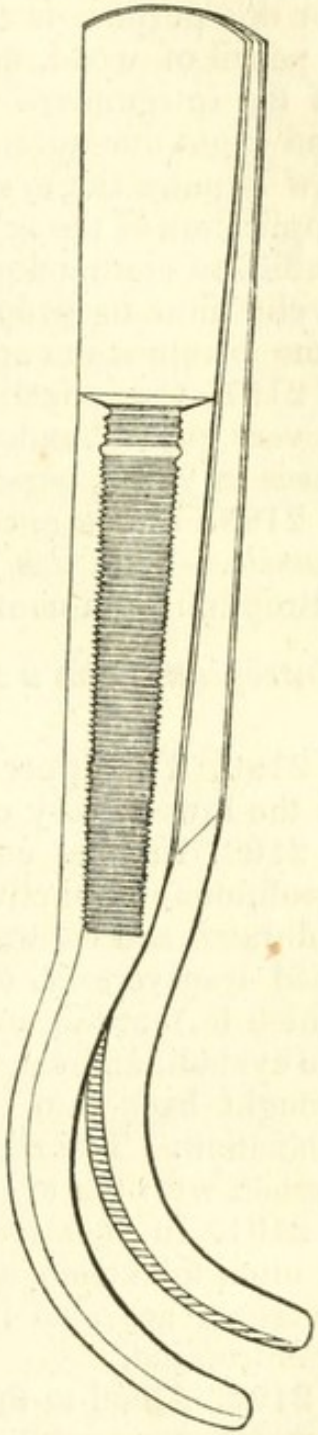
2179. In this form of entropium, the margin of the eyelid and the eyelashes are in other respects perfectly natural, and the tarsal cartilage appears to be healthy. The eyelid is simply rolled back upon itself, sometimes, so much round that the margin with the cilia lies in the inferior palpebral sinus of the conjunctiva. If the finger be applied to the outside of the eyelid and the skin pressed down a little, the margin of the lid with its eyelashes readily starts into its place, and will continue so of itself until the patient winks, when it will fall back with a jerk into its former state of inversion.

2180. A relaxed and superabundant state of the integuments of the eyelid, does not appear to be of itself the essential cause of the entropium; it appears merely to favour its development at first, and to allow of its continuance afterwards. The displacement inwards of the margin of the eyelid, will usually be found to have taken its rise in the following manner. During an attack of ophthalmia attended by a swollen or œdematous state of the eyelids, these being long kept closed or even spasmodically contracted, the edge, overbalanced by the puffy state of the orbital portion of the lid, is pressed or turned inwards by the ciliary portion of the orbicularis muscle. A wrong direction having been thus acquired, it continues even after the subsidence of all swelling or œdema. The form of entropium just described, is most frequently met with in old persons.

2181. When no relaxed and superabundant state of the integuments of the eyelid exists, entropium may be produced by the

spasmodic contraction of the orbicularis muscle, during an acute attack of inflammation with intolerance of light, and a swollen state of the eyelids; but it will cease on the subsidence of the ophthalmia, especially if care be taken to keep the eyelid in its proper place by some mechanical contrivance. The most efficient and convenient contrivance for this purpose, is a bit of firm wire so twisted and bent, as to fit on the back of the head by its middle, and press by its rounded extremities against the orbital portion of the lower eyelids.

Fig. 78.



2182. *Treatment.*—This consists in, 1st, the excision, or the destruction by caustic of a portion of the relaxed integuments; or, 2d, the subcutaneous section of the orbicularis palpebrarum muscle.

2183. *Excision.*—The portion of integument removed should be of an elliptical shape, and of such a breadth, that when the edges of the gap which is left are brought together, the eyelid will be retained in its proper position. Though the piece of integument ought to be removed as near as possible to the margin of the eyelid, a sufficient breadth of skin must still be left at the margin for the insertion of stitches.

2184. To effect the removal of the piece of integument in the form of an ellipse, a transverse fold, of a size sufficient to bring the eyelid into its proper place, is to be taken hold of with the entropium forceps, (fig. 78,) and snipped off with a pair of scissors. After the excision of the fold, the edges of the wound are to be brought together by two stitches. The needles which I have found best adapted for inserting the threads are small glovers' needles, made smooth and sharp on a hone, and bent into a curve towards the point.

2185. This excision of a transverse fold of integument may in some cases be advantageously followed up by the excision of a vertical fold, as has been done by Dzondi. A mode of operation practised by Janson of Lyons consists in the excision

of a vertical fold of skin alone, extending to near the free edge of the eyelid. Velpeau recommends the orbital end of this vertical fold to be broader than the other.

2186. *Cauterization.*—The escharotic most commonly used for this purpose is concentrated sulphuric acid. By means of a pencil of wood, the acid is to be rubbed over an oval portion of the integuments of a length corresponding to the inversion, and about one-quarter of an inch broad in the middle. After a few minutes the eyelid is to be dried with a bit of lint and the application of the acid repeated, and this again and again, until a sufficient contraction of the skin is produced so as to bring the eyelid into its proper position. It may be necessary after a time to repeat the application of the acid.

2187. Cauterization is not admissible in cases where the skin is very superabundant. It is best adapted for slight and recent cases in young persons.

2188. *Subcutaneous section of the orbicularis palpebrarum muscle.*—This has been performed with success in cases of entropium from confirmed contraction of the orbicularis.

Entropium from a contracted and deformed state of the tarsal cartilage.

2189. The upper eyelid is as liable to this form of entropium as the lower; very often both are affected together.

2190. In long continued ophthalmia tarsi, or catarrhal or scrofulous conjunctivitis, the tarsal cartilage suffers. It becomes indurated and contracted on its inner surface, whilst it is shortened transversely, or from canthus to canthus; the effect of which is, that the margin of the eyelid is turned in right against the eyeball, and cannot by any traction on the integuments be brought back into its proper position, as in entropium from relaxation. The edge of the eyelid may indeed be drawn from contact with the eyeball, but it still remains curved inwards.

2191. In this form of entropium, the margin of the eyelid is often thickened and irregular, while the eyelashes, few and dwarfish, are also inverted, constituting trichiasis in addition to entropium.

2192. Allied to the above form of entropium, is that which is sometimes produced by injury of the conjunctiva and cartilage, from the intrusion of lime or other caustic substances into the eye. The contraction attendant on the cicatrization gives rise to inversion of the eyelid, which is often conjoined with symblepharon.

2193. *Treatment.—Ware's operation.*—As in this form of

entropium, the inversion is owing in a great degree to the transverse shortening of the tarsus, Mr. Ware, in order to remedy this, recommended a perpendicular incision to be made through the whole substance of the lid at its temporal extremity or in its middle. Mr. Tyrrell tells us he has performed this operation both on the superior and inferior palpebra, and in every case hitherto, with perfect success. In some cases, he says the simple perpendicular section (near the centre of the eyelid) is followed by a rapid removal of the inversion. In other cases it is necessary, in order to complete the cure, to remove a part of the integument with the scissors or destroy it with caustic. The perpendicular section of the lid is immediately followed by a separation of the edges of the wound: and it presents an outline similar to that of the letter V; wide at the ciliary margin, and terminating in an acute point in the opposite direction. This wound is afterwards gradually filled up by granulation, and very little deformity results.

2194. *Crampton's operation modified.*—Supposing the upper eyelid to be the subject of this operation, two perpendicular incisions through its whole substance are made, one near the external canthus, the other near the inner canthus.*

2195. The lid being thus set free, a transverse fold of its skin is then to be removed from near its ciliary margin, and the edges of the gap thus produced brought together by two or three stitches. The threads forming the stitches are to be left long. The eyelid is now to be everted and turned up, and kept in this position for a few days by means of the threads fixed to the forehead by strips of plaster. The perpendicular incisions are thus prevented from uniting by the first intention. They are permitted to heal only by granulation. After the removal of the ligatures, the eyelid is, by the cicatrization of the perpendicular wounds which ensues, gradually drawn into its natural position without being again inverted. During the time the eyelid is kept everted and turned up, it is to be covered with a piece of linen spread with simple cerate.

2196. In cases of entropium of the lower eyelid from transversely contracted tarsus, I have performed the operation in the following manner with perfect success. An incision through the whole thickness of the lid being made perpendicular to its

* The first incision will necessarily wound the lower mass of the lachrymal gland, together with some of the lachrymal ducts; but in the cases in which I have performed the operation, I have not observed any lachrymal fistula or other bad consequence follow. The incision near the inner canthus ought always to be on the temporal side of the punctum, in order to avoid cutting the canalicule.

edge near the outer canthus, a piece of the skin of the lid is excised, and then the lid kept in the everted position by fixing on the cheek the end of the thread forming the suture, which unites the edges of the wound left by the excision of the piece of skin.

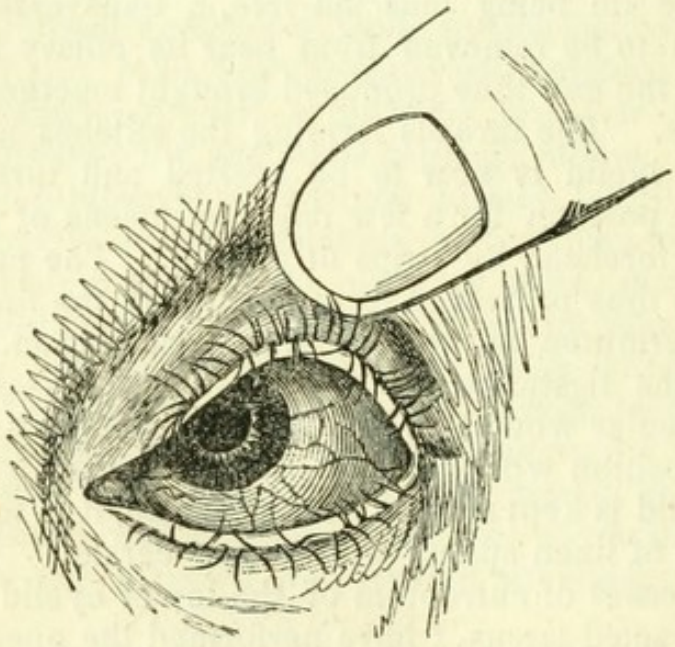
2197. When, as often happens, in inveterate cases of the form of entropium under consideration, the operations just described prove ineffectual, recourse must be had to extirpation of the bulbs of the eyelashes as in trichiasis.

Trichiasis and distichiasis.

2198. *Trichiasis* is a growing in of eyelashes against the eyeball, the border of the eyelid remaining in its proper position, which circumstance constitutes the distinction between trichiasis and entropium (s. 2175).

2199. *Distichiasis*, again, is merely a variety of trichiasis, in which the misdirected eyelashes are disposed, though not very regularly, in a row distinct from the others which remain properly directed.

Fig. 79.



2200. The faulty eyelashes in trichiasis and distichiasis are generally the natural hairs which have been made to take a wrong direction, in consequence of cicatrices, &c., of the border of the eyelid. Sometimes, however, they appear to be in part at least of new development.

2201. Trichiasis may be *partial* or *total*. In the one case,

the misdirected eyelashes are confined to a part only of the border of the eyelid; in the other, they spring from it along its whole extent.

2202. The eyelashes of either eyelid separately may be turned in against the eyeball, or the eyelashes of both eyelids may be turned in at the same time. It is not uncommon to find trichiasis or distichiasis affecting the eyelids of both eyes.

2203. The misdirected eyelashes are sometimes very few in number, and so pale and fine, that they are apt to escape notice, and the inflammation of the eye which they occasion, attributed to some other cause, unless an exploration of the borders of the eyelids and state of the eyelashes be carefully made as above indicated, (ss. 30, 31.)

2204. The effects on the eye, both *objective* and *subjective*, from the irritation of the misdirected eyelashes in trichiasis, are the same as those above mentioned in entropium, (ss. 2173, 2174.)

2205. *Causes.*—Trichiasis and distichiasis are sequelæ of those inflammations of the borders of the eyelids which are attended by abscesses and ulcers at the roots of the eyelashes, such as variolous inflammation of the eyelids and ophthalmia tarsi in both its forms.

2206. The co-existence of entropium and trichiasis, and the causes on which it depends, have been noticed, ss. 2190, 2191.

2207. *Treatment.*—Trichiasis or distichiasis admits of being relieved only by operation.

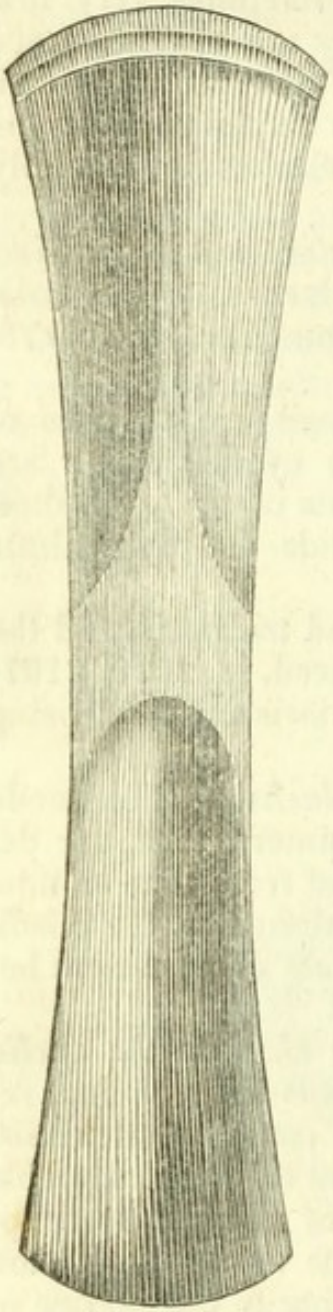
2208. *Evulsion of the misdirected eyelashes.*—The mode of performing this operation and the instrument used, are described in s. 155. It requires to be repeated from time to time as the eyelashes are reproduced. Unless, therefore, the misdirected eyelashes be few in number, this mode of treatment becomes very troublesome.

2209. *Excision or cauterization of the skin of the eyelid as in entropium.*—Either of these operations may be had recourse to with some advantage in those cases of trichiasis, sometimes met with, in which the eyelashes for a considerable extent along the edge of either lid, instead of being curved upwards in the upper eyelid, and downwards in the lower, are directed perpendicularly, so as readily to cling to the surface of the eyeball.

2210. *Extirpation of the roots of the eyelashes.*—In inveterate cases of trichiasis, as well as of entropium, or of trichiasis and entropium combined, there is no other resource but destruction of the eyelashes by extirpation of their roots.

2211. In reference to this operation, it is important to call to mind the following anatomical points:—The eyelashes spring from the anterior edge of the free borders of the eyelids, and are inserted three or four deep, especially in the middle. The capsules of the bulbs of the eyelashes lie close on the tarsal cartilage under the ciliaris muscle and skin, extending to the depth of about one-eighth of an inch.

Fig. 80.



2212. The lid to be operated on is to be raised and stretched on the horn spatula-like instrument, represented in the annexed figure, introduced behind it, and held steadily by an assistant, who at the same time retains the eyelid from slipping away by pressing the eyelashes against the horn spatula with the thumb-nail of the hand holding it.

2213. The surgeon, then, with a small scalpel, makes an incision, parallel to the border of the eyelid and about one-eighth or one-sixth of an inch from the edge whence the eyelashes issue, through the skin, cellular tissue, and ciliaris muscle, down to the tarsal cartilage. According as it is along the whole border of the eyelid, or along a part only, that the trichiasis extends, and consequently that the extirpation of the roots of the eyelashes requires to be carried, so of course must be the length of the incision. From each end of the incision now made, a short one is to be carried at right angles to the edge of the eyelid.

2214. The long narrow flap of skin thus marked out is now, together with the subjacent cellular tissue, ciliaris muscle, and the bulbs of the eyelashes, to be laid hold of with a toothed or good-holding common forceps, and dissected clean from off the tarsal cartilage towards the margin of the eyelid.

2215. It is scarcely necessary to say that in this dissection

injury of the lachrymal point and canalicule must be carefully avoided.

2216. The detached flap, comprising skin, cellular tissue, muscular fibres, and bulbs of eyelashes, is now to be cut away with the scissors along the margin of the eyelid, leaving a stripe, however, about one-thirtieth of an inch broad, for the insertion of sutures, if thought necessary.

2217. During the operation, the blood, which oozes out in very considerable quantity, requires to be assiduously taken up with a sponge by an assistant, in order that the operator may see that no bulbs are left unremoved.

2218. To insure still more the removal of all the bulbs, a careful examination is to be made of the wound when the oozing of blood has ceased. If any bulbs still remain they will present themselves as black points, and thus be readily discovered. They are to be laid hold of with the forceps and removed with the scissors.

2219. The edges of the wound left by the removal of the flap, are united by stitches by some operators, by others not.

2220. If the case be one of entropium and trichiasis combined, it is advisable to unite the wound by stitches, and also to make one or two perpendicular incisions through the whole thickness of the border of the eyelid, as in Ware's or Crampton's operation for entropium (ss. 2193, 2194), only not so long.

2221. The eyelashes, which are now loose, may be plucked away with the finger and thumb.

2222. The only dressing necessary, are cloths wet with cold water laid over the eye.

2223. Great relief is at once obtained, and the part heals quickly.

2224. If the bulbs have not been all removed, it will be found that the part has scarcely healed, when a hair or two will be found here and there sprouting out again.

2225. *Excision of a wedge-shaped portion of the eyelid.*— When but a very few eyelashes, together in a bundle, are turned in, excision of the small portion of the eyelid in which they are implanted has been recommended. This is done by making the excised portion of a wedge-shape, and then either uniting the cut edges of the eyelid by the hair-lip suture as above (ss. 2127, 2128), or leaving the parts to unite by granulation.

*Lagophthalmos.**

2226. This name is given to a constant open state of the eyelids, the consequence of which is, that the eye is, as in ectropium, exposed to the entrance of foreign particles and other causes of irritation.

2227. There are three principal forms of lagophthalmos, depending on very different causes, viz :—

1st. Paralysis of the orbicularis muscle, allowing of the unrestrained action of the levator palpebræ.

2d. Organic contraction or adhesions of the eyelids.

3d. Congenital imperfect development of the eyelids.

Lagophthalmos from paralysis of the orbicularis palpebrarum.

2228. This is one merely of several symptoms of paralysis of the portio dura of the seventh pair. The paralysis of the orbicularis may be so complete that the upper eyelid is immovably retracted; but in general, it is not so complete, the eyelids still admitting of being approximated, though not accurately closed.

2229. Besides the retraction of the upper eyelid, the border of the lower is somewhat fallen away from the eyeball; the lachrymal papillæ and puncta being thus no longer duly directed to the lacus lachrymalis, the tears are not absorbed and drawn off into the nose, but fall down over the cheek.

2230. *Causes of paralysis of the portio dura.*—Paralysis of the portio dura may be owing to cerebral disease, or to some affection of the nerve itself, either in its passage through the aqueduct of Fallopius, or at its exit from the stylo-mastoid foramen.

2231. Affection of the nerve in its passage through the aqueduct of Fallopius usually depends on caries of the osseous walls of the tympanum.†

2232. The affection of the nerve at its exit from the stylo-mastoid foramen may consist in pressure on the nerve by an enlarged lymphatic gland or other tumour.

2233. Sometimes the affection of the nerve would appear to be of a rheumatic nature, like what is sometimes the case with paralysis of the nerve of the third pair (s. 2026).

2234. *Treatment.*—This resolves itself into the treatment of

* Oculus leporinus or hare's eye, so called from its having been supposed that hares sleep with their eyes open.

† See my article—Ear and Hearing, Diseases of, in the Cyclopædia of Practical Surgery.

the cerebral disease, disease of the ear, or enlarged lymphatic gland or tumour. In cases in which the paralysis of the nerve seems to have arisen from cold, and is altogether uncomplicated with disease of the ear or swelling at the angle of the jaw, the plan of treatment above indicated for rheumatic paralysis of the nerve of the third pair is equally applicable (s. 2030).

Lagophthalmos from organic contraction or adhesions of the eyelids.

2235. The organic shortening or retraction of the eyelids producing lagophthalmos, usually depends, like that producing ectropium, on the contraction attendant on cicatrization of a burn or other injury; or on the skin of the eyelid being drawn into adhesion with the edge of the orbit in consequence of carious ulceration.

2236. *Treatment.*—This form of lagophthalmos can only be remedied by one or other of the operations above described for ectropium, the choice of the operation being determined by the circumstances of the case.

2237. Of course, when the retraction of the eyelid depends on caries of the edge of the orbit, no operation should be had recourse to till this is cured.

Congenital lagophthalmos.

2238. Congenital lagophthalmos is usually a part merely of general *microphthalmos*.

Ptosis or falling down of the upper eyelid.

[Blepharoptosis.]

2239. Ptosis is the opposite of lagophthalmos, the upper eyelid hanging down over the eye, and not admitting of being raised for the exercise of vision.

2240. There are four principal forms of ptosis.

1st. Ptosis from paralysis of the nerve of the third pair.

2d. Ptosis from injury of the levator palpebræ muscle.

3d. Ptosis from extension and relaxation of the skin or of the whole substance of the eyelid.

4th. Congenital ptosis.

Ptosis from paralysis of the nerve of the third pair.

2241. The nature of this form of ptosis has been already noticed (s. 2021).

2242. *Treatment.*—If the paralysis of the nerve of the third pair be confined to one side, and resist the treatment above

indicated, nothing more can be done; if, however, the nerve on both sides be affected, and double ptosis therefore exists, the application of a strip of plaster, or some such contrivance, must be had recourse to, to retain the upper eyelid on one side open, in order that the person may see to move about; or, as suggested by Dr. Mackenzie and others, Mr. Hunt's operation noticed below (s. 2245) might be performed on one side.

Ptosis from injury of the levator palpebræ muscle.

2243. In wounds of the upper eyelid, the levator muscle may be divided, or otherwise so injured, as to be rendered unfit to exercise its function; the result of which is ptosis.

2244. After healing of the wound, the function of the muscle may become re-established by reunion, in which case the ptosis disappears. This may, however, not take place, especially if the muscle be much torn.

2245. For the rectification of ptosis thus occasioned, an operation has been performed by Mr. Hunt of Manchester, which consisted in the removal of a transverse fold of integument from the eyelid, of such an extent and from such a place, that when the edges of the wound became united, the eyelid was attached to that portion of the skin of the eyebrow upon which the occipito-frontalis acts; so that the action of this muscle was substituted for that of the levator palpebræ.

Ptosis from extension and relaxation of the skin, or of the whole substance of the eyelid.

2246. Extension and relaxation of the skin of the eyelid occasioning ptosis may be the result of long-continued œdematous swelling of the parts, and the like, but it sometimes occurs in old persons without any evident cause.

2247. This form of ptosis may in general be remedied by the excision of an elliptical piece of skin as above directed for entropium, (ss. 2183 et seq.)

2248. Ptosis from extension and relaxation of the whole substance of the eyelids, I have seen as a sequela of purulent ophthalmia in which blue stone and other caustics had been much abused in the attempt to remove the granulated state of the conjunctiva.

2249. In such a case, the excision of a wedge-shaped piece of the eyelid has been recommended, in order to diminish its length transversely. To this, if necessary, might be added the excision of an elliptical piece of skin, as above directed, in order to shorten the lid vertically. But such an operation should of

course not be had recourse to unless the eye has otherwise pretty well recovered.

Congenital ptosis.

2250. Ptosis sometimes occurs congenitally, owing usually to an imperfectly developed state of the levator palpebræ muscle, and therefore incurable, but in some cases merely to relaxation of the skin of the eyelid, and therefore admitting of relief from the operation above indicated, (s. 2247.)

Epicanthus.

2251. This name has been coined to designate a congenital peculiarity, which consists of a fold of skin extending from the side of the root of the nose over the inner canthus of the eye. The free edge of the fold is crescentic, and its extremities are lost in the skin of the upper and lower eyelids. Dr. Ammon, to whom we are indebted for the name, has performed an operation for the obliteration of the folds, which consists in the vertical excision of an elliptical piece of skin from over the root of the nose on a level with the epicanthus, and then bringing the edges of the wound together by suture. It is seldom, however, that epicanthus impedes the movements of the eyelids so much as to render any operation necessary. The folds, moreover, usually disappear as the child's nose increases in prominence. If, however, they appear to dispose to squinting, or if their size should be so considerable as to occasion a material personal blemish, the operation just mentioned may be had recourse to.*

Section III.—MORBID CONNECTIONS OF THE EYELIDS.

Anchyloblepharon.

2252. This, which is not of very common occurrence, is an adhesion of the eyelids to each other by their borders.

2253. Anchyloblepharon is distinguished into *mediate* and *immediate*, according as the adhesion is through the medium of a false membrane, or without any intervening substance; and

* [For representation of this malformation see 2d Am. ed. of Lawrence on the Eye, p. 161.]

into *partial* and *total*, according as the borders of the eyelids are united in part only, or in their whole extent.

2254. In partial anchyloblepharon the adhesion is usually towards the outer angle. In total anchyloblepharon, the edges of the secondary fissure at the inner canthus are seldom or never adherent, so that there is an opening at the inner angle leading into the oculo-palpebral space of the conjunctiva.

2255. Anchyloblepharon is either congenital or acquired.

2256. Congenital anchyloblepharon is generally total,* and either mediate or immediate, and often co-exists with imperfect development of the eyeball.

2257. Acquired anchyloblepharon is generally the consequence of excoriations by burns or escharotics, in which case it is often complicated with symblepharon, or adhesion of the lids to the eyeball, or of such inflammations as are attended with excoriation and ulceration of the tarsal borders, and generally only partial.

2258. Partial anchyloblepharon is to be distinguished from *phimosis palpebrarum*, which is properly contraction of the palpebral fissure from transverse shortening of the borders of the eyelids, accompanied by contraction of the conjunctiva (ss. 991, 2268).

2259. Supposing the eye otherwise sound, the effect of anchyloblepharon is of course to impede or wholly prevent the exercise of vision according as it is partial or total; but very often, anchyloblepharon is complicated with symblepharon, or adhesion of the eyelid to the eyeball, or with some other defect of the latter, viz., such as may arise from the same injury or inflammation, which gave occasion to the adhesion of the eyelids, or, in the case of congenital anchyloblepharon, imperfect development of the eyeball.

2260. *Prognosis and treatment.*—The treatment consists in separation of the adhesion with the knife; but in cases of total anchyloblepharon, it is necessary, before proceeding to operate, to direct attention to the state of the eyeball as regards prominence and firmness, and whether or not the case is complicated with symblepharon, or adhesion of the eyelid to the eyeball. The degree of sensibility to light ought also to be had regard to as an indication of the condition of the eyeball.

2261. To determine whether or not the case is complicated with symblepharon, or adhesion of the eyelid to the eyeball,

* An opening at the inner canthus commonly exists; sometimes an opening at the outer canthus has been met with; in other cases no opening at either canthus, but one in the middle.

the united eyelids are to be pinched up into a fold, and the patient desired to move the eyeball about and to make efforts as if to open and shut the eye. During this, the attention of the surgeon is to be directed as to whether the eyeball moves freely or not behind the eyelids. The point may be also ascertained by passing a probe through the opening at the inner or outer angle, if such exist, and observing whether or not it can be freely moved up and down in the oculo-palpebral space.

2262. The operation for partial anchyloblepharon is performed by passing a director behind the part where the borders of the eyelids adhere, whilst an assistant stretches the upper eyelid upwards, and the lower downwards, and separating them with a scalpel, taking care, in the case of immediate union, not to cut the proper substance of the tarsus either of the one or other eyelid. If the anchyloblepharon be mediate, the false membrane is to be detached first from the border of the lower eyelid, and then from that of the upper, a scalpel or scissors being the instrument employed according to the thickness and connections of the false membrane.

2263. In the case of total anchyloblepharon, if there is an opening at the inner angle, a director or probe is to be passed through it behind the united eyelids, and their separation effected in a manner similar to that just indicated. If, however, there is no opening, the united eyelids are to be pinched up into a vertical fold and drawn from the eyeball, the assistant taking charge of the upper eyelid, the surgeon himself the lower, and the united edges separated at the part. Through the opening thus made, the director is passed, and run along, first to the inner angle, and the adhesion divided in that direction, and then to the outer angle, and the adhesion divided in that direction.

2264. The operation which has now been described, it will be observed, is of comparatively easy performance, but the tendency to re-adhesion constitutes the great obstacle to a successful issue, especially in cases in which the anchyloblepharon has arisen from burns and the action of escharotics.

2265. To prevent reunion, the eyelids should be frequently drawn from each other after the operation, and the raw borders smeared with tutty ointment, until cicatrization takes place. What is very likely to prove useful, is to promote union between the skin and conjunctiva at the external angle, by means of a suture.

Symblepharon.

2266. This is adhesion of the conjunctival surface of one or both eyelids to that of the eyeball. The cornea is generally more or less involved in the adhesion. It may be either *mediate* or *immediate*, *total* or *partial*, and may exist in complication with anchyloblepharon.

2267. Symblepharon is usually the consequence of injury of the conjunctiva from the action of escharotics intruded into the eye (s. 322).

2268. The contraction of the conjunctiva, with obliteration of the palpebral sinuses, above referred to under the head of Xerophthalmia, (s. 991,) has been called *symblepharon posterius*, but it differs from the symblepharon under consideration as essentially as phimosis palpebrarum, with which it generally co-exists, does from anchyloblepharon (s. 2258).

2269. *Prognosis and treatment.*—The morbid adhesion between the eyelid and the eyeball may be readily separated by the knife, but re-establishment of the adhesion is as prone to take place as in anchyloblepharon, or more so. Even in partial meditate symblepharon, the bands or frœna have been generally found to be reproduced.

2270. In some cases of this sort, better success might perhaps be obtained by first cutting the band or frœnum at its connection with the eyeball, and uniting the wound of the conjunctiva with a few stitches of fine thread, the band or frœnum being left in connection with the eyelid, and only removed, if necessary, after the union of the wound of the conjunctiva, supposing it to take place.

Section IV.—TUMOURS, CANCER, &c., OF THE EYELIDS AND EYEBROWS.

Phlyctenulæ on the borders of the eyelids, from obstruction of the Meibomian apertures and retention of the secretion.

2271. This state, which has been above noticed, (s. 32), gives rise to some uneasiness in the part, especially when the eyelids are moved. The film which forms the walls of the phlyctenula will give way of itself, and the accumulated secretion be allowed to escape; but removal may be at once effected by lacerating the phlyctenula with the point of a pin.

Meibomian calculus.

2272. Small calcareous concretions sometimes form apparently in the Meibomian glands, and are seen shining through the palpebral conjunctiva on everting the eyelid. Sometimes they project on the surface of the conjunctiva, acting thus as a cause of irritation to the eye. The removal of such a calculus becomes necessary. It is effected by dividing the conjunctiva over it, and turning it out with a cataract needle or the like.

Enlargement and induration of the Meibomian glands.

2273. When the Meibomian glands are thus affected, they are felt under the skin like strings, besides forming prominences towards the borders of the eyelids.

2274. Alteratives and tonics generally, and friction with camphorated mercurial ointment locally, constitute the only admissible treatment.

Vesicles or phlyctenulæ on the cutaneous surface of the eyelid near its margin.

2275. Vesicles or phlyctenulæ, containing a watery fluid, are sometimes met with single or several together, and of a size from that of a mustard seed to the size of a pea. The evacuation of the fluid by a puncture with a lancet is sometimes sufficient for the removal of these vesicles; if not, the vesicle is to be snipped off with the scissors.

Warts on the eyelids.

2276. Warts are not uncommon on the cutaneous surface of the eyelids or on their border.

2277. If pedunculated, it is best to remove them by ligature, or at once to snip them off with the scissors, and then to touch the root with strong acetic acid or lunar caustic. If they have a broad base, their removal may be effected by the escharotics alone.

Horny-like excrescences connected with the skin of the eyelids.

2278. One of the minute sebaceous follicles of the skin of the eyelids, especially of the lower, may become enlarged, and give out a morbid secretion, which, hardening as it is produced, does not fall away on being thrust out by successive additions, but forms the horny-like excrescences under consideration.

2279. The portion of skin in which the excrescence has its root, is to be snipped off in a fold with the scissors.

Encysted steatomatous tumour.

2280. A small white pearly-looking tumour, of about the size of a pin's head, called *milium*, often presents itself in greater or less numbers in the skin of the cheeks and eyelids, situated apparently immediately underneath the epidermis, which they raise up and through which they shine.

2281. Composed of a comparatively thick capsule without opening, in which is contained a sebaceous-looking matter, milia are quite different from enlargements of the common sebaceous follicle, produced by accumulated secretion.

2282. The bodies in question are in their natural course thrown off by the giving way of the epidermis covering them, and may be succeeded by new ones. They thus appear to be of the same nature, as dehiscent glandular cells of the simplest kind.

2283. Their removal when required is best effected by carefully scratching through the epidermis covering them with any fine-pointed instrument, taking care not to scratch so deep as to cut the capsule, and squeezing the body out of its nidus between the thumb nails. If the capsule be wounded, it may remain while its contents only escape. The body when turned out whole, exactly resembles a minute pearl.

2284. Larger tumours*—of the size sometimes of a horse-bean, or even greater—but apparently of the same nature as the miliary ones just described, are sometimes met with, especially in children, imbedded in the skin and subcutaneous cellular tissue of the eyelids.

2285. The capsule part of the tumour is white, very thick, sometimes of considerable almost gristly consistence, and rough and tuberculated on its surface.

2286. The removal of such a tumour is most easily effected by dividing it, as well as the investing integument, with a stroke of a lancet, and then by pressure squeezing out the halves of the thick cyst from their nidus.

Grando and chalazion.

2287. The first is the Latin, the second the Greek word for *hailstone*, and are names applied to small tumours of the eyelids. Some authors employ them synonymously, but recognize two forms of the disease—*external* and *internal*. Other authors again, and their example is for the sake of convenience followed

* Albuminous tumour,—Molluscum contagiosum, Mackenzie; Half-encysted tumour, Lawrence; Glandiform tumour, Tyrrell.

here, restrict the name *grando* to the external form, *chalazion* to the internal.

2288. *Grando.**—This is usually described as a hordeolum which has not advanced to suppuration, but become indurated; or as a hordeolum which, after bursting, has healed over without the small mass of sloughy matter at its base being discharged. Grando, however, is sometimes of the same nature as chalazion, differing only by being prominent externally instead of internally.

2289. *Chalazion,† or tarsal tumour.*—This tumour is situated in the substance of the tarsal cartilage, usually some little way from the margin of the eyelid, and tends more to its inner than its outer surface. It does not cause any great elevation of the skin of the eyelid, or other marked appearance externally. On everting the eyelid, the conjunctiva at the place is observed to be livid red, and elevated, but sometimes depressed in the middle. As the tumour increases, the conjunctiva becomes thin, and at last gives way, when a small fungus-like substance rises from the opening. Suppuration may take place in the tumour around its nucleus.

2290. The tumour consists of a gelatiniform fibrinous matter not encysted, but simply contained in a cavity it has formed for itself by accumulating in the substance of the tarsal cartilage.

2291. *Treatment of grando.*—Make an incision through the skin over the tumour parallel to the margin of the eyelid, and try to squeeze it out. If this does not succeed, seize the tumour with hooked forceps, snip it out with curved scissors, and cauterize the place with nitrate of silver.

2292. *Treatment of chalazion.*—If, as is frequently the case, the patient be dyspeptic, by improving the state of the digestive organs, the tumour may be arrested in its progress and even altogether dispersed. Locally friction with camphorated mercurial ointment may be employed.

2293. If the tumour, however, has already become large, and presses disagreeably on the eyeball, it ought to be removed. The operation consists in everting the eyelid, making a free incision into the tumour, and pressing out or breaking down its contents with the handle of the scalpel.

2294. It may happen that two tumours lie close together, and one only be evacuated by the incision. Should this prove to be the case, the incision is to be extended to the second tumour, and its contents pressed out.

* External grando or chalazion.

† Internal grando or chalazion; Fibrinous tumour, Mackenzie.

2295. A chalazion giving way, a fungus-like excrescence, as above mentioned, arises from its bottom. This may continue without farther trace of the chalazion.

2296. An incision being made on each side of its base, it is to be cut out by the root with a pair of curved scissors.

Encysted tumour.

2297. Encysted tumours, sometimes congenital, are occasionally met with in the eyelids, especially the upper, towards the temporal side. They are situated under the orbicularis palpebrarum, and are often adherent to the periosteum of the margin of the orbit. The cyst is thin but firm, and the contents, a fatty or glairy matter, sometimes mixed with hairs.

2298. For the removal of such tumours, the following general directions only can be given:—

1st. The external incision should be free, and in the direction of the orbicularis palpebrarum.

2d. The cyst should be dissected out entire, if possible. At any rate, it must all be extirpated. If any part of it is left, which without care might happen in regard to that part of it adhering to the bone, the wound will not heal, and disease and exfoliation of the bone may take place.

Hydatids in the cellular substance of the eyelids.

2299. Dr. Mackenzie mentions a case of swelling over the temple and zygoma, from which, by puncture from within the mouth, a glairy fluid and a number of hydatids were discharged. After this an abscess formed in the upper lid, in the pus evacuated from which there were contained several hydatids.

Nævus maternus and aneurism by anastomosis of the region of the eyelids.

2300. The skin of this region, as well as that of any other part of the body, is occasionally found to be the seat of that form of nævus, called *mole*, in which a circumscribed part of the skin is thickened, of a brown colour, and covered with hair.

2301. Aneurism by anastomosis also sometimes implicates the eyelids.

2302. The various methods of treating aneurism by anastomosis which have been adopted, are:—pressure—cautery, actual or potential—vaccination—escharotic and irritant injections into the tumour—incision of the vessels within the tumour—seton—ligature—excision—ligature of the carotid.

2303. The details of these various plans of treatment belong to general surgery.

Scirrhoid callosity of the eyelids.

2304. A hard tuberculated warty-like degeneration of the whole thickness of the eyelid, commonly the lower, at the tarsal border to a greater or less extent, traversed by varicose vessels, and ending in ulceration, sometimes occurs, especially in old people. Though resembling, it is not of the nature of scirrhus.

2305. If not irritated, it may remain stationary. Sometimes, however, it causes so much irritation to the eye, and produces so much deformity, that the patient seeks for its removal by operation.

2306. The operation consists simply in the amputation of the diseased part.

Cancer of the eyelids.

2307. Cancer commences more commonly in the lower eyelid than in the upper, and first manifests itself as a small indurated tubercle, at the edge of the eyelid, or towards one or other angle, over which the skin may be otherwise natural, except that it is pervaded by varicose vessels, and which is little or not at all painful. This tubercle is followed by others.

2308. This stage of the disease—*the stage of induration*—after remaining for an indefinite time, is succeeded by *ulceration*. The ulcer is smooth and destitute of granulations, and the discharge from it is not unhealthy-looking. The edges of the ulcer are knotted and irregular, but the surrounding skin is natural. The ulceration may be arrested for a time, and again proceed, or while it stops at one part it goes on at another.

2309. Though the ulceration may eventually eat away not only the whole eyelids, but also the neighbouring parts, it does so very slowly, perhaps only in the course of years.

2310. In the progress of the disease, the eyeball may be destroyed by ulceration and bursting of the cornea with evacuation of the humours, but this appears to be sometimes the effect rather of common inflammation of the eyeball, from the exposure to which it is subjected by the loss of its protecting parts, than of extension of the cancerous disease.

2311. Inconsiderable suffering in general attends the stage of ulceration, but when nerves are exposed, or when the eyeball bursts, there is severe pain.

2312. The neighbouring lymphatic glands do not become contaminated, and the general health does not suffer.

2313. Cancer of the eyelids, which is an uncommon disease, does not occur before the middle period of life.

2314. From syphilitic ulceration of the eyelids above described, cancerous ulceration may be distinguished by the slowness of its progress, and the natural state of the surrounding integuments, together with the history of the case.

2315. *Treatment.*—While the disease is as yet confined to the eyelids, the only effectual treatment is removal of the affected parts with the knife, together with a portion of the healthy structure immediately around.

2316. Though the disease sometimes returns after the operation, a permanent cure has been effected in a considerable proportion of cases.

2317. It is to be observed, that though a very large portion of the eyelids is removed, the eyeball may, after recovery, be still pretty well protected by the elongation of what remains, and that even though the lachrymal pupillæ and canalicules be cut away, no stillicidium lachrymarum ensues.

2318. Though the disease has already extended its ravages so far as to have destroyed the eyelids and neighbouring parts, antiphlogistic and anodyne remedies will still be found useful, not only in palliating symptoms, but even in retarding the progress of the disease.

2319. The eyelids and conjunctiva are sometimes implicated in melanosis, but it is not necessary to go particularly into the subject.

Phtheiriasis of the eyebrows and eyelashes.

2320. This keeps up a state of chronic inflammation, and causes intolerable itching.

2321. *Treatment.*—The eyebrows, and edges of the eyelids, after as many of the eyelashes have been plucked out as are loose enough to yield to the force exerted by means of the finger and thumb, are to be smeared with some mercurial salve, such as the strong red precipitate or citrine, twice a day. After which, an attempt is to be made to dislodge the insects from the eyebrows by means of a fine comb; from the eyelashes, by means of a small spatula or forceps.

CHAPTER VIII.

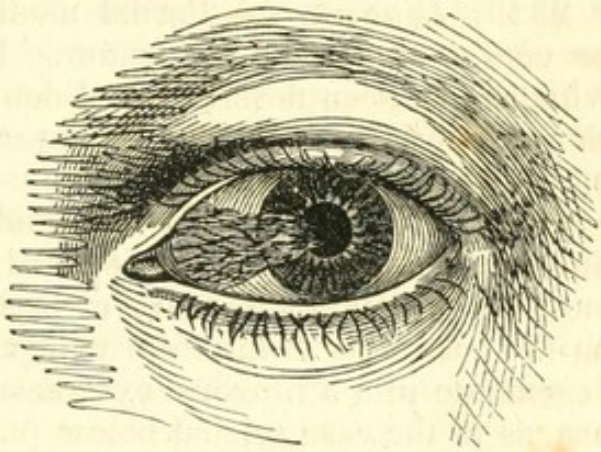
Section I.—DISEASES OF THE CONJUNCTIVA.

Pterygium.

(Web.)

2322. This is a vascular and thickened state of a circumscribed portion of the conjunctiva of a triangular form, the apex corresponding to the cornea, on which it encroaches to a greater or less extent; the base corresponding to the circumference of the eyeball. The connection between the portion of conjunctiva implicated and the subjacent sclerotica, continues as loose as in the natural state.

Fig. 81.



2323. Pterygium has its seat generally on the nasal side of the eye, in which case its base corresponds to, and is incorporated with, the semilunar fold, but that it is not in its nature an extension of that fold of conjunctiva is proved by the circumstance, that pterygium sometimes occurs on the temporal side, and even, though more rarely, on the upper or lower side of the eye.

2324. Moreover, in many cases, if not in all, the disease appears to begin by the formation of what ultimately forms its apex, close to the edge of the cornea, before any thickening or unnatural vascularity of the conjunctiva is observable.

2325. The disease is of consequence only when it implicates the conjunctiva corneæ so far that the vascularity and thickening extend to the middle of the cornea, and obstruct the pupil.

2326. Both the nasal and temporal sides of the same eye are sometimes the seat of pterygium. Cases have even been met with in which pterygium existed not only on the nasal and temporal, but also on the upper and lower sides of the same eye.

2327. Two degrees of pterygium are met with, viz., *pterygium tenue vel membranosum* and *pterygium crassum vel musculosum;* the former thin and semi-transparent, the latter thick and fleshy-looking.

2328. *Causes.*—Nothing certain has been made out on this head. The subjects of it are generally old persons. It sometimes takes its origin in chronic inflammation of the conjunctiva. The affection has been most frequently met with in labourers whose work exposed them to the entrance of mortar and stone dust into the eye, and in persons who have been long resident in hot climates. Dr. Mackenzie mentions that he has seen a particle of gunpowder, which had been lodged for years under the conjunctiva, at last cause pterygium.

2329. *Diagnosis.*—Partial mediate symblepharon is apt to be confounded with pterygium. Indeed, many of the cases which have been described and delineated as examples of superior and inferior pterygium, appear to be examples rather of partial mediate symblepharon.

2330. *Prognosis.*—The morbid state of the conjunctiva under consideration, is not disposed to disappear spontaneously, but it may remain stationary or be long before it extends so far on the cornea as to interfere with vision. If mistreated, it may degenerate into a fungous excrescence covering the whole cornea, as in the case related below (s. 2341).

2331. *Treatment.*—Pterygium may sometimes be removed by frequently touching it with the nitrate of silver solution or with vinum opii. If, however, it does not yield to this treatment, and if it has extended so far on the cornea as to obstruct vision, its removal by operation becomes necessary.

2332. *Operation for the removal of pterygium.*—The patient being seated as for the operation for cataract, and both eyelids secured by an assistant, the surgeon, while the patient turns the eye outward, if the pterygium be on the nasal side, with a hooked forceps seizes the pterygium about its middle, and, whilst keeping it raised from the surface of the sclerotica, he passes a cataract or iris knife with the edge towards the cornea, and one of the flat surfaces of the blade towards the sclerotica, behind it, and detaches it from the sclerotica by cutting inwards as far as the margin of the cornea, where the knife is to be made to cut itself out. Still keeping hold of the pterygium with the forceps, he now with the same knife, or with a pair of curved scissors, separates the pterygium towards its base, where it is to be cut away without encroaching too near the semilunar fold, if it be an internal pterygium.

2333. After the operation cold applications are made to the eye.

Pinguecula.

(Pterygium pingue.)

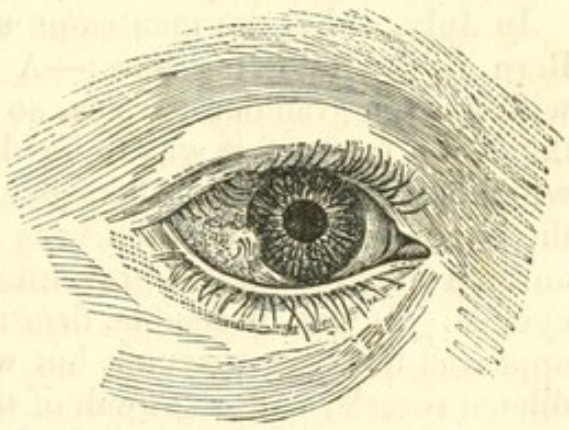
2334. This is a small whitish-yellow tumour, from the size of a pin's head to that of a small pea, in the sclerotic conjunctiva and subjacent cellular tissue, close to the margin of the cornea on its nasal or temporal side. It is so called from its being supposed to be a deposition of fat, though erroneously, as shown by Weller, who found it to be of an albuminous nature. One or two of the rectal vessels, enlarged and varicose, usually run into it.

2335. Pinguecula, which is of very common occurrence towards the middle period of life, can scarcely be viewed as morbid, inasmuch as it occasions no inconvenience of any kind. When its removal is required, it is only for the sake of appearance. Being seized with a hooked forceps, and raised, the tumour and a small portion of the surrounding conjunctiva are to be snipped off transversely with a pair of curved scissors.

Trichosis bulbi.

2336. This is a small congenital tumour with hairs growing from it, analogous to those of the skin called *moles*, occasionally met with on the white of the eye, close to the margin of the cornea, on which it perhaps slightly encroaches. The tumour here delineated, which I removed, was composed of pretty dense tissue, similar to that of the sclerotica, with which indeed it was incorporated, covered with conjunctiva, in which the hairs had their roots. It is said that such tumours are sometimes fatty. Similar tumours, but without hairs growing from them, are met with. In a case mentioned by Mr. Wardrop, hairs did not appear until the time of puberty.

Fig. 82.



2337. The tumour being not only a blemish, but sooner or later a source of irritation, its removal is desired, and may be readily effected by seizing it with the hooked forceps, whilst an assistant holds the eyelids asunder, and either transfixing it at

its base with a knife, detaching it on the side next the cornea, and then dompleting its removal with the same knife, or with scissors, in the manner above recommended for pterygium, or at once snipping it off in a transverse direction close to its root, with a pair of sharp curved scissors.

2338. Some of the root in the sclerotica may be left, and will require to be touched with the lunar caustic pencil.

Abnormal development, or hypertrophy of the conjunctiva corneæ.

2339. An extension of membrane, like sclerotic conjunctiva, over a part of the cornea, is sometimes met with.

Fungous excrescence of the conjunctiva corneæ.

2340. The whole cornea may be covered with a fungous excrescence, tuberculated on the surface, and of a red or livid colour. The two following cases will illustrate the nature and treatment of such affections.

2341. J. S., æt. forty, a strong, healthy-looking countryman, suffered for several years repeated attacks of ophthalmia. A pterygium subsequently formed on the nasal side of the right eye, and was for a long time treated with caustics; but instead of diminishing under the treatment, it progressively increased in size and thickness, extending over the margin of the cornea, and at last implicating it so far as wholly to impede vision.

In July, 1837, the man came under the care of Dr. Rau, of Bern, in the following state:—A pale red fungous excrescence, with uneven granular surface, so perfectly covered the cornea that not a trace of it was to be discovered. The excrescence, which at the margins projected about a sixth of an inch above the surface of the sclerotica, was at its middle about one half of an inch thick, so that it prevented the complete closure of the eyelids. It was insensible, firm and consistent to the touch; it appeared not very vascular, but was in connection, by means of dilated vessels, with a growth of the sclerotic conjunctiva, which appeared to proceed from, or at least to implicate, the semilunar fold. The rest of the sclerotic conjunctiva was injected. In the left eye there was a pterygium, which did not reach to the margin of the cornea.

Dr. Rau proceeded to the extirpation of the tumour with the knife, but with a doubtful prognosis, as it was impossible to determine beforehand the state of the cornea. The mass, having the consistence of granular fat, gave way under the forceps, so that it was found impossible to separate it in an entire piece; it

was therefore removed in fragments, and even this was rendered difficult by the not inconsiderable hemorrhage. After the removal of the excrescence, it became quite evident that it had its origin from the conjunctiva corneæ, the surface of which presented an uneven and granular appearance. A part of the large vessels of communication was excised. Notwithstanding repeated cauterization with lunar caustic, the tumour began to grow again, the vessels, of which a part had been excised, appeared as before, and in one month the fungus had again acquired a considerable size. Repeated extirpation of it and of a considerable fold of sclerotic conjunctiva, together with the much distended vessels, at last put a stop to the growth. Instead of the nitrate of silver, caustic potash was now employed. Besides being applied carefully to the whole surface, it was penciled all round the cornea, so as to destroy the vascular communications. The remains quickly shrank and came away under the repeated application of vinum opii. A bluish smooth surface now came into view, and the patient had a distinct perception of light. The cornea, which was very vascular on the surface, gradually cleared under the use of nitrate of silver salve in alternation with vinum opii. In six weeks after this the pupil could be distinctly seen, and the clearing of the whole cornea ensued under the continued use of the nitrate of silver salve.

Two years after, Dr. Rau found the cornea of the right eye as transparent as that of the left, all trace of vascularity gone, and vision so good that the man had no difficulty in reading the finest print.

2342. Mr. Travers gives an account of a case, in which the cornea was concealed by a lobulated tumour of a dark purple colour, apparently melanotic, and in which he extirpated the anterior hemisphere of the eyeball. On examination of the tumour, the cornea and sclerotica proved to be entire, and the morbid growth, lying upon and adhering to the cornea and a small portion of the sclerotica, had acquired the lobulated appearance, as if by degeneration of the investing conjunctiva. The patient quickly recovered from the operation, and the remaining part of the eyeball collapsed.

Various kinds of tumours of the conjunctiva.

2343. Polypi and warts, pedunculated or sessile, may be met with growing from any part of the conjunctiva. They should be removed by excision with the curved scissors.

2344. *Small very hard vesicular tumours*, of the size of pins' heads, are sometimes presented by the sclerotic conjunc-

tiva. If seized and crushed with a hooked forceps they will disappear. They may, however, be at once snipped off with the scissors.

2345. Dr. Mackenzie describes tumours on the white of the eye in children, which seemed to be scrofulous tubercles growing from the sclerotica, and elevating the conjunctiva. Such tumours, which I have also seen, are of a whitish or yellowish colour; they appear as if about to suppurate, but continue firm, slowly increase to perhaps the size of a hazelnut, burst through the conjunctiva, but do not come to suppuration. Left to themselves, such cases are apt to end in disorganization and atrophy of the eyeball. If extirpation is attempted, the diseased mass is found to be soft and easily torn.

Entozoa in the cellular tissue under the sclerotic conjunctiva.

2346. Hydatids have been occasionally met with under the sclerotic conjunctiva. They give rise to a vesicular tumour about the size of a pea, in general unaccompanied by inflammation, or any other inconvenience. On dividing the conjunctiva, the hydatid is readily removed.

2347. Cases of the Guinea worm under the conjunctiva are on record.

Section II.—DISEASES OF THE SEMILUNAR FOLD AND LACHRYMAL CARUNCLE.

2348. The *lachrymal caruncle* consists of a mass of fibrous tissue similar to that of the tarsal cartilages, in which are imbedded follicles secreting a fluid of the same nature as that of the Meibomian glands, and pouring it out by twelve or fifteen excretory orifices on its surface, which is invested by the conjunctiva.* In the healthy state, the lachrymal caruncle is of a yellowish-red colour, slightly tuberculated on the surface, which, in addition to the excretory orifices, is beset with very delicate scarcely visible hairs.

2349. *The semilunar fold of conjunctiva*, which encloses at its free edge a minute portion of fibrous tissue, similar in nature to the tarsal cartilages, is distinguished from the ocular

* Anciently the lachrymal caruncle was thought to be the secreting organ of the tears, and the lachrymal points the excretory orifices.

portion of the conjunctiva by its reddish colour and greater thickness.

Inflammation of the semilunar fold and lachrymal caruncle.

(Encanthis inflammatoria.)

2350. In the puro-mucous ophthalmiæ the semilunar fold and lachrymal caruncle are always very much affected,* but they are sometimes found the principal seat of inflammation; and this, especially as regards the lachrymal caruncle, occurs under two forms, viz., what may be called catarrhal, and what may be called phlegmonous.

Catarrhal inflammation of the semilunar fold and lachrymal caruncle.

2351. The conjunctiva forming the semilunar fold and investing the lachrymal caruncle is the principal seat of this inflammation, which is in its nature very analogous to catarrhal ophthalmia tarsi (ss. 2072 et seq.)

2352. *Symptoms.*—The semilunar fold and lachrymal caruncle are very red and much swollen, as also the neighbouring parts more or less, and puriform mucus by and by collects in considerable quantity at the inner angle, the result of increased secretion from the conjunctiva and from the follicles of the caruncle.

2353. There is a sensation as if a foreign body were lodged at the inner angle of the eye, and considerable lancinating pain, especially when the eyelids are moved.

2354. In consequence of the displacement of the lachrymal papillæ and points, as well as their implication in the inflammation, the tears which collect in the lacus lachrymalis are not duly absorbed, and therefore drop down over the cheek.

2355. *Causes.*—After cold, the irritation of inverted eyelashes and of foreign bodies appears to be the most common cause. The foreign bodies may be lodged behind the semilunar fold. A loose eyelash has sometimes been found to have accidentally entered one of the puncta by one end, and by its free end pointed against and irritating the semilunar fold and caruncle, to be the source of the irritation which has excited and which keeps up the inflammation.

* The semilunar fold may be so much enlarged in purulent ophthalmia, as to resemble the membrana nictitans of quadrupeds, of which it is naturally the miniature analogue. In this state of enlargement, I have seen a surgeon cut a considerable piece of it away under the erroneous impression that it was an excrescence from the conjunctiva.

2356. *Treatment.*—All causes of irritation, if any still exist, being removed, the inflammation will sometimes subside under the use of fomentations, with tepid water, rest to the eye, attention to diet, and a little laxative medicine. If not, the local applications recommended in catarrhal ophthalmia will be necessary, (s. 480,) with perhaps a leech or two to the skin at the inner angle.

Inflammation and abscess of the lachrymal caruncle.

2357. This is altogether analogous to abscess of the Meibomian glands. The symptoms are at first similar to those of catarrhal inflammation of the semilunar fold and lachrymal caruncle, but as suppuration takes place, the pain becomes throbbing, the redness darker, and the swelling greater, until it presents a yellow point, usually between the caruncle and semilunar fold. This point bursting or being opened with the lancet, the abscess is evacuated; whereupon the symptons subside and the part heals. As a consequence of the suppuration, atrophy of the caruncle sometimes takes place.

2358. *Treatment.*—When suppuration is threatened, warm fomentations are to be applied to the inner angle, and as soon as fluctuation is perceptible or a yellow point presents itself, the abscess is to be opened with a lancet.

Chronic enlargement of the lachrymal caruncle and semilunar fold.

(Encanthis fungosa, encanthis benigna.)

2359. Chronic enlargement of the lachrymal caruncle and semilunar fold sometimes occurs, and presents itself in the form of a red, soft tumour, tuberculated on the surface, bleeding readily on being touched, without pain, and of a size sometimes as great, it is alleged, as that of a nut, from which the semilunar fold in the form of wing-like processes extends behind the upper and lower eyelids.

2360. *Treatment.*—As reduction of the tumour is sometimes eventually effected by simply penciling it with the solution of the nitrate of silver or sulphate of copper, or with vinum opii, the surgeon must not proceed hurriedly to excise any part of the enlarged caruncle before giving these remedies a full and fair trial. If a portion of it should be removed, the caruncle, supposing it afterwards recovered its healthy condition, would be so much reduced in size, that it would no longer support the lachrymal papillæ and points in their proper adjustment to the

lacus lachrymalis, the consequence of which would be incurable stillicidium lachrymarum.

2361. If, notwithstanding perseverance in the treatment indicated, the enlargement of the caruncle persists, its reduction must be attempted by means either of caustic or excision.

2362. *Cauterization.*—The solid nitrate of silver is the caustic employed, and the manner of applying it is the same as is recommended in cases of enlarged tonsils, viz., to hold the point of the caustic pencil on the tumour until a small eschar has formed. This is done on different parts of the tumour, and repeated as the eschars fall away.

2363. *Excision.*—A portion of the enlarged caruncle,—one half, or even two-thirds of it,—may be excised, as is done in the case of enlarged tonsils. The eyelids being properly secured by an assistant, the excision is readily effected with the curved scissors, the surgeon first seizing the tumour by means of the hooked forceps.

Polypous and fungous excrescences of the lachrymal caruncle and semilunar fold.

2364. Polypous and fungous excrescences occasionally grow from the semilunar fold, or lachrymal caruncle, or between the two, inflammation having, or having not, previously existed. They may be sessile, and no larger than a pin's head, or they may be pedunculated, and of considerable size.

2365. Small sessile excrescences I have seen cease to grow and eventually disappear without any interference. When this is not the case, and if they are large and cause inconvenience, they should be touched with the nitrate of silver in solution or substance; or if pedunculated and large, they are first to be snipped off with the scissors, and their root touched with the caustic.

Cancer of the lachrymal caruncle.

(Encanthis maligna.)

2366. Some authors speak of cancerous disease primarily affecting the lachrymal caruncle, but this either does not occur at all, or is very rare. Implication of the lachrymal caruncle, however, in cancer commencing in neighbouring parts sometimes occurs.

CHAPTER IX.

DISEASES OF THE LACHRYMAL ORGANS.

SECTION I.—DISEASES OF THE SECRETING LACHRYMAL ORGANS.

Disordered states of the lachrymal secretion.

2367. THE secretion of the lachrymal gland may be suppressed, or, on the contrary, it may be poured out in too great abundance. These disordered states of the lachrymal secretion, it is well known, are frequently the result of mental affections. Suppression of the secretion is more common in old age, excess of secretion in youth.

2368. In all cases these states are to be viewed in the light rather of symptoms than of diseases in themselves. They may both of them present themselves indeed in different stages of one and the same disease.

Suppression of the lachrymal secretion.

(Lachrymal Xeroma.)

2369. Dryness of the eye from suppression of the secretion of the lachrymal gland, has been distinguished from dryness of the eye depending on defective secretion of mucus by the conjunctiva; but it may be questioned whether a suppression of the secretion of the lachrymal gland, independently of any disturbance of the conjunctival secretion, is a cause of dryness of the eye, for in cases in which the lachrymal gland has been extirpated, the eye has continued to be sufficiently moistened by the conjunctival secretion, which in fact is the ordinary means of moistening the eye.

2370. The dryness of the eye which sometimes attends amaurosis, appears to be owing to a disturbance in the secretory action as well of the conjunctiva as of the lachrymal gland.

2371. Obliteration of the excretory ducts of the lachrymal gland is spoken of as a cause of lachrymal xerophthalmia, but such a condition appears to be, as I have above expressed my belief, rather assumed than unequivocally established by any direct observation.

2372. The fact appears to be, that, as above stated, (s. 994,) xerophthalmia is always conjunctival, depending on a cuticular state of the conjunctiva, and that the secretion of the lachrymal gland may or may not be suppressed.*

Epiphora, or watery eye.

2373. This is superabundant secretion of tears, and most commonly presents itself as a symptom of irritation of the conjunctiva. This irritation may be owing to inflammation, especially scrofulous inflammation of the membrane, or, as is well known, to the action of chemical or mechanical agents—cold winds, acrid vapours, or foreign particles in the oculo-palpebral space, inverted eyelashes, &c.

2374. *Epiphora*, as above pointed out, (s. 46,) is to be distinguished from *stillicidium lachrymarum*, another form of watery eye, the latter arising not from superabundant secretion, but from a morbid state of the derivative lachrymal organs, whereby they are unable to draw off into the nose the fluid which is always collecting in the lacus lachrymalis at the inner corner of the eye. But as the morbid state of the derivative lachrymal organs is frequently accompanied by an irritable state of the conjunctiva, epiphora may exist at the same time with stillicidium lachrymarum.†

2375. *Treatment.*—The treatment is of course the removal of the cause, whether inflammation, of whatever kind it may be, or chemical or mechanical irritants of the conjunctiva, &c.

Inflammation of the lachrymal gland.

2376. Inflammation of the lachrymal gland is not of common occurrence; and although acute and chronic forms of it have been described, there are no very certain marks by which they may be distinguished, beyond pain and fullness in the situation of the lachrymal gland accompanying suppression of the lachrymal secretion in the acute form, but increased secretion in the chronic, with displacement of the eyeball downwards and inwards.

2377. The obvious treatment in such cases is the application of leeches and fomentations to the part and the usual general remedies.

* Obliteration of some of the ducts of the lachrymal gland has been alleged to be the condition of another disease, viz., dacryops, or lachrymal tumour of the upper eyelid.

† Some authors employ stillicidium lachrymarum in the sense in which epiphora is above used.

2378. Inflammation going on to suppuration sometimes occurs in the situation of the lachrymal gland, generally in consequence of blows. In such cases the abscess is probably in the cellular tissue in or around the gland, and may present all the severe symptoms and displacement of the eyeball, attending orbital abscess, into which, indeed, it may merge. It may become complicated with disease of the bone. In the latter case, after the abscess has burst or been opened, there remains a fistula, which cannot heal until the diseased portion of bone has exfoliated; but besides that, the skin around becomes diseased, and is so drawn in or contracted by cicatrices at the fistulous opening, that ectropium or lagophthalmus is produced.

2379. The bad results which may follow an abscess in, or in the situation of the lachrymal gland, should induce the surgeon to be particularly circumspect in the management of such a case. If it is found resolution cannot be effected, as soon as the accumulation of matter is distinctly recognized, an issue is to be given to it, by an incision through the skin parallel to the margin of the orbit. In dressing the part afterwards, great attention must be paid to prevent the skin from being drawn in and contracted in a bad cicatrice.

2380. Should the bone be found diseased, of course no attempt need be made to promote cicatrization until exfoliation of the diseased portion, which is always a tedious process; but even then the neighbouring skin is generally in so diseased a state, that contraction and bad cicatrization, with consequent lagophthalmos and ectropium, can scarcely be prevented.

Fistula of the lachrymal gland or true lachrymal fistula.

2381. A minute fistulous opening, situated on the upper eyelid, towards the outer canthus, and under the margin of the orbit in the situation of the lachrymal gland, and from which a clear fluid discharges, has been said by Beer and others occasionally to remain after injury or the bursting of an acute abscess in the lachrymal gland. In one such case Beer effected a cure by thrusting into the fistula, which was about a quarter of an inch deep, a knitting needle made red hot.

Extirpation of tumours in the neighbourhood of the lachrymal gland, or of the diseased gland itself.

2382. Tumours sometimes occur in the neighbourhood of the lachrymal gland without this being itself diseased, but the appearance externally may be such as to lead to the supposition

that it is the gland itself which is enlarged and diseased. This should always be kept in mind in proceeding to the extirpation of what may be considered a diseased gland, and the operation proceeded in with great circumspection.

2383. After the exposure of the tumour by incision of the skin, careful examination should be made to determine whether or not the tumour be really the lachrymal gland diseased, or simply a growth developed close by it. A case has occurred in which the operator removed by mistake a healthy lachrymal gland along with a steatomatous tumour.

2384. The disease of the lachrymal gland, for which its extirpation has been undertaken, is enlargement and induration, but whether of a really cancerous nature or not there is a difference of opinion.

2385. Before any enlargement is observed externally, the patient may have suffered from pain in the situation of the lachrymal gland and epiphora. When a tumour becomes perceptible it is hard and knotty. As it increases in size, it forces the eyeball downwards, inwards, and forwards; the consequence is at first double vision from the displacement of the axis of the eye, and subsequently dimness of sight and loss of vision, from the action of the pressure on the retina.

2386. Under these circumstances, extirpation of the diseased gland is indicated, as discutient treatment has usually proved of no avail.

2387. The operation is performed by making an incision through the skin over the tumour parallel to the edge of the orbit, and of a length sufficient fully to lay bare the anterior part of the tumour. This being done, the surgeon will discover on examination of the size and connections of the tumour, if he had not been able to determine before, whether this single incision will suffice, or whether it will be necessary to carry another from its middle, and perpendicular to it upwards, through the skin of the eyebrow. The exposed gland is now to be seized with a hook or hooked forceps, drawn forwards, and separated from its connections with the scalpel.

2388. The tumour being removed, the cavity in which it was seated is to be carefully explored by means of the finger, to ascertain if none of the indurated mass still remains. When the bleeding has ceased, the wound is to be freed from adhering clots, and its edges brought together by suture. A compress and bandage will promote the return of the eyeball to its natural position, and by this the sides of the cavity left by the removal of the tumour will be in a great measure approximated.

2389. It has been recommended in extirpating the eyeball, to extirpate the lachrymal gland also, whether diseased or not. In support of this recommendation, M. Velpeau mentions a case of extirpation of the eyeball, in which the surgeon was forced, six months after, to remove the lachrymal gland which he had left in the orbit, in consequence of the abundant lachrymation which was kept up.

2390. After extirpation of the lachrymal gland, it has been found that the conjunctival surfaces continue to be moist as usual; this appears to depend on their own secretion, and is a proof that xerophthalmia cannot be owing to suppression of the lachrymal secretion alone, but to an accompanying suppresion of the conjunctival secretion.

Section II.—DISEASES OF THE DERIVATIVE LACHRYMAL PASSAGES.

2391. Obstruction in some part of the course of these passages is generally an accompaniment of their diseases, and the most marked and troublesome symptom attending it is *stillicidium lachrymarum*, or, as it has been improperly called, *fistula lachrymalis*. It is a dropping of tears from the eye over the cheek, in consequence of the obstruction in the derivative passages preventing their being drawn off into the nose in the natural manner.

2392. Dryness of the nostril of the affected side sometimes attends obstruction of the derivative lachrymal passages. This has been attributed to the non-arrival of the tears into the nose. But if, on the one hand, we take into consideration the quantity of fluid which is received from the eye by the nose, and the small extent of surface in the nose over which that fluid can be dispersed; and on the other the copious secretion of mucus of which the whole lining membrane of the nose is naturally the seat, it will be perceived that the presence or absence of the fluid from the eye can have little if any—I should rather say no, influence on the state of the lining mucous membrane of the nose, as regards dryness or moisture. Dryness of the nostril, it is to be observed, does not always accompany obstruction of the derivative lachrymal passages, and when it does occur, it appears to be owing to diminution or suppression of its own mucous secretion from concomitant inflammation in the part.

2393. The smell, like that of dust, which is sometimes perceived, appears to be a subjective sensation, depending on dryness of the nostril.

Inflammatory swelling, abscess or sinuous ulcer in the region over the lachrymal sac.

2394. Inflammation of the skin and subjacent cellular tissue in the region over the lachrymal sac sometimes occurs.

2395. *Symptoms.*—There is at first diffused erysipelatous-like redness and swelling, with pain in the region over the lachrymal sac. The eyelids, conjunctiva, and lachrymal passages are apt to be more or less affected sympathetically, the Meibomian and conjunctival secretions are therefore poured out in increased quantity, whilst the tears, not duly drawn off into the nose, drop over the cheek.

2396. The inflammation in general runs on quickly to the formation of diffuse abscess, the redness at the same time becoming darker, the surrounding œdema greater, and the pain pulsating and severe.

2397. Left to itself, the abscess usually bursts externally, and gives out matter mixed with blood and sloughy cellular tissue, leaving a sinuous ulcer.

2398. Sometimes instead of bursting externally, the matter penetrates into contact with the lachrymal sac, and makes its way into it through an ulcerated opening in its wall, constituting *spurious fistula* of the lachrymal sac.

2399. The inflammation under consideration is of the same nature as phlegmonous erysipelas of the eyelids, and is to be treated in the same manner.

2400. The principal reason for noticing it apart in this place is for the sake of drawing attention to the diagnosis between it and inflammation and fistula of the lachrymal sac, which see.

Catarrhal inflammation of the derivative lachrymal passages.

2401. In nasal catarrh, the inflammation and tumefaction which affects the pituitary membrane may implicate the mucous membrane of the derivative lachrymal passages also, so that the transit of the tears to the nose is somewhat obstructed.

2402. A consequence of this is the swimming of the eye in tears, which so often accompanies nasal catarrh. This swimming of the eye is also in part due to an increased discharge of tears from the lachrymal gland, occasioned by the catarrhal state in which the conjunctiva also is more or less in such cases.

2403. As the cold in the head subsides, the free passage of

the tears is restored. But it may happen that a repetition of such attacks, especially in scrofulous constitutions, shall leave the passages in a chronic blennorrhœal state.

Acute inflammation of the derivative lachrymal passages.

(Acute dacryocystitis, or acute inflammation of the lachrymal sac.)

2404. The derivative lachrymal passages are sometimes, though not very often, the seat of idiopathic acute inflammation. The disease is at first characterized by a hard circumscribed swelling, of the size and shape of a horse-bean,* in the situation of the lachrymal sac, accompanied by a severe deep-seated pain, and by *stillicidium lachrymarum.*

2405. The swelling becomes red and extremely tender to the touch, and there is redness and œdema of the parts around to a greater or less extent. The conjunctiva, semilunar fold, caruncle, and Meibomian glands are sympathetically affected. The pain radiates in all directions, and is accompanied by throbbing. There may be inflammatory fever with delirium at night.

2406. The inflammation sometimes terminates in resolution, more frequently in abscess. In the latter case, along with increase of the throbbing pain, the swelling enlarges, and becomes darker red, soft, and fluctuating. The œdema of the eyelids and neighbouring parts is at the same time much increased.

2407. The canaliculi and nasal duct having been closed by tumefaction of their lining membrane, in an early stage of the attack, the matter accumulates in the sac, which thus appears to be the focus of the disease.

2408. Left to itself, the abscess points and bursts, usually below, though sometimes above, the tendon of the orbicularis palpebrarum. From the closure of the canalicules and nasal duct, there is no escape for the matter through them.

2409. The evacuation of the abscess is followed by great relief; and in favourable cases, the inflammation subsides, the canalicules again become pervious, and allow the passage of the tears into the sac, so that what is now discharged through the fistulous opening is puriform mucus mixed with tears. By and by the fistulous opening into the sac contracts, and if the lining membrane of the latter and of the nasal duct return to their

* The bean shape of the swelling is owing to the lachrymal sac being somewhat bound down about the middle by the tendon of the orbicularis palpebrarum, whilst above and below it has freer scope to swell.

natural state, so that there is a free passage for the tears into the nose, it may close altogether.

2410. Acute inflammation of the derivative lachrymal passages may not terminate so favourably. The lining membrane of the sac and nasal duct may remain thickened, and in a blennorrhœal state, so that the fistulous opening will continue, constituting what is called a *fistula of the lachrymal sac*. Another unfavourable termination of acute inflammation of the derivative lachrymal passages is the effusion of lymph, whereby they may be left more or less completely obliterated.

2411. *Treatment*.—In the early stage of the disease, leeches should be applied around the inner angle of the eye, and also to the entrance of the corresponding nostril. In the robust adult, it may be advisable, if the pain be very severe, to abstract blood by venesection. Fomentations are to be applied to the part, rest and abstinence enjoined, and the bowels and skin acted on by laxatives and diaphoretics.

2412. If by these means suppuration should not be averted, the sac is to be opened as soon as it becomes soft and fluctuating, and issue given to its contents. The opening of the sac is effected by thrusting the knife or lancet, held with its flat surfaces parallel to the margin of the orbit perpendicularly into the distended sac below the tendon of the orbicularis palpebrarum, and withdrawing the instrument, enlarging the opening outwards and a little downwards.

2413. After the incision of the sac, the fomentations are to be continued. There should be no sounding with probes; nothing done directly to the parts for the next day or two after the opening of the sac, but at the most washing it out by syringing tepid water through the opening.

2414. When everything has become quiet, and before permitting the opening into the sac to close, the surgeon must satisfy himself of the perviousness of the canaliculi and nasal duct. The absence of stillicidium lachrymarum, and the presence of tears in the sac, will show that the puncta and canalicules are doing their duty, and the entrance into the nose of water, injected into the sac, will show that there is perviousness in that quarter.

2415. If any doubt should remain as to the perfect freedom of the passages, an exploration is to be made by sounding them with probes.

Chronic inflammation of the derivative lachrymal passages.

(Chronic dacryocystitis—blennorrhœa of the lachrymal sac.)

2416. Chronic inflammation of the derivative lachrymal passages is usually accompanied by a chronic inflammation of the edges of the eyelids, of the palpebral conjunctiva, and of the ocular conjunctiva at the inner corner of the eye, so that at first sight the case might be taken for one of catarrhal ophthalmia. But on closer examination, a fullness and perhaps redness, will be perceived in the situation of the sac, and on making pressure at the place, tears, mixed with streaks of puriform mucus, will escape by the puncta, and perhaps also by the nose.

2417. The mucous membrane of the passage is thickened and secretes a puriform mucus. This thickening of the mucous membrane tells most on the perviousness of the nasal duct; for being surrounded by unyielding bony walls, the tumefaction tends inwards, so that the canal becomes so obstructed that the tears can no longer pass. As, however, the puncta and canaliculi generally continue to perform their office of transmitting the tears, the latter accumulate in, and distend the sac, from whence, by pressure on it, they are regurgitated through the puncta, mixed with flakes of the puriform secretion of the diseased mucous membrane, as already mentioned. The regurgitation is sometimes occasioned by the mere pressure exerted by the orbicularis muscle on the distended sac, during the movements of the eyelids.

2418. After the sac has been emptied through the puncta, the eye remains free from stillicidium until the sac again becomes filled, and can no longer receive any more tears.

2419. Chronic inflammation of the derivative lachrymal passages may come on quite imperceptibly, the watering of the eye being the symptom which first attracts the patient's attention. It may succeed to an attack of acute inflammation of the passages, (s. 2410,) or to an inflammation of the skin and cellular tissue over the sac, (s. 2394,) or, as is frequently the case, it is a sequela of one of the exanthemata (ss. 941, 953).

2420. Besides the affection of the eyelids and conjunctiva already mentioned, the disease of the lachrymal passages may be complicated with a similar state of the mucous membrane of the nose.

2421. In warm dry weather all the symptoms are much relieved or disappear altogether; but in cold and wet weather they become aggravated.

2422. This disease is usually connected with a faulty state of health. It most frequently occurs in scrofulous constitutions.

2423. In cases of chronic inflammation of the derivative lachrymal passages, an acute attack with abscess may supervene from exposure to cold, &c. If not timely opened, great pain is suffered while the distension of the sac goes on increasing; at length it bursts, and the severity of the symptoms are relieved.

2424. Should the opening in the sac, whether made by the knife or produced by the spontaneous bursting of the abscess, again close without the passages being first restored to a healthy state, the same process of acute inflammation and abscess may take place over again from any new exposure.

2425. In some cases, repeated attacks of this kind will be found connected with caries of the surrounding bones, especially the lachrymal and inferior spongy.

2426. *General Treatment.*—As the digestive organs are very commonly disordered, particular attention must be directed to them, if this has not been already done, irrespective of the local disease. A mild nourishing diet, a course of some gentle mercurial, such as hydrargyrum cum creta and laxatives, followed by disulphate of quinine or other tonic, will be found beneficial in many cases. Iodine is a remedy under the use of which alone cures have been effected. As the skin is often in an unhealthy state, attention should be directed to it. Daily friction of it should always be practised. Change of climate will often effect much.

2427. *Local Treatment.*—Counter-irritation behind the ears is to be used, premised, if need be, by the application of leeches over the sac, and to the entrance of the nostrils. Besides these, the eye should be bathed three times a day with some eyewater (such as that of hydr. bichlorid., or lapis divinus with vinum opii, (s. 124,) and weak red precipitate ointment, (s. 136,) applied to the edges of the eyelids at bedtime. These remedies act by subduing the attendant conjunctivitis, and if care be taken to keep the lacus lachrymalis filled for some minutes with the eyewater each time it is used, the sac having been previously emptied by pressure, some of it will be absorbed by the puncta and conveyed along the canaliculi into the sac, and will be thus brought into direct contact with the mucous membrane, which is the seat of the disease, and will act on it as beneficially as on the conjunctiva. There is scarcely ever any occasion to use Anel's syringe for the purpose.

2428. The frequent emptying of the sac towards the nose by pressure is an important point to be attended to by the patient, in order to prevent dilatation and relaxation of the sac.

2429. Sternutatories will often be found useful in chronic inflammation of the lachrymal passages.

2430. If the above treatment prove unavailing in removing the chronic inflammation and restoring the free passage of the tears to the nose, the propriety of operative interference for the purpose of mechanically dilating the nasal duct will come to be considered.

Atony or relaxation of the lachrymal sac.

(Hernia of the lachrymal sac.)

2431. In some cases of chronic inflammation of the derivative lachrymal passages, the sac becomes much dilated and relaxed, its wall being at the same time thickened, so that the tears and mucus accumulate in it in very considerable quantity, even although the nasal duct be not obstructed. The swelling at the inner corner of the eye, produced by this state of the sac, is soft and without pain; and the skin is in general not at all discoloured.

2432. By pressure on the sac, the accumulated tears and mucus may be expelled both through the puncta into the eye, and through the nasal duct into the nose. By holding the face down while the pressure is made on the sac a considerable quantity of fluid will sometimes drop from the nose.

2433. *Treatment.*—The first object in the treatment is to improve the state of the mucous membrane of the derivative lachrymal passages, and this is to be attempted by the use of astringent lotions dropped into the lacus lachrymalis to be absorbed, or injected at once into the passages through the puncta by means of Anel's syringe.

2434. Frequent and continued pressure over the sac is of great use. The patient, if properly instructed, may effect this himself with his finger, in a manner superior to what can be done by any of the *compressoria* which have been invented for the purpose.

2435. When the relaxation is very great, it has been recommended to lay bare the sac, and remove with the scissors an elliptical-shaped piece of its wall.

2436. Should the state of the mucous membrane not be improved by the treatment, and should, on the contrary, the nasal duct come to give passage to the tears less readily, then it will be proper to consider the propriety of opening the sac by incision, in order to operate directly on the nasal duct, in the manner to be treated of below.

Mucocele.

(Dropsy of the lachrymal sac.)

2437. Mucocele is a swelling, of variable size, sometimes livid, generally elastic, in the situation of the lachrymal sac, not at first, though it may come at last to be very painful to the touch.

2438. When pressure is applied, there is no escape of any matter, either by the puncta or by the nasal duct; this and the canaliculi being impervious.

2439. This disease appears to depend on the slow accumulation of the mucous secretion of the sac itself in a case of relaxation of the sac in which the canaliculi and nasal duct have become obstructed.

2440. A mucocele may exist for a long time—for years—without discoloration of the skin, without pain, elastic, and with an indistinct fluctuation, but may become enlarged, hard, livid, and painful, from an attack of inflammation in the part.

2441. The contents of the distended sac are fluid in the earlier stage, but of a gluey consistence from inspissation in one more advanced.

2442. *Treatment.*—The treatment consists in first laying open the tumour with a knife, evacuating the contents of the sac, and then injecting tepid water to clear it out completely. If the contents are consistent and gluey, it will be necessary to scoop out the mass before injecting the water.

2443. The sac having been cleared out, the next business is to examine the state of the canaliculi and nasal duct, and to treat them in the manner to be described below.

Fistula of the lachrymal sac.

2444. After the evacuation of an abscess of the lachrymal sac by bursting or incision, if the lining membrane still continue unhealthy, and the nasal duct obstructed, the opening into the sac, though it contracts, does not entirely close, but remains in a fistulous state with callous edges.

2445. The fistulous opening in the skin may correspond with that of the sac, or the communication between the two openings, may be through a sinus. There may be more than one opening in the skin with a corresponding number of sinuses.

2446. Sinuses of this description are to be distinguished from sinuses in the same situation not communicating with the sac, or, at least, not originally communicating, and resulting from phlegmonous erysipelas at the inner corner of the eye

(s. 2394, et seq.) Sinuses thus arising, it is to be observed, however, sometimes penetrate inwards by ulceration of the wall of the sac.

2447. Sinuses at the inner corner of the eye not communicating with the sac are to be treated as simple sinuses. Those communicating with the sac by ulceration from without may be treated in the same way, provided the lining membrane of the sac has not become otherwise diseased.

2448. True fistula of the lachrymal sac is to be closed only after restoration of the passages to a healthy state if that is possible; if not, the palliative treatment described below, must be had recourse to.

Atony or relaxation of the papillæ with a dilated state of the puncta.

2449. The puncta may be found dilated, with the papillæ relaxed, and not properly directed towards the lacus lachrymalis. This state is usually found connected with some chronic inflammation of the conjunctiva of the blennorrhœal kind. There may also be present defective action of the tensor tarsi muscle and of the orbicularis.

2450. *Treatment.*—The application to the parts of the drops of the nitrate of silver, or of the lapis divinus with vinum opii (s. 128).

Shrunk papillæ and contracted state of the puncta.

2451. When the lachrymal puncta are contracted, the first object should be to endeavour to dilate them, and for this purpose a common pin, of a proper thickness, rendered blunt and smooth at the point by rubbing on a whetstone, is a very good instrument.

2452. *Lower punctum.*—The patient being seated before a window, the surgeon holds the edge of the lower eyelid, towards the inner angle, a little depressed and everted with one hand, so as to bring into view the punctum, while with the other he introduces the point of the pin, with a rotatory movement between his thumb and forefinger, into the lower punctum downwards in the direction of the vertical portion of the corresponding canalicule, into which he passes it a little way.

2453. *Upper punctum.*—The operation on the upper punctum is the counterpart of this but not quite so simple. The upper eyelid towards the inner angle being held raised and everted, so as to expose the punctum, the blunt pointed pin is introduced into it, and pushed with a rotatory movement upwards in the

direction of the axis of the vertical portion of the corresponding canalicule.

2454. The operation is to be repeated with thicker and thicker pins if necessary, until the puncta are sufficiently dilated to admit easily a moderately-sized Anelian probe for the exploration of the canaliculi.

Obliteration or obstruction of the lachrymal points or canalicules.

(Atresia of the lachrymal points.)

2455. *Exploration of the canalicules.*—The instrument employed is a slender gold probe, commonly called Anel's probe. The first steps in the operation are the same as in that of the introduction of the blunt-pointed pin into the puncta just described.

2456. *Lower canalicule.*—Having entered the probe, held lightly between the thumb and forefinger, into the punctum, and pushed it downwards to the dilated bottom of the vertical part of the canalicule, that is, to the depth of about one-tenth of an inch, withdraw it a little and change the vertical direction of the probe downwards for a horizontal one inwards, or rather for one deviating from the horizontal inwards, so as to be slightly oblique from below upwards, which is the direction of the second part of the canalicule. At the same time that the direction of the probe is thus altered, the inner part of the lower eyelid is to be stretched, by the finger holding it, towards the temple, and pressed slightly more downwards, in order as much as possible to undo the curvature of the canalicule.

2457. *Upper canalicule.*—Having pushed the probe upwards to the dilated bottom of the vertical portion of the canalicule, and then withdrawn it a little as above directed for the lower canalicule, the change of the vertical direction of the probe upwards is to be made for one deviating so far only from the horizontal inwards, as to be slightly oblique from above downwards. At the same time that this is being done, the inner part of the upper eyelid is to be stretched towards the temple and somewhat more upwards, with the same view as that for which the analogous proceeding in the case of operation on the lower canalicule is directed.

2458. The manœuvre just described being performed, whether in the case of the lower or upper canalicule,—and it is the work of a second or two only—the probe is pushed on towards the lachrymal sac.

2459. If there be actual obliteration of the canalicule in some

part of its course, the probe will be arrested in its progress towards the lachrymal sac. But it must not be too hastily inferred that obliteration exists, when the probe is so arrested. Often by delicate manipulation and rotation of the instrument, it is at last made to pass on into the sac, showing that, though there is stricture or obstruction from tumefaction of the lining membrane, there is no obliteration.

2460. *Obliteration*, when it exists, is generally the result of a wound or burn, which has implicated the canalicule, and of which the scar may be still observable. If one canalicule only be obliterated, the tears may continue to pass without interruption by the other; hence, no surgical interference will be required. Obliteration of both canalicules gives rise to stillicidium lachrymarum.

2461. Obstruction of the canalicules from inflammatory tumefaction may exist independently of a similar affection of the derivative lachrymal passage in general, though most frequently it is a part merely of a general affection of those passages. But, on the other hand, it is to be remarked, that the canalicules may be, and very frequently are little or not at all affected when the lachrymal sac and nasal duct are much affected.

2462. This is shown by what is ordinarily the case in chronic inflammation of the passages, viz., that the tears are taken up and conveyed into the sac, and not having a passage to the nose on account of the obstruction of the nasal duct, accumulate there, and, intermixed with streaks of puriform mucus, may be readily regurgitated through the puncta, by pressing on the sac (s. 2416).

2463. Although, in obstruction of the canalicules from tumefaction of the mucous membrane, a probe might be made to pass, the swollen membrane would, when the probe was withdrawn, again fill up the canal. In such a case, therefore, the introduction of a probe would be useless, if not positively hurtful. The obstruction is to be overcome only by removing the inflammatory and thickened state of the membrane on which it depends.

2464. *Treatment when both canalicules are obliterated.*— Between the place of obliteration and the sac, the canalicule is to be opened from within, by removing, along with a fold of the conjunctiva as it is passing into the skin, a portion of its inner wall with the curved scissors, and an attempt made to maintain the opening next the sac patent, by keeping a probe more or less constantly in it during cicatrization.

2465. Jüngken* appears to have succeeded, by such an operation as this, in curing a young man in whom a burn of the inner corner of the eye with a hot iron, by which he was struck, had occasioned obliteration of the canaliculi, with adhesions between the internal commissure of the eyelids, the lachrymal caruncle, and the semilunar fold.

2466. Velpeau mentions that he has seen in two persons who had the canalicules accidentally cut during some other operation, that the tears were taken up by the accidental opening, so that no inconvenience resulted.

2467. If the operation has not succeeded, or if it cannot be performed on account of proximity of the obliteration to the sac, it has been proposed to make an opening into the sac from within the lower eyelid through the conjunctiva, and endeavour, by catgut bougies, to keep it permanently open.

2468. The lower eyelid being held everted, the sac is opened by thrusting the knife into it from the groove between the caruncle and lower eyelid.

2469. If this also is unsuccessful, the case, as far as regards the transmission of the tears to the nose, is incurable.

Exploration of the nasal duct, to determine whether it is obstructed or obliterated.

2470. In obstruction to the transmission of the tears from the eye into the nose, attending any of the affections of the derivative lachrymal passages above described, if we have satisfied ourselves that the puncta and canaliculi are not in fault, we naturally direct our attention to the nasal duct.

2471. The nasal duct is much more frequently obstructed or wholly impervious than any other part of the derivative lachrymal passages. This, as above mentioned, (s. 2417,) appears to depend, in a great measure, on the circumstance, that when its lining mucous membrane is tumefied or thickened, the space necessarily required for the increase of bulk is taken at the expense of the calibre of the duct itself, no distension outwards being permitted by its bony walls. Lymph being thrown out in this state, either within or without, permanent obliteration results.

2472. Exploration of the nasal duct may be made in three different ways, viz.—1. By an Anelian probe introduced through the upper [or lower] punctum and canalicule into the sac, and thence down into the nasal duct. 2. By the introduction of a probe, properly curved for the purpose, from the nose.

* Motherly, Diss. de atresia punctorum lachrymorum. Berolini, 1834.

3. By the introduction of a probe through an opening into the sac, either already existing, or made for the purpose, below the tendon of the orbicularis palpebrarum.

2473. *Exploration of the nasal duct by an Anelian probe introduced through the upper punctum and canalicule into the sac, and thence down the nasal duct.*—Having, in the manner above described, (s. 2457,) passed the probe through the upper punctum along the canalicule as far as the sac, it is to be raised to a direction deviating from the vertical only by the point of the instrument being inclined backwards and slightly outwards, which is the direction of the nasal duct. By now pushing the probe down with a rotatory movement between the fingers, it will, if the duct be not closed, or very much obstructed by fungous granulations, come to strike on the floor of the nostril.

2474. In regard to the direction just given to incline the point of the probe backwards and slightly outwards, it is to be observed, that the backward inclination of the point will generally without any care on the part of the surgeon, be determined by the prominence of the eyebrow.

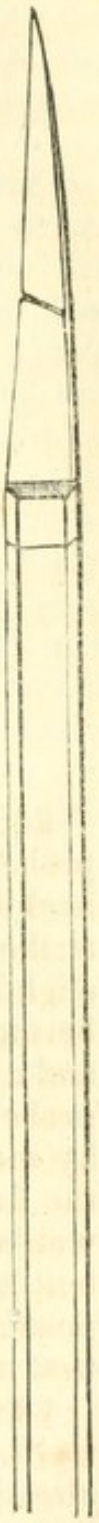
2475. *Exploration of the nasal duct by the introduction of a probe from the nose.*—Gensoul's sound, the instrument for the performance of the operation, is a probe bent, but not abruptly, at nearly a right angle, at the distance of about nine-tenths of an inch from the point. Close to this bend there is in the handle part of the probe a slight lateral one, to the right or left according to the nostril operated on, in order that the instrument may be accommodated to the projection of the nasal process of the superior maxillary bone.

2476. It is to be remembered that the lower orifice of the nasal duct is in the anterior and upper part of the lowest meatus, at the lateral wall of the nasal cavity, and about one inch from the entrance of the nostril; that it is overhung by the lower spongy bone, and that it is of the form of an oblique fissure looking downwards and inwards.

2477. The instrument is introduced into the nostril with its point and first concavity directed downwards and outwards. In this position the point is run along the floor of the nostril as far as the first bend. It is then to be elevated and grazed along the outer wall of the nostril towards the orifice of the duct; in executing this manœuvre, the handle of the instrument is with great delicacy to be carried from its original direction, outwards and somewhat downwards, to a horizontal direction, forwards, and this by slightly rotating the handle of the instrument between the fingers, and executing a curved sweep from

below upwards. If there is no obstruction, the instrument is thus made to slip into the duct, and its end may be felt by applying the finger over the sac.

Fig. 83.



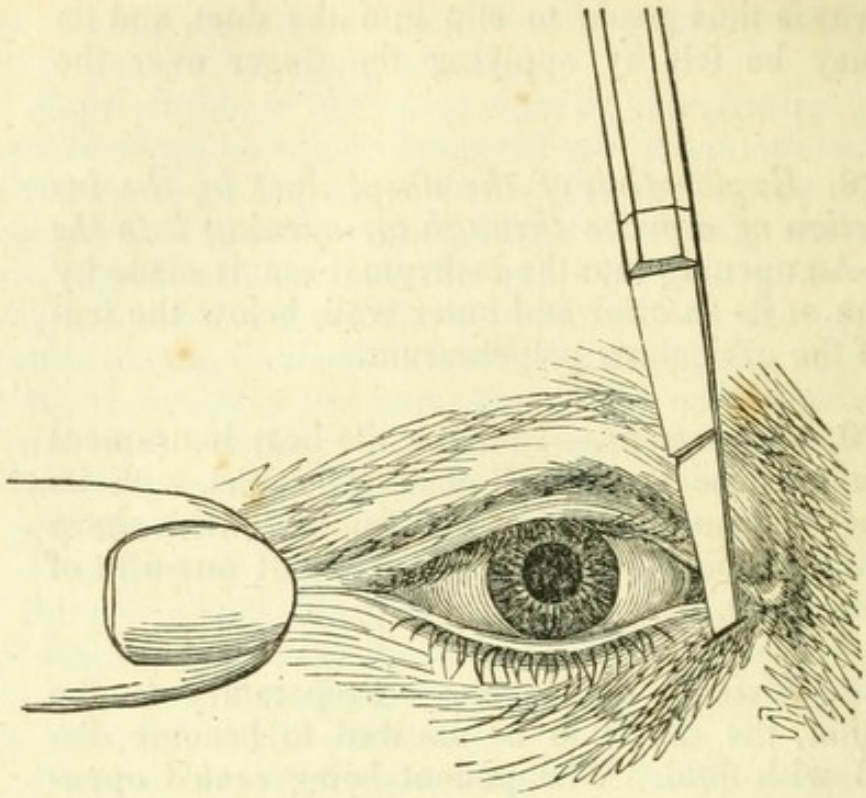
2478. *Exploration of the nasal duct by the introduction of a probe through an opening into the sac.*—An opening into the lachrymal sac is made by incision of its anterior and outer wall, below the tendon of the orbicularis palpebrarum.

2479. *Instrument.*—Perhaps the best instrument for the purpose is a small narrow scalpel with its back beveled on either side, and running into a sharp edge at the point for the extent of about one-fifth of an inch. Fig. 83.

2480. *Incision of the sac.*—Preparatory to the operation, the sac is to be allowed to become distended with fluid. The patient being seated opposite a window, the assistant, who stands behind holding the head, is to press the skin at the outer angle of the eye towards the temple, in order to stretch the skin over the sac, and thus to bring prominently into view the tendon of the orbicularis palpebrarum to serve as a guide. Fig. 84.

2481. The surgeon having touched and felt the part over the sac with his finger, takes the knife between his thumb and fore and middle finger, and proceeds to the penetration of the sac. The point of the knife is directed perpendicularly to the surface of the skin, i. e., backwards and inwards, over the wall of the sac below the tendon of the orbicularis, its edge being directed outwards and somewhat downwards. The knife in this position having been made to penetrate the sac, which is known by the escape of fluid and cessation of resistance, its handle is to be raised, and then the point pushed down a little way within the sac in the direction of the nasal duct. By the increasing breadth of the knife, a sufficiently large opening is made obliquely across the sac parallel to the margin of the orbit, but in withdrawing the knife the external incision may be enlarged a little outwards and downwards.

Fig. 84.



2482. *Introduction of the probe.*—Direct the point of the probe, a whalebone one is the best, held nearly horizontally backwards and inwards through the opening in the sac until it strikes upon its opposite wall. Then withdrawing the probe slightly, direct its point downwards to the nasal duct, remembering that its direction is downwards, backwards, and outwards, and also slightly curved, the convexity being forwards. If the probe does not readily pass, it should not be forced down, but by moving about the point and rotating the instrument between the fingers and thumb, at the same time that pressure downwards is gently made, it will probably at last pass. If not, a tent is to be left in the opening into the sac, and the trial repeated next day. A whalebone probe is to be employed in the first instance, a silver one in the second.

2483. *Procedure when a fistulous opening already exists in the sac.*—If a fistulous opening leading directly into the sac already exists, and if of sufficient size, the probe may be at once introduced through it into the nasal duct. Or if very small, it may be dilated by a succession of thicker probes; but it is better to use the knife, either as above directed, including the fistulous opening in the incision, or entering a small grooved director into the fistulous opening, to enlarge it, by cutting on one or other side, or both if necessary, the lower side first.

2484. If the opening in the skin does not correspond with that in the sac, the director should be introduced through the former into the sinus. This being laid open to its bottom, the director is introduced into the opening in the sac, for the purpose of enlarging it by incision, as just directed.

2485. *Appreciation of the three different ways above described of exploring the nasal duct.*—All that can be ascertained by means of Anel's probes introduced through the puncta, canalicules and sac, into the nasal duct, is that this canal is or is not permeable to a probe necessarily very much smaller than its own diameter. But in consequence of the winding form of the canal along which the small probe is passed, there cannot be, except in very practised hands, much certainty whether an impediment which the probe may encounter be owing really to an obstruction in the nasal duct, or merely to the circumstance, that the small point of the probe has been caught in a fold of the lining membrane. Again, though the probe passes, there may, nevertheless, be obstruction sufficient effectually to prevent the passage of the tears into the nose. For these reasons, and for the violence done to the punctum and canalicule, this mode of exploration is not to be recommended.

2486. As little is the operation to be recommended as a means of removing the obstruction. Such a small probe must be totally inefficient as a means of dilatation, or as a means of removing any obstruction that would continue to oppose the passage of the tears. And the few cases in which it is alleged benefit was obtained from the practice, were of a slight nature, and most likely would have been benefited without recourse to any such measure.

[Our experience has led us to a different estimate of the treatment of obstruction of the lachrymal passage by Anel's probes, from that expressed by our author. It is that which we have for some years employed and with very satisfactory results. These passages may be sufficiently dilated with Anel's probes, skilfully and perseveringly used, and with less suffering to the patient than is inflicted in the operation of Petit.]

2487. In regard to the exploration of the nasal duct by the introduction of a probe from the nose, it is to be observed that the lower orifice of the duct is not always readily hit upon by the point of the probe. It is, therefore, in most hands, an uncertain mode of exploration, and not well adapted as a means of removing obstruction of such a nature as that which affects the nasal duct. Besides, the introduction of the instrument is very painful.

2488. According to the concurrent testimony of practical men, the best plan, as well for the exploration of the nasal duct as for the application of means calculated to remove or palliate obstruction of it, is to operate through an opening made into the sac from without, as first suggested by Petit.

2489. When in the exploration of the nasal duct above described, the whalebone probe can be pushed down into the nose without any marked opposition, the surgeon merely feeling as if the probe were closely grasped by the walls of the passage, it may be inferred that the obstruction to the passage of the tears is owing to a general tumefaction or a somewhat fungous state of the lining membrane.

2490. When considerable manipulation and rotation require to be made before the probe passes, or when it is only after repeated attempts on successive days that the probe is made to pass at all, thickening of the mucous membrane with fungosities and granular growths must exist to a very considerable degree.

2491. When the probe cannot be made to pass at all into the nose, obliteration of the duct is of course to be inferred. The place of obliteration will be ascertained by the extent to which the probe can be made to pass.

2492. It is to be remembered that in some cases complete obliteration of the nasal duct has been found to depend on exostosis of the surrounding bone. The lachrymal sac, on being opened, has been found filled up with a polypus, which was the cause of the tumour. In this case, which is related by Walther, on the removal of the polypus the nasal duct was on exploration found obstructed, but was rendered permeable by the treatment.

Obstruction of the nasal duct and the different operative methods adopted with a view to remove it and to restore a passage to the tears.

2493. The introduction of meshes of thread, catguts, and styles, are the means by which dilatation of the nasal duct is attempted.

2494. *The mesh as a means of dilating the nasal duct.*— The mesh, composed of a less or greater number of silk threads, is drawn into the nasal duct from the nose by means of a loop of thread, which has been previously introduced into the passage for the purpose in the manner immediately to be described.

2495. It has been proposed to draw the mesh into the duct, without any opening into the sac, by conveying the looped thread by which the mesh is to be drawn in, by means of a

fine flexible probe with an eye, through the upper punctum and canalicule, and thence through the sac and duct into the nose. To the end of the double thread, hanging from the nose, the mesh was to be linked. By now drawing the end hanging from the punctum, the mesh would be drawn from the nose into the nasal duct. In such a proceeding, however, the canalicule and punctum must necessarily be much injured by the drawing of the thread. In fact, to say nothing of the imperfect manner in which the object can be effected by them, all such attempts to operate through the puncta and canalicules are attended with more pain and trouble than the making of an opening into the sac when one does not already exist, and operating through it on the nasal duct.

2496. *The introduction of the mesh.*—An opening into the sac already existing or having been made, a double thread is drawn through it and along the nasal duct into the nose, by means of the flexible eyed probe. But as particular instruments are required to catch hold of the probe within the nose, in order to draw it out and after it the thread with which it is armed, a bit of catgut will be found a more simple and efficient apparatus.

2497. The bit of thin catgut, softened at the end by chewing, is introduced through the opening into the sac, and from thence through the duct into the nose. Some length of it having been pushed down, it is to be either forced out from the external nostril by the patient's expiratory efforts through that nostril, while the other is closed, after the catgut has lain some time and become softened by the absorption of moisture, or at once drawn out by means of a blunt hook introduced into the lowest meatus and drawn out while grazing the lower and lateral wall of the nostril.

2498. To the end of the catgut the ends of a long loop of thread are to be tied, and by means of it drawn up from the nose through the duct out of the opening in the sac; the loop being alone left hanging from the nose. A mesh of silk threads of such a thickness as the previous exploration of the duct has shown will be admitted, is linked by doubling into the loop of thread and by means of the ends of this which are hanging out from the opening in the sac, drawn into the nasal duct as high up as, but not into, the sac.

2499. The end of the mesh hanging from the nostril, left of a sufficient length to hold by when the mesh comes to be drawn out, may be rolled up and thrust a little way into the nostril to be out of sight, but so as it may be easily caught hold of again. The ends of the loop of thread hanging from

the opening in the sac are to be coiled up and retained by means of a patch of court plaster on the side of the root of the nose. The loop will be required again for drawing in new meshes.

2500. When the mesh has lain two or three days in the duct, it is to be withdrawn and a new one introduced. For this purpose, the ends of the loop of thread plastered to the side of the root of the nose are to be set free, and the end of the mesh lying within the external nostril caught hold of. By pulling it down, the mesh is withdrawn from the duct and along with it the looped end of the thread by which it had been drawn up. The old mesh is now to be removed from the loop, and a new and thicker one if necessary linked on and drawn up into the nasal duct as before.

2501. This is to be repeated, a thicker and thicker mesh being used every now and then, until a sufficient amount of dilatation is believed to have been attained. The readiness with which coloured water injected into the sac flows through the nasal duct into the nose will give some information on this point.

2502. *The catgut as a means of dilating the nasal duct.*—It has been above said, that the introduction of a mesh into the nasal duct from the nose, by drawing the loop thread through the canalicule and punctum, is not to be recommended. To this it may be added, that when we have an opening into the sac to operate from, the mesh may be well substituted by a catgut or style.

2503. In using the catgut, there is no occasion for the coil employed by Beer. A piece of catgut of proper thickness and sufficient length—say one and a half inch—having one end rounded and slightly softened, by being moistened, and bent abruptly at about a quarter of an inch from the other end, will serve the purpose. By the rounded and softened end the catgut is introduced in the same way as a style or probe, through the opening of the sac into the duct, and pushed down in it to the nostril. The bent end is left sticking out from the opening in the sac, and by a thread attached to it and fixed to the side of the nose by court plaster, is secured from slipping in through the opening into the sac.

Fig. 85.

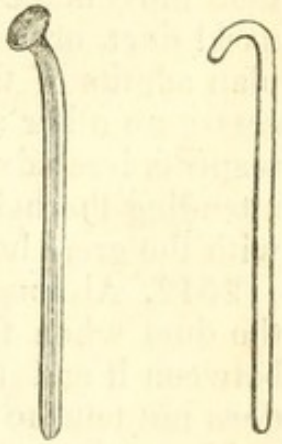
2504. The catgut is much less convenient than the style, and is to be recommended only when it is desired to exert gradually increasing pressure on the walls of the duct from within. When introduced

dry, and of a thickness readily admitted by the duct, the catgut gradually swells by absorbing moisture, and produces the pressure. If the catgut when dry is so thick as to be admitted by the duct, and no more, the pressure from within which ensues on the distension of the catgut by moisture, may be so great as to cause very considerable pain. This will be avoided, by so regulating the thickness of the dry catgut to the width of the duct, that the former shall be readily admitted by the latter.

2505. The catgut is to be removed every day or two and a new bit introduced, and of greater thickness, if necessary. When withdrawn, the swollen catgut presents a more or less distinct cast of the nasal duct, and from it something may be learned as to the seat and form of any stricture or fungosity which may exist. It is to be remembered, that it will always be constricted at the places which correspond to where the sac joins the duct, and where the latter opens into the nose.

2506. *The style as a means of dilating the nasal duct.*—The form and size of the style are well known (fig. 86). It is usually made of lead or silver. One may be easily made for an occasion, by taking a bit of lead wire of the proper length and thickness, smoothing its surface, rounding one end and bending the other, thus : (fig. 87.)

Fig. 86. Fig. 87.



2507. A thinner style is to be followed by a succession of thicker ones, until one of a moderate thickness can be borne ; or the duct may be first prepared for the reception of a moderately thick style by the previous use of catguts, as above described.

2508. The patient soon learns to manage the metallic style himself—a great advantage, considering the length of time the employment of means for dilating the nasal duct requires to be persisted in.

2509. Whatever be the means employed for dilating the nasal duct—mesh, catgut, or metallic style—the passage is to be cleansed on every reapplication by injections of tepid water. After which some astringent lotion is to be thrown in, or the dilating body may be employed as the vehicle of some medicament, in the form of salve, with which, when about to be introduced, it is to be smeared. The bichloride of mercury collyrium, and the red precipitate ointment, are perhaps the best applications, in general, that can be made to the diseased mucous membrane of the duct. The nitrate of silver, in the form of

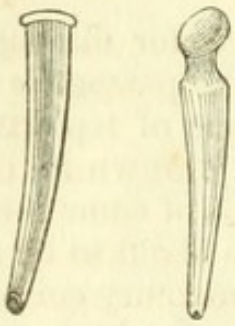
solution or ointment, will be found advantageous when used occasionally.

2510. When by the above described mode of treatment, which must be persevered in for at least three months in any case, but often for a much longer time, the nasal duct is dilated to its natural width, and it is believed that its lining mucous membrane is restored to something like a healthy state, the use of the dilating bodies is to be discontinued. If the transmission of the tears into the nose should now go on naturally, the opening in the sac is to be left to close; for this purpose the edges are to be touched with caustic, and when rendered raw by the separation of the eschar, closure will generally take place, provided the tears pass freely.

2511. If the tears do not continue to be freely transmitted, the treatment will require to be resumed, and if it is found, after several trials, that the employment of the style, &c., cannot be abandoned without recurrence of the obstruction, then the patient must make up his mind to wear the style habitually in the nasal duct, or to have a gold tube inserted into it. The latter plan admits of the opening into the sac being closed, but possesses no other advantage over the style, in fact, is in all other respects less advantageous. The inconvenience and deformity attending the habitual use of the style are small in comparison with the great benefit obtained from it.

2512. Although the style may occupy the whole calibre of the duct when first inserted, a sufficient space is always left between it and the wall of the duct, as the mucous membrane does not tend to grasp the style as the gum grasps a tooth, but rather tends to widen around it. This shows that it is unnecessary to have the style grooved to serve as a channel for the tears, as some have recommended.

Fig. 88. Fig. 89.



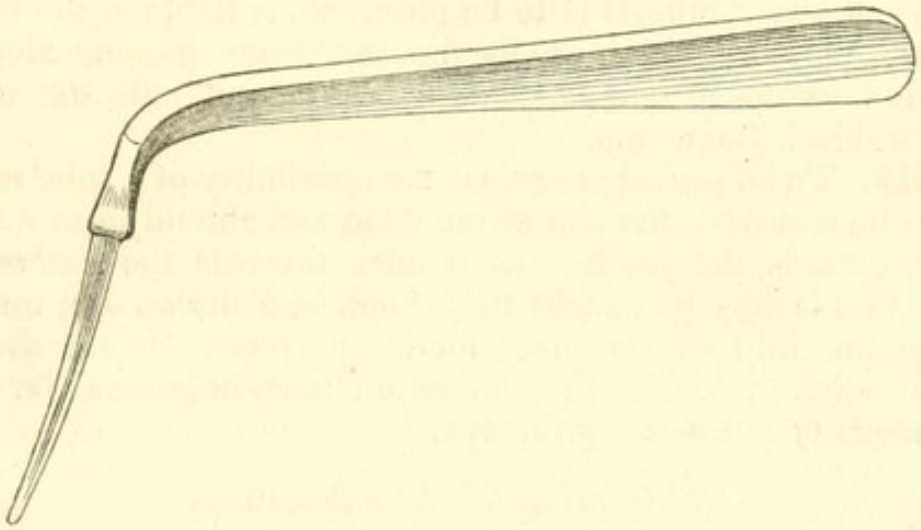
2513. *Insertion of a gold tube into the nasal duct and lower part of the sac.*— As it is with the intention of its being left permanently in the nasal duct that the tube is introduced, the opening into the sac is closed over it.

2514. *Tube.*—The tube which has been principally used of late years, since Dupuytren revived the practice of Foubert and Wathen, is of the form and size represented in the annexed cut (fig. 88).— The tube originally used by Wathen is here represented (fig. 89); and from its appearance it may readily be understood that

it would require much force to fix it properly in its place ; the projection below the cup or head being of greater diameter than the duct itself; and how that in pressing the instrument into its place, the force employed breaks the os unguis.

2515. Dupuytren's tube is certainly the best. It is about an inch or so long ; at one end, one-sixth of an inch wide, and provided with a rim, intended to be caught by the contraction between the sac and duct; at the other end, about one-twelfth of an inch wide, and cut obliquely. For the purpose of being introduced, it is slid on the styliform part (*a*, fig. 90), of the

Fig. 90.



conductor or handle here represented, which fits into it so loosely, that when the tube is fixed in the duct, the conductor or handle may be withdrawn without bringing the tube along with it. The curvature of the styliform part of the conductor necessarily determines the proper direction of the tube as regards its curvature when inserted into the duct.

2516. *Mode of introducing the tube.*—Having enlarged the opening in the sac by incision, the tube, mounted on its conductor, is to be passed into the sac, and thence slid down into the duct, its wide end remaining in the lower part of the sac, and the concavity of its curvature directed backwards. The tube is thick in proportion to the duct, as in order to be retained in its place it requires to be wedged in, and for this some force is necessary. The tube being thus fixed, the conducting handle is withdrawn from within it. The edges of the incision into the sac are then brought together by a bit of plaster.

2517. The tears are immediately freely transmitted into the nose, and in a day or two the opening into the sac will have

closed, even where there had previously been a fistulous opening. In general no further inconvenience is felt; no deformity is seen, and so the patient is dismissed cured, and may continue in the belief that he is so for years.

2518. Thus does the insertion of a tube into the nasal duct appear a speedy and elegant mode of effecting a cure, without deformity, or the inconveniences attending obstruction of the nasal duct. But it has often happened that, sooner or later, the tube has been pressed up out of its place, caused irritation, or so much aggravated irritation, excited by other causes, that its extraction became necessary; or the bony structures around the duct having become carious, the tube has dropped out by the nose. A silver tube, it is to be observed, is liable in the course of time to be so acted on by the secretions passing along it, that it becomes decomposed and brittle, and falls out of the nose in black fragments.

2519. To be provided against the possibility of a tube requiring to be removed, the rim at the wide end should form a slight ledge towards the interior as it does towards the exterior, in order that it may be caught by a hook and drawn out through an opening into the sac made for the purpose. In the absence of any such provision, the extraction may in general be made by means of a dissecting forceps.

Obliteration of the nasal duct.

2520. When on exploration it is found that the nasal duct is quite closed, but to a small extent only, a cautious attempt may be made to perforate the obliterated part by means of a stylet introduced through the opening in the sac down to the place of obliteration. If perforation be successfully effected, a style is to be inserted into the duct as above directed.

2521. If the obliteration be to any extent, which is rare, there is not much chance of successfully perforating it; the only thing that could now be had recourse to, is the old operation of perforating the os unguis, and trying to establish a communication between the sac and middle meatus of the nose, were it not that success seldom or never crowns the attempt.

2522. Perhaps the best palliative measure that can be adopted is to make an opening into the sac above or below the tendon and maintain it permanently. Through this opening the tears and matter accumulated in the sac may be occasionally pressed out, and thus the irritation to the eye avoided which would result from regurgitating them by the puncta.

2523. It was the practice of the older surgeons who did not

understand the anatomy, physiology, and pathology of the lachrymal organs, to attempt the obliteration of the whole lachrymal passages, on the principle of striking at the root of the disease by removing its seat.

Lachrymal calculi.

(Dacryolites.)

2524. Calculous concretions deposited from the tears have been met with, in some cases, lodged in the sinuses of the oculo-palpebral space of the conjunctiva, in other cases in the derivative lachrymal passages.

CHAPTER X.

DISEASES OF THE ORBIT.

SECTION I.—INFLAMMATIONS, &c., OF THE ORBIT.

Inflammation of the orbital cellular tissue.

2525. This inflammation occurs in an acute or chronic form.

2526. In the *acute* form, the *symptoms*, *objective*, *subjective*, and *constitutional*, are very much the same as those of phlegmonous panophthalmitis above described (ss. 925 *et seq.*), but the eyeball is more protruded from the orbit, in consequence of the greater exudation into the orbital cellular tissue, and either presents no evidence of inflammation of its proper tunics or comparatively slight ones.

2527. In the *chronic* form, protrusion of the eyeball may have been preceded by no other symptom, or, at the most, by inconsiderable and partial pain in the orbit, during motion of the eyeball.

2528. Inflammation of the orbital cellular tissue has a great tendency to run into suppuration. This, however, does not always take place; the inflammatory action may subside, the exuded matter be absorbed, and the eyeball return to its place; or the cellular tissue may be left in a state of induration, the eyeball, perhaps, become amaurotic from pressure, continuing protruded and motionless.

2529. In the *acute* form, when suppuration takes place, the subjective symptoms are also much the same as in the suppurative stage of panophthalmitis, but as may be inferred from the

difference in the seat of the matter, the objective differ. The eyeball is still more protruded, but perhaps not otherwise much changed in appearance. The matter having made its way forwards, fluctuating points present themselves either behind the conjunctiva or behind the skin of the eyelids, or in both situations at the same time.

2530. In the *chronic* form, that suppuration has taken place may be inferred, if the patient has experienced shiverings, &c., though suppuration may not be ushered in by any marked symptoms. As matter accumulates, the protrusion of the eyeball increases; the eyelids, red and œdematous, are distended over it, and, besides diminishing vision with photopsy and diplopy, the patient complains of a feeling of traction in the orbit. At length, more or less obscure fluctuation is felt at some point between the eyeball and margin of the orbit.

2531. *Causes.*—Inflammation of the cellular tissue of the orbit, which is a rare disease, is sometimes of traumatic origin. More frequently it appears to arise from cold in persons labouring under a bad state of health or constitution. In erysipelas of the eyelids, the inflammation is apt to spread to the cellular tissue of the orbit, and terminate either in induration or in diffuse abscess. In many cases the inflammation occurs without any very evident cause.

2532. *Prognosis.*—Whether the inflammation proceed to suppuration or not, recovery with preservation of vision may take place, but on the other hand, it sometimes happens that amaurosis is occasioned by the pressure to which the eyeball has been subjected. In the acute form there is additional risk of injury to the eye from implication of its proper tunics in the inflammation, but a still more formidable event is the extension of the inflammation to the brain or its membranes, which may prove fatal.

2533. *Treatment.*—The same active antiphlogistic treatment above indicated for phlegmonous panophthalmitis (s. 935) in its first stage, is called for in the acute form of inflammation in the orbital cellular tissue.

2534. In the chronic form the alterative plan of treatment is indicated.

2535. In the second stage of the inflammation, when abscess has formed, the matter is to be evacuated by incision at the fluctuating points.

2536. If, as may happen in the chronic form, there is no fluctuation, but from the protrusion of the eye, and other symptoms, there is reason to fear that accumulation of matter in the cellular tissue of the orbit exists, an incision should be cautiously

made into the orbit through the skin, between the margin of the orbit and the eyeball, in the situation where it appears most likely matter is collected. It may be necessary to extend the incision to a considerable depth—as much as an inch—before the matter is reached.

2537. After the abscess has been opened, matter may continue to be discharged for a considerable time, though there be no disease of the bone.

Inflammation of the periorbita and bones of the orbit.

2538. This inflammation sometimes occurs in an acute form, but more frequently in a chronic, and may present itself as a primary affection, or as a consequence of inflammation of the orbital cellular tissue.

2539. The symptoms are in general similar to those of inflammation of the orbital cellular tissue, but vary somewhat according to the part of the orbit affected, which may be the exterior margin, just within the cavity, the lachrymal fossa, the middle part of one of the walls, or the apex, and suppuration is equally prone to take place. The inflammation may, however, terminate in resolution, or, in the chronic form especially, its event may be thickening of the periorbita and bones.

2540. When suppuration takes place, and the abscess has been opened, either by spontaneous bursting or the knife, the opening does not close, but becomes fistulous, and surrounded by fungous granulations, and on examination with the probe, the bone is felt to be in a state of caries or necrosis.

2541. *Causes.*—The inflammation may be traumatic, but generally it is owing to a scrofulous or syphilitic taint of the constitution, or both at the same time.

2542. *Prognosis.*—When the bones of the orbit have become diseased, exfoliation may after a time take place, and allow of the external opening closing, but the skin, already, perhaps, drawn in towards it, becomes still more so, and the eyelid retracted and incapable of being drawn over the eye (*lagophthalmos*, s. 2235), or both retracted and everted (*ectropium*, s. 2168).

2543. *Treatment.*—The treatment of the acute and chronic forms of inflammation of the periorbita, and of the bones of the orbit should be the same as that recommended respectively for the acute and chronic forms of inflammation of the orbital cellular tissue, in the purely inflammatory stage, and in the stage of abscess.

2544. In the stage of fistula, the indication is to promote

exfoliation of the bone, according to general surgical principles, and this being effected, the next point is to prevent distortion of the eyelids, or, if this has already taken place, to remove it by some one of the operative procedures described under the heads of *ectropion* and *lagophthalmos*.

Section II.—ORBITAL GROWTHS AND TUMOURS.

2545. *The symptoms and effects of orbital growths and tumours*, are:—1. Misdirection, displacement, and protrusion of the eyeball in various degrees, (*exophthalmus.*) 2. Impaired mobility to a greater or less extent. 3. Sometimes little or no pain, but a feeling merely of fulness, tension, and traction. Sometimes, however, more or less pain. 4. Besides diplopy, as the necessary effect of misdirection of the eyeball, impairment of vision, with photopsy, even to amaurosis, from the pressure. 5. Œdema of the eyelids, with more or less distension of the upper and eversion of the lower. 6. Sometimes eventual inflammation and disorganization of the eyeball, (*exophthalmia.*) 7. Dilatation of the orbital cavity, and destruction of its walls, and consequent fatal pressure on the brain, the eyeball, perhaps, continuing to resist the pressure.

2546. Orbital growths and tumours may have their seat in the walls of the orbit or in its cavity. The growths and tumours seated in the walls of the orbit, are *node*, or *periostosis*, thickening of the bone, or *hyperostosis*, bony tumour, or *exostosis*, and cancer, or *osteosarcoma*. Those which occur in the cavity of the orbit are:—sarcomatous, encysted, hydatidgenous, medullary, melanotic, and aneurismal.

2547. Both walls and cavity of the orbit may be encroached on by tumours having their origin in adjoining cavities—the nostril, frontal sinus, maxillary sinus, sphenoid sinus cavity of the cranium.

2548. The tumours which it is intended to consider here, are those only which form in the cavity of the orbit.

2549. *Causes.*—The causes of orbital tumours, in general, are obscure. In many cases they appear to have formed after blows, &c. on the margin of the orbit, but often they cannot be attributed to any cause.

2550. *Treatment.*—The diagnosis of orbital tumours is often very obscure. Under such circumstances, the alterative mode

of treatment is the only one indicated. When the tumour has become so far developed that its nature can be ascertained, what further treatment may be called for will admit of being determined.

Sarcomatous tumours in the orbit.

2551. When in the case of a sarcomatous tumour, swelling presents externally, it is felt to the touch, solid and resisting.

2552. Sarcomatous tumours grow slowly, and do not in general attain any great size. They may form in any part of the orbit.

2553. A tumour of the kind which I extirpated had, to the naked eye, the appearance of fat, but it was much firmer and more consistent to the touch, and presented microscopical characters altogether different.

2554. *Treatment.*—The only treatment applicable to such tumours is total extirpation.

Encysted tumours in the orbit.

2555. When these tumours, which may originate in any part of the orbit, present themselves externally, they form between the eyeball and margins of the orbit, a rounded, equal, elastic swelling, more or less distinctly fluctuating, and yielding to pressure, so as to retire within the orbit.

2556. The cyst of the tumour is in some cases thin and serious, in others thick and fibrous, with cartilaginiform and even ossiform depositions. The contents may be watery (*hygroma*), like suet (*steatoma*), like pap (*atheroma*), or like honey (*meliceris*). Hairs, and in one case a tooth, have been found among the contents of orbital tumours, similar to what is of more frequent occurrence in ovarian tumours.

2557. *Treatment.*—Total extirpation when, from the situation and connections of the tumour, it can be effected; if not, partial extirpation, in the hope that, by exciting inflammation on filling the cavity with charpie, the remains of the cyst may be eventuatly destroyed, or separated and thrown off by the suppuration. In some cases simple puncture of the encysted tumour and evacuation of its contents have been performed with success, but it is not a practice deserving of much confidence.

Operation of extirpating sarcomatous and encysted orbital tumours.

2558. The possibility of extirpating orbital tumours with safety to the eyeball and neighbouring parts, will depend on the

situation, connections, and size of the tumour. If the tumour is so connected that it cannot be wholly extirpated without the eyeball, this also must be removed, if the necessity for operation is imminent.

2559. According to the situation and size of the tumour, so must be the situation,—whether through the skin or conjunctiva, —direction, and extent of the external incision, and the necessity of dividing one or other eyelid vertically, or the external commissure. If the tumour be seated in the upper part of the orbit, and appears on examination with the touch, whilst the upper eyelid is moved, to be on the orbital side of the levator palpebræ, the incision should be through the skin ; but if on the ocular side, through the conjunctiva.

2560. The external incision being cautiously but freely made, and the tumour duly exposed, it is to be seized with a hook or hooked forceps, drawn forwards, and its separation effected by careful dissection with the knife, assisted by the handle, the finger, and curved scissors, whilst the blood is assiduously removed by an assistant.

2561. The surgeon having satisfied himself by examination with the finger that the whole tumour has been removed, allows the bleeding to stop, and then proceeds to dress the wound.

2562. The wound is first to be carefully cleansed from clotted blood, and then if it admits of being filled when the eyeball is gently pressed back into the orbit, the edges of the wound are to be united by suture or plaster, or both, according to necessity. If there is a large cavity which cannot thus be filled, the wound must be kept open, but not stuffed with charpie.

2563. Great care is required in the after-treatment. It has sometimes happened that inflammation of the orbital cellular tissue has supervened, and, extending to the brain, has proved fatal.

Hydatidgenous cysts in the orbit.

2564. Cysts containing hydatids have been met with in the orbit. They presented the characters of encysted orbital tumours. On making an opening into the prominent part of the tumour, fluid was evacuated, followed immediately in one case by a large hydatid, in another case, after two or three days, by half a teacupful.

Medullary tumour in the orbit.

2565. Medullary tumours are developed sometimes slowly, sometimes quickly, with more or less pain, &c. They are

generally soft and yielding, and communicate to the touch a deceptive feeling of fluctuation, so that they are apt to be confounded with encysted tumours. Such cases are as hopeless as medullary tumour of the eyeball.

Melanotic tumour in the orbit.

2566. Melanotic tumours have been met with in the orbit.

Aneurism by anastomosis in the orbit.

2567. Tumours of this kind, congenital or acquired, occur in the orbit, having either had their origin there, or being an extension of the disease from the eyelids.

2568. The characters of such tumours are their pulsation, with whizzing noise in the head, their readily becoming diminished by pressure, and increased by excitement of the circulation.

2569. *Treatment.*—Ligature of the common carotid artery has been twice performed with success in cases of the disease which suddenly came on with a snap or crack in pregnant women; the first case by Mr. Travers, the second by Mr. Dalrymple of Norwich.

True aneurism in the orbit.

2570. A case of true aneurism of both ophthalmic arteries terminating fatally has been recorded by Mr. Guthrie.

CHAPTER XI.

INJURIES OF THE EYE.

Section I.—INJURIES OF THE CONJUNCTIVA AND EYEBALL.*

INJURIES OF THE CONJUNCTIVA FROM INTRUSION OF FOREIGN BODIES INTO THE OCULO-PALPEBRAL SPACE.

2571. The intrusion of foreign bodies into the oculo-palpebral space of the conjunctiva, their removal and the applications necessary in the first instance, have been above treated of (ss.

* Effusion of blood under the conjunctiva or within the eyeball, which not unfrequently occurs in those injuries, is above considered under the head of *Hæmophthalmus*, ss. 1144 et seq., p. 213.

156 *et seq*). Here the injury occasioned, and its treatment come to be considered.

Mechanical Injuries.

2572. The inflammation which supervenes on the mechanical irritation or injury done to the conjunctiva, by the intrusion of foreign bodies into the oculo-palpebral space, or by simple wounds or abrasions of the membrane by whatever means produced, differs very much in different cases, both as to seat and as to nature and severity. Sometimes the inflammation is confined to the conjunctiva, sometimes it is internal; sometimes less, sometimes more severe, and that irrespective of the severity of the injury. When conjunctival, the inflammation may present the scrofulous character, or it may be puro-mucous.

2573. These differences, though they may be determined in some degree by the nature of the injury, depend also very much on the age and constitution of the patient.

2574. *Treatment.*—See Traumatic Ophthalmia, s. 970 et seq.

Chemical injuries.

2575. According to their degree of concentration and the length of time they have been allowed to remain in the eye, bodies chemically active may simply excite more or less severe inflammation, internal as well as external; or may at once produce very material organic injury, which is of course also followed by inflammation.

2576. That the conjunctiva can bear a great deal in this way is proved by the strong irritants,—such as nitrate of silver ointment or even nitrate of silver in substance,—frequently applied to it by way of treatment, and by the circumstance that melted pitch, tallow, and even lead, have fallen into the eye, without any bad ultimate result. In some cases, however, the effects of the action of such agents are both severe and destructive.

2577. The chemical agents, the intrusion of which into the eye not unfrequently occurs, are lime, mineral acids, and the like, or burning hot substances.

2578. *Lime.*—According as it is in the state of quick lime, slaked lime, or mortar, and according to the quantity intruded into the eye, and the length of time it has lain there, so will be the extent of the injury.

2579. Quick lime is very fatal to the eye. Not only is the epithelium of the conjunctiva and cornea immediately decom-

posed, but their proper substance may be more or less completely destroyed, and the eye for ever rendered useless.

2580. Slaked lime does not produce such immediate mischief. The conjunctiva and cornea are rendered thickened and of an opaque white appearance from decomposition of their epithelium, wherever they have been directly acted on by the caustic. Sloughs of the conjunctiva may be formed.

2581. Mortar, if quickly removed, may not cause any organic injury, but simply excite more or less severe conjunctivitis. If allowed to remain, however, more or less organic injury will be produced.

2582. Inflammatory injunction of the conjunctiva quickly takes place with more or less subconjunctival œdema and perhaps ecchymosis. From the opaque and altered state of the epithelium and subconjunctival œdema, the redness of the conjunctiva is of a peculiar pinkish and marbled appearance.

2583. The decomposed epithelium peels off in opaque white flakes. Over the cornea, it first rises in a blister, and when it has peeled off, the proper substance is left smooth, but somewhat opaque, and vessels soon form in it.

2584. When the cornea has been implicated, but if the action of the lime have not extended to its proper substance, and if the inflammation which follows is moderate, as the epithelium is regenerated, the transparency of the cornea may be gradually restored in a greater or less degree, but vascularity of it will probably remain.

2585. If the lime have acted more deeply, or if severe inflammation has ensued, the cornea may never again become clear.

2586. *Sulphuric acid.*—This has been sometimes thrown into the eyes of persons with the criminal intention of destroying sight. In such cases, besides the injury to the face and eyelids, the conjunctiva appears almost scarred, being white, soft and swollen. It afterwards peels off, while the cornea rapidly becomes disorganized by infiltration of pus, ulceration, and sometimes sloughing.

2587. Though the immediate effects of the injury may not be to such an extent as the above, Dr. Mackenzie remarks that dangerous symptoms, such as onyx and iritis, are apt to occur in such cases, weeks after the receipt of the injury.

2588. Symblepharon, either mediate or immediate, and to a greater or less extent, is a common effect of injury of the conjunctiva by caustic substances. The corresponding surfaces of the eyeball and eyelid having been left raw by corrosion, ulcera-

tion, or sloughing, readily unite, and that, notwithstanding every effort of the surgeon to prevent it.

2589. *Burning hot substances.*—Burns blister the conjunctiva and cornea, and sometimes excite very destructive inflammation.

2590. When gunpowder is exploded against the eye, besides the burn which takes place by the flame and the grains in a state of ignition which are projected against the organ, unexploded grains, when the gunpowder has been confined as in a flask, are apt to be projected against and to fix in the skin of the eyelids, the conjunctiva, and the cornea.

2591. *Treatment.*—The removal of caustic or burning hot substances, whether solid or fluid, and grains of gunpowder, and the treatment in the first instance, have been above considered, (s. 170.)

2592. To moderate the inflammatory reaction as much as possible, the patient must be kept at rest and his bowels opened; blood should be abstracted by venesection or leeches, and the eye covered with cold lotions.

2593. The inflammation which supervenes must be treated according to its nature and severity. Most commonly the inflammation is puro-mucous conjunctivitis.

INJURIES OF THE EYEBALL, AND ITS PROPER TUNICS.

Concussion of the eyeball.

2594. Amaurosis is a not unfrequent consequence of even very slight blows on the eyeball, with or without any visible injury of the organ. In such cases, the amaurosis is considered to be owing to injury of the retina, by concussion, (s. 1832.)

2595. Blows, contusions, and wounds of the eyebrow and margin of the orbit, without any visible injury of the eyeball, may also occasion amaurosis. In some of these cases, there is intracranial injury, to which the amaurosis might be attributed, but in many cases there being no such injury, the amaurosis is considered to be owing to concussion of the retina.

2596. As in wounds of the eyebrow, the frontal branch of the fifth nerve is often injured, the opinion has been entertained, that the amaurosis is in some manner connected with that injury rather than concussion. Although this can scarcely be admitted as regards amaurosis immediately consequent on the injury, it is by no means unlikely that injury of the fifth nerve, by determining slow internal ophthalmia, (s. 199,) may prove

a cause of the amaurosis, which sometimes comes on subsequently to the injury.

2597. *Treatment.*—For the treatment of the amaurosis from concussion of the eyeball, see s. 1866.

Contused wounds of the eyeball.

2598. The eyeball bears simple incised wounds very well, but not contused wounds. Injuries of this kind, in fact, are very dangerous.

2599. In injuries of the eyeball from contused wounds, occasioned, for example, by small shot, fragments of percussion caps, &c., striking it, with or without penetrating into its interior, if blindness from attending concussion should not be the immediate effect, it will generally be eventually occasioned by the destructive internal inflammation which supervenes. But in addition to this, the uninjured eye is, as above shown, (s. 972,) very prone to become similarly affected with internal inflammation.

2600. *Treatment.*—See Traumatic Ophthalmia, (ss. 970 et seq.)

Injuries of the cornea.

2601. *Foreign bodies imbedded in the cornea.*—The removal of foreign bodies adhering to the surface of the cornea, or imbedded merely in its conjunctival layer, has been above treated of. Here foreign bodies imbedded in the substance of the cornea fall to be considered.

2602. Chips of pure metal, splinters of glass, stone, hard wood, and the like, projected against the eye, often stick, more or less deeply, in the cornea, or even wholly penetrate it, and lodge in the interior of the eye. If a part of the foreign body remains projecting, very great irritation ensues, but if the body has sunk fairly in the substance of the cornea, it may produce little reaction, or, becoming enveloped in a capsule of lymph, may cease to be a cause of irritation, and the inflammation, to which it has given rise, subside, the cornea at the part remaining opaque. More frequently, however, ulceration of the cornea takes place around the foreign body, which thus becomes loose at the bottom of the ulcer, requiring but a touch for its detachment.

2603. When a chip of pure iron sticks in the cornea, and is allowed to remain any time, it becomes oxydated, and tinges the adjacent cornea of a brown colour.

2604. If any part of a foreign body which has penetrated

the substance of the cornea projects, it is to be seized with a forceps and drawn out; but if it does not project, it is necessary to use a pointed instrument, such as a large and rather blunt cataract needle for its dislodgment. In doing this, great care should be taken not to cause any abrasion of the cornea, and never to scrape it, with the intention of removing, for instance, the brown speck left by the oxydation of a fragment of iron—such as a speck it is well not to interfere with.

2605. When the foreign body is irregular in shape, and has penetrated the cornea obliquely, and to some extent, it may be necessary to make an incision with a cataract knife, so as to expose the body, which is then to be seized with a forceps, or turned out with the spatula.

2606. It is to be observed, that when a foreign body cannot be readily got at, attempts at extraction should not be continued too long, for more injury may result from this than from the presence of the foreign body. By and by it will become loose, and may then be more easily extracted.

2607. *Abrasions of the cornea.*—Though the surface of the cornea may be touched without inconvenience, a sudden wipe on it, with a handkerchief, for instance, causes considerable uneasiness, lachrymation, and intolerance of light for a time.

2608. Abrasion of the cornea is sometimes produced by a scratch of the finger nail, or by awkward attempts to remove a foreign body; or it is the result of a stroke with an ear of corn, an accident to which reapers are much exposed.

2609. *Punctured and incised wounds of the cornea.*—The puncture or incision made in the cornea in operations generally heals soon and kindly; and even wounds produced by accident sometimes heal beyond expectation, though they are not unfrequently followed by severe and destructive inflammation. Such a result is readily accounted for by the contusion of the whole eye attending the accident, by the irregularity of the wound, perhaps a bad state of health at the time, and not unfrequently by the neglect with which the case is apt to be treated at first.

2610. The immediate effect, in most cases of penetrating wounds of the cornea, is escape of the aqueous humour, and, sometimes, especially if the wound is of any extent, and situated near the edge of the cornea, protrusion of the iris. It is this latter circumstance, when it occurs, which constitutes the principal difficulty of the case, for the mere wound of the cornea may heal, and the aqueous humour be renewed in from thirty-six to forty-eight hours. Even when the accident is quite

recent, it is seldom we succeed in returning the iris to its natural position—never, if but a few hours have elapsed.

2611. If the iris be but slightly engaged in the wound of the cornea, and if this be towards the circumference, the first thing to be tried is rubbing the upper eyelid over the cornea, and then suddenly opening the eye to a bright light. The tendency of the pupil to contract being thus excited, disengagement of the iris from the wound of the cornea is expected to follow. This proceeding may be repeated along with attempts to push the iris back into its place with a blunt probe. But, of course, all of this would be useless if the iris were at all strangulated in the wound of the cornea.

2612. If the wound of the cornea be nearer the centre, and if it be the pupillary portion of the iris which is prolapsed, dilatation of the pupil by belladonna, prejudicial in the former case, may be tried in this, along with rubbing the eyelid over the cornea.

2613. In regard to exciting the pupil to contract or dilate, it is to be remarked, that though the contractile power of the iris appears very considerable while supported by the aqueous humour, it becomes almost null when this is removed in consequence of the resistance of its own weight, and the pressure of adjacent parts, to say nothing of its engagement in a wound of the cornea.

2614. If protrusion of the iris be evidently kept up by the aqueous humour pressing it forward, this should be evacuated by puncture.

2615. If the attempts to return the iris have failed, and if the case be still recent, the protruding iris should be snipt off with scissors, especially if it be the pupillary edge, and then friction employed as before. By this proceeding we may preserve the cornea entire, though with a pupil large and irregular. By leaving the iris protruded, synechia anterior and contracted pupil, with opacity of the cornea to a greater or less extent, if not partial staphyloma, inevitably result.

2616. If some time has already elapsed since the accident, the case falls into the category of ophthalmia, attended by penetrating ulceration of the cornea, and protrusion of the iris.

2617. It occasionally happens that in old and enfeebled persons, the incision made in the cornea for extracting a cataract does not unite, for want of sufficient reaction in the part: the consequence of this may be, that the aqueous humour drains away, the cornea becomes flaccid, dim, and gradually opaque, and eventually destruction of the eye follows. Sometimes the

wound of the cornea does heal, after a considerable interval, and the eye is saved. In such cases nourishing diet and tonics should be given, and the eye itself touched with some irritant, such as nitrate of silver.

2618. A penetrating wound of the cornea, close to its margin, sometimes closes by the conjunctiva alone healing over it while the proper substance of the cornea remains ununited. The consequence is, the aqueous humour elevates the conjunctiva in the form of a vesicle. This state of parts is called *fistula corneæ*, and must be distinguished from hernia corneæ and partial staphyloma.

2619. After snipping off the elevated conjunctiva, the orifice in the proper substance of the cornea, leading into the anterior chamber, is to be touched freely with the lunar caustic pencil.

2620. *Treatment of inflammation excited by injury of the cornea.*—The inflammation may be very slight and readily subside by rest, cold lotions, and antiphlogistics.

2621. The result of injury of the cornea, however, even when trifling in degree, is not always so slight. The inflammation is sometimes severe, obstinate, and dangerous, involving not only the cornea itself, but also other parts of the eye, both external and internal. The membrane of the aqueous humour is particularly liable to suffer; and iritis on the one hand, and inflammation of the proper substance of the cornea, ending in purulent infiltration, on the other, are not unfrequent complications.

2622. A severe form of inflammation is often met with in reapers, who have had the cornea abraded by a stroke from an ear of corn, (s. 2608,) though a similar inflammation often arises from other injuries of the cornea. The patient presents himself to the surgeon with the cornea muddy and of a greenish yellow hue, the iris discoloured, and pupil contracted, with considerable conjunctival and sclerotic injection, such as is seen in catarrho-rheumatic ophthalmia, (s. 730-738.) These objective symptoms are accompanied by fever, severe circumorbital or temporal pain, aggravated at night, and dimness of vision.

2623. If the inflammation be allowed to run on, or if treatment fail to arrest its progress, purulent infiltration of the cornea, hypopyon, and effusion of lymph into the pupil, may take place singly or together. The ultimate result is loss of the eye, either by the bursting of the cornea and the formation of staphyloma, or by atrophy.

2624. In such a case mercury is our principal remedy, after the abstraction of blood. The extent to which venesection

should be carried ought to be carefully regulated by the circumstances of the case; it is not to be dreaded too much on the one hand, nor, on the other, pushed, by repetition, too far. The pupil is to be kept dilated by belladonna, smeared on the eyebrow; and when the progress of the inflammation is arrested, the exhibition of bark, as a general remedy, and the application of the drops of the bichloride of mercury with vinum opii (s. 128) as a local remedy, will powerfully promote the cure.

2625. In illustration of the dangerous nature of the inflammation which is apt to take place in consequence of abrasion of the cornea in reapers, it is mentioned by Professor Walther, of Munich, in a small work, published thirty years ago, that in the Isar district of Bavaria from fifty to sixty eyes used to be annually lost, during harvest, from this cause.

Foreign bodies in the aqueous chambers.

2626. Foreign bodies may penetrate right through the cornea and remain lodged in the anterior chamber, often at the same time sticking in the iris or crystalline. Eyelashes have in several instances been driven in through a wound of the cornea: some of these cases have been described as examples of development of hairs within the eye.

2627. If the wound in the cornea be large enough, an attempt may be made to extract the foreign body through it by means of the small hook delineated at page 258, or forceps at page 264. If not large enough, and if so placed that enlargement of it would not be advisable, a clean section of the cornea near its margin should be made of the necessary size, and on the side where it appears the foreign body will admit of being most readily seized. It sometimes happens that, on section of the cornea, the foreign body escapes along with the aqueous humour, when this has not been previously evacuated.

2628. Foreign bodies, though not extracted, may cease to cause irritation by becoming inclosed in a capsule formed of lymph deposited around them; or, in the case of small particles of iron or steel, as the point of a cataract-knife or needle accidentally broken off during operation, they may become oxydized and dissolved.

Injuries of the iris and pupil.

2629. Along with the cornea, ciliary body, and other parts of the eye, the iris may be implicated in punctured, incised, and lacerated wounds.

2630. By smart strokes on the eye, the iris is apt to be separated from its ciliary attachment.

2631. The iris may be lacerated across in its whole breadth, and at the same time separated to a greater or less extent from its ciliary attachment.

2632. Great and irregular dilatation of the pupil sometimes occurs, from the iris being on one side wholly displaced to behind the sclerotica.

2633. All these injuries may be attended with more or less effusion of blood and impaired vision.

2634. Such injuries, it will be observed, are similar in their nature to those inflicted either accidentally or intentionally in various operations on the eye, or which occur in disease as above described.

2635. Thus when an opening is made in the iris, it gapes and remains as a false pupil. When the iris is separated at some part of its ciliary circumference, the result also is a false pupil. When the iris is torn across there is produced a state resembling coloboma iridis. Lastly, when the iris is displaced on one side to behind the sclerotica, so as no longer to be visible through the cornea, a state of pupil is presented similar to that which often occurs in posterior internal ophthalmia and choroid staphyloma.

2636. *Prognosis and treatment.*—See Traumatic Ophthalmia.

Injuries of the crystalline body.

2637. The crystalline body is liable to suffer from two kinds of injuries. It may be directly wounded by a foreign body or instrument which has penetrated the eyeball, or it may have its connections so broken up in consequence of a blow upon the eye or its neighbourhood, that dislocation takes place either immediately or consecutively. Dr. Mackenzie mentions, that he has repeatedly seen grains of gunpowder propelled through the cornea into the lens, so as to produce cataract.

2638. *Wounds.*—Wounds of the crystalline body, even when simply punctured or incised, give rise generally, though not invariably, in the human eye to lenticular opacity, and often to more or less capsular opacity in the seat of the wound. After a wound of the capsule, the soft exterior part of the lens is sometimes seen to ooze out in the form of a semi-opaque flock.

2639. The wound of the capsule may unite and the opaque lens remain; but when, by reason of its extent, the wound does

not close, the lens is gradually dissolved, and disappears, as after the operation for cataract by division. In such a case the injury is both bane and antidote.

2640. The wound of the eye, of which that of the crystalline is merely a part, is usually followed by an attack of internal inflammation, sometimes very severe and destructive. This may take place even after needle-operations for cataract, in which the wound is as simple as possible. The membranes of the aqueous humor and the iris are, in the least complicated cases, the parts commonly most affected; and the consequence is, effusion of lymph into the pupil.

2641. *Dislocation of the crystalline.*—Sometimes a wound of the capsule is followed by dislocation of the lens, an accident which occasionally happens during needle operations for cataract. The capsule may also be burst by a blow, and the lens forced out of its situation.

2642. The extent to which the crystalline is removed from its place has been found to vary in different instances. It may be merely so far separated from its connections, as to press the iris forward, and thus obliterate the posterior chamber and diminish more or less the anterior, or it may be entirely dislocated into the anterior chamber. Cases again have been met with in which the lens has escaped through a breach in the cornea, from a blow, or, having been forced through a laceration in the sclerotica, has been found lying underneath the conjunctiva.

2643. The capsule may accompany the dislocated lens; but this will seldom be the case in a previously healthy eye, because the connections of the capsule are everywhere so close. But it sometimes happens, that the connections of the capsule having gradually become dissolved in consequence of some slow morbid action in the interior of the eye,—the result, sometimes, of no particular cause, sometimes of a blow previously received—the slightest concussion is sufficient to cause dislocation of both it and the lens. In such a case, as a dissolved state of the vitreous body is a frequent concomitant change, the dislocated crystalline may fall back into it, or through the pupil into the anterior chamber. Sometimes the connections of the crystalline not being wholly broken up, it remains *in situ*, but is tremulous; or it is retained at some part of its circumference merely, and there moves as a door on its hinges.

2644. A dislocated crystalline very generally becomes opaque, but not always; for instances are related, not only of a lens and its capsule, but also a lens alone, being dislocated into the an-

terior chamber, and remaining there for some time without losing transparency.

2645. It generally happens in those cases in which the connections of the crystalline are slowly dissolved, that opacity also takes place. This is called *cataracta cystica;* and, as it is seen bobbing up and down, or floating in the dissolved vitreous humour, the epithets *tremulans* or *natatalis* are sometimes superadded. A cystic cataract may occasionally fall through the pupil into the anterior chamber, and again slip back.—See farther on this subject the section on Cataract (ss. 1275, 1276).

2646. Very often during needle-operations for cataract, the crystalline, from its bonds of connection having become much weakened, falls down into the dissolved vitreous humour on the first touch; and when extraction has been attempted in a similar state of the eye, the lens, instead of coming out, has sunk down behind the iris.

2647. *Treatment.*—Wounds of the crystaline body are not of themselves the immediate subject of treatment, but it is the internal inflammation, which is so apt to result, that requires to be carefully attended to. A dislocated lens is frequently the cause of keeping up inflammation, and ought to be extracted; and this, even though there should be no irritation at the time, if from its hardness it is not likely to be absorbed; because acting as a foreign body, it is apt sooner or later to give rise to inflammatory action.

2648. The propriety of removing a lens forced out of the eyeball through a rent in its coats, and lying under the conjunctiva, is obvious.

2649. The degree of vision preserved after injury of the lens will depend, of course, on the state of the other parts of the eye.

Wounds of the posterior segment of the eyeball.

2650. The tunics being divided, there is a tendency to protrusion of the vitreous body, with escape of its fluid, effusion of blood, and, perhaps, protrusion of the internal tunics, and even escape of the lens.

2651. By blows on the eye, the sclerotica may be ruptured, but besides this, there is necessarily more or less serious injury to the other parts of the posterior segment of the eye, such as extravasation of blood within the organ, laceration and protrusion of the internal tunics, escape of vitreous humour, sometimes of the lens, with concussion of the retina.

2652. *Treatment.*—Nothing more can be done in such cases

than to keep the patient at rest, with his eyelids closed, and covered with cold applications, and to meet inflammation as it arises. See Traumatic Ophthalmia.

2653. The yellowish opaque deposition, sometimes traversed by blood-vessels, at the bottom of the eye, which is a not unfrequent result of injury of the eyeball, especially of its posterior segment, has been above described under the head of non-malignant tumours, (p. 213.) Sclerotic staphyloma, atrophy of the eyeball, a shrunk state of the same from loss of humours and the like, have also been referred to, as not unfrequent eventual consequences of injury of the eyeball (pp. 199, 201, 202).

Dislocation of the eyeball.

2654. Foreign bodies forced in between the eyeball and the wall of the orbit, may cause protrusion of the former. The foreign body being removed, pressure on the eyeball, continued, steady, but gentle, will effect reduction of it; sometimes with a jerk. Vision, which had been lost from the stretching of the optic nerve and pressure on the eyeball, is on reduction sometimes quite restored.

Evulsion of the eyeball.

2655. The eyeball, with a portion of the optic nerve, has been completely torn out of its socket by a cart-wheel going over the side of the man's head. Recovery took place. The eyeball may be blown out by a musket shot.

Section II.—INJURIES OF THE EYEBROW AND EYELIDS.

Contusion, with ecchymosis.

2656. The effect of contusion of the eyebrow and eyelids is at first swelling, which after a few hours is followed by ecchymosis or extravasation of blood into the substance of the dermis, causing discoloration of the parts, or what is called a black eye. In severer cases of contusion, there is effusion of blood into the subcutaneous cellular tissue also.

2657. Subconjunctival ecchymosis is often occasioned at the same time by contusion of the eyebrow and eyelids. Extra-

vasation of blood may even take place into the orbital cellular tissue, occasioning some degree of exophthalmus.

2658. *Treatment.*—If there is effusion of blood into the subcutaneous cellular tissue, it is to be evacuated by puncture. When the contusion is severe, it will be necessary to apply leeches and cold lotions to keep down inflammation. In simple cases, cold lotions alone may be sufficient.

2659. The discoloration from ecchymosis disappears as the blood is absorbed; but as this takes place but slowly, various applications are made in order to hasten the process. A cataplasm of the grated roots of convallaria, or Solomon's seal, is a popular and efficient remedy, reapplied every half hour for several hours. It occasions considerable redness and œdema of the skin, with smarting. A solution of the hydrochlorate of ammonia (Ammon. hydrochlorat. ℥j; aq. distillat. ℥xiv; alcohol dilut. ℥ij), is also a useful remedy for the purpose. Likewise a vinous infusion of Arnica flowers and rosemary (āā ℈iv), in wine (℥iv).

Incised, lacerated, and contused wounds of the eyebrows and eyelids.

2660. Wounds of the eyebrows and eyelids are to be carefully united by strips of court plaster or by suture, according to their situation and extent. When, in consequence of the wound being lacerated and contused, union does not take place by the first intention, great care will be necessary during the process of granulation,—unless there be loss of substance, when healing by a broad cicatrice is rather to be attempted, (s. 2137,) —to keep the edges of the wound drawn toward each other, and in a proper direction, with strips of plaster, so as to ensure as regular a cicatrice as possible.

2661. It is always to be kept in mind, that one great point in the treatment of wounds of the eyebrows and eyelids, is to prevent distortion of the eyelid, such as ptosis on the one hand, or lagopthalmus or ectropium on the other, taking place from irregular cicatrices.

2662. If no undue inflammation supervenes, wounds of the eyebrows and eyelids readily heal. Even when lacerated or contused, little suppuration may take place, and but a slight scar may be left, without injury to the eyelid. Undue inflammation, phlegmonous or erysipelatous, may, however, come on. In this case, the wound must be left open and covered merely with water dressing until the inflammation has subsided.

2663. In wounds of the upper eyelid, as above mentioned, (s. 2243.) the levator muscle may be divided, and ptosis thereby occasioned.

2664. A fissure of the eyelid, like a button-hole or like hare-lip,* has been met with as the result of wounds of the eyelids, in which, by neglect, the edges have not been kept in apposition, but allowed to cicatrize separately. Such cases are to be treated, by making the edges of the fissure raw, and uniting them by suture.

2665. In penetrating wounds of the eyelid, whether from the conjunctival surface of the eyeball being at the same time injured, or from its being subsequently abraded, adhesion of the eyelid to the eyeball may take place. In treating such wounds, the possibility of this should always be kept in mind, and care taken to prevent it.

2666. *Injury of the nerve of the fifth pair* in wounds of the eyebrow has been above referred to (s. 2596).

Poisoned wounds.

2667. When the eyelids happen to be stung by wasps, bees, or the like, there are considerable swelling and irritation, sometimes severe erysipelatous inflammation of the part, ending in the formation of a small slough.

2668. If the sting of the insect has been left in the wound, an attempt should be made to extract it. Whether this proves successful or not, the part is to be rubbed with olive oil, and covered with cloths wet with a fresh-made solution of the hydrochlorate of ammonia.

2669. If there is any general disturbance of the system occasioned by the injury, a glass or two of wine may be taken, or a few drops of ammonia in sugared water occasionally.

2670. *Malignant pustule*, which might be brought under the head of poisoned wounds, has been already treated of (s. 2066).

Burns and scalds.

2671. Scalds of the eyebrows and eyelids, in which the texture of the dermis is not injured, are of comparatively small

* The fissure like hare-lip has been called *coloboma*, or, since the name has been employed generically, *coloboma palpebræ*, the other species being *coloboma iridis*, (s. 1593.) A congenital fissure of the eyelid (*congenital coloboma palpebræ*), has been met with.

consequence, except in so far as the conjunctiva may be complicated. Slight burns may be also unimportant in their effects, but when the burn is so severe that the dermis is injured, then there is great danger of such contraction taking place, in cicatrization, as to occasion lagophthalmos or ectropium.

2672. To oppose as much as possible the tendency to contraction during cicatrization, the eyelids must be kept closed, luxuriant granulation encouraged, and cicatrization retarded.

2673. Another danger of burns, and this is also the principal danger from severe scalds, is, supposing the eyeball to have escaped, anchyloblepharon, when the borders of the eyelids have been rendered raw, and the patient allowed to lie with his eyes closed.

2674. When gunpowder is exploded against the eye, the injury is seldom confined to the eyebrow and eyelids. See above (s. 2590).

Section III.—INJURIES OF THE LACHRYMAL ORGANS.

Injuries of the lachrymal gland and ducts.

2675. While the upper mass of the lachrymal gland is, from its situation, well protected from injury, the ducts, together with the lower mass of the gland, may readily be implicated in a wound of the upper eyelid. Wound of the lower mass of the gland, together with some of the lachrymal ducts in Crampton's operation for entropium, is above referred to, p. 403, foot note. In a case of lacerated wound of the upper eyelid involving the ducts and lower mass of the gland, sinuses formed, and the wound showed no disposition to heal.

2676. In a case of gun-shot wound, related by Larry, the ball struck towards the superior external angle of the left orbit. Being cleft into two, one half took the direction of the temple, the other half lodged in the upper mass of the lachrymal gland, along with which, in a lacerated state, it was removed by enlarging the wound in the eyelids. The wound healed, the eye was saved, and continued to be sufficiently moistened.

Injuries of the derivative lachrymal organs.

2677. *Foreign body in the punctum.*—A loose eyelash sometimes gets into one of the puncta by one end, and by the other,

which projects, irritates the lachrymal caruncle, as above mentioned, (s. 2355.) The possibility of this accident should be kept in mind, and attention directed to the state of the puncta in any case of irritation at the inner canthus. Dr. Mackenzie, who has seen a number of such cases, mentions that in one of them, the patient himself detected the hair as the cause of irritation, but not recognizing its unusual mode of implantation, he made it be cut short with a pair of scissors, but this only rendered the irritation greater. Demours relates a case in which a piece of a barley awn got introduced into the lachrymal point, one end projecting out to a small extent. The foreign body being discovered, the removal of it is an obvious and simple matter.

2678. *Injuries involving the lachrymal papillæ, puncta, and canalicules.*—Wounds of these parts are not of common occurrence. The edges should be brought accurately together, and retained so by stitches, in order, if possible, to obtain union by the first intention. But this is only a means towards the great object of preserving the permeability of the passages. For this purpose, a pin, rendered blunt at the point, and properly bent, should be introduced along the wounded canalicule as far as the sac, and retained for the first two or three days after the injury. I am not aware, however, of any case in which such a practice has been successful. (See s. 2466.)

2679. Injury of the papillæ, puncta and canalicules may be occasioned by burns, caustics, &c.

2680. *Injury of the lachrymal sac.*—A simple penetrating wound of the lachrymal sac will heal if the lining membrane be healthy, but a fistulous opening is apt to remain if the lining membrane has not been in a healthy state originally, or if it has in consequence of the injury fallen into such a state. This is more apt to happen in consequence of laceration or contusion of the part, and that especially in scrofulous subjects.

2681. Mr. Lawrence mentions his having seen three or four instances of the lachrymal sac being burst by a blow, with escape of air into the cellular tissue of the lids; the emphysematous swelling, which was considerable, but not extending beyond the palpebræ, disappeared spontaneously in a few days.

2682. In injuries of the osseous walls of the nose, the nasal duct may be implicated, the bones being driven in and pressing on the duct. When such appears to be the case, it would be warrantable to open the sac by incision, and insert a style into the duct, in order to prevent its being obliterated by any encroachment of its fractured walls.

Section IV.—INJURIES OF THE ORBIT.

Blows, &c., on the edge of the orbit.

2683. Such injuries are, as above stated, the cause sometimes of periorbitis, running into suppuration and disease of the bone; sometimes of orbital tumours; sometimes of concussion of the eyeball.

Penetrating wounds of the orbit.

2684. Injury of the orbit from penetrating wounds is necessarily attended with external wound of the eyelids, &c., but this, it is to be remarked, may be very small.

2685. The consequences of such injuries of the orbit may be:—

1. Swelling of the eyelids, protrusion of the conjunctiva, and exophthalmus, from effusion of blood into the orbit.
2. Inflammation of the orbital cellular tissue, especially if any portion of the wounding body has been left lodged in the orbit.
3. Injury of the muscles and nerves of the orbit, sometimes dislocation of the eyeball (s. 2654).

2686. As the instrument inflicting a penetrating wound of the orbit may, by piercing the orbital plate of the frontal bone, wound the brain, accidents of this kind must always be regarded with great anxiety, and carefully watched and treated.

2687. If a foreign body has penetrated into, and lodged in the orbit, it must be extracted as soon as possible. By its extraction the risk of inflammation will be diminished, and if the eyeball is at the same time dislocated, restoration of it to its proper position, in the manner above indicated (s. 2654), will be possible. If, however, from the situation of the body, removal does not admit of being readily effected, attempts should not be persisted in, and, especially if inflammation has already come on, it will be safer to wait.

2688. Rest, and the antiphlogistic regimen, more or less strict, must not only be enjoined, but the case must be closely watched for some time in order that inflammation may at its onset be duly met.

GLOSSARY.

Achromatopsia (α, priv. χρῶμα, *colour*, ὤψ, *the eye*), want of power to distinguish colours.

Aegilops (αἰγίλωψ, from αἴξ, αἰγὸς, *a goat*, ὤψ, *the eye*), a name given by the older surgeons to a sinuous ulcer at the inner corner of the eye, from its resemblance to the *larmier*, or infra-orbital glandular sac of goats and other ruminating animals.

Albugo (albus, *white*), an opacity of the cornea.

Amaurosis (ἀμαύρωσις, *obscuration*, from ἀμαυρόω, *to render obscure*), impairment or loss of vision from paralysis of the optic nervous apparatus.

Amblyopia (ἀμβλὺς, *dull*, ὤψ, *the eye*), impaired vision from defective sensibility of the retina.

Amphiblestroiditis (ἀμφιβληστροειδὶς, *the retina*, from ἀμφιβληστρον, *a net*, and εἶδος, *form*), retinitis, or inflammation of the retina.

Anchilops (ἀγχίλωψ, from ἄγχι, *near*, and ὤψ, *the eye*), name given by the older surgeons to the abscess at the inner corner of the eye, ending in the sinuous ulcer which they called Aegilops.

Anchyloblepharon (ἀγκύλος, *crooked*, βλέφαρον, *eyelid*), cohesion of the eyelids to each other at their borders.

Asthenopy (α, priv., σθένος, *strength*, and ὤψ, *the eye*), weaksightedness.

Atresia (α, priv. τιτράω, *to perforate*), closure or imperforation; applied to the pupil, &c.

Blepharitis (βλέφαρον, *eyelid*), inflammation of the eyelids.

Blepharoblennorrhœa (βλέφαρον, *eyelid*, βλέννα, *mucus*, ῥέω, *to flow*), first stage of puro-mucous inflammation of the conjunctiva.

Blepharophthalmia (βλέφαρον, *eyelid*, ὀφθαλμὸς, *eye*), called also Blepharophthalmo-blennorrhœa, puro-mucous inflammation of the conjunctiva in its fully-formed state.

Blepharoplegia (βλέφαρον, *eyelid*, πληγή, *stroke or blow*), paralysis of the eyelid.

Blepharoptosis (βλέφαρον, *eyelid*, πτῶσις, *a falling down*), called also simply Ptosis, a falling down of the upper eyelid.

Blepharospasmus (βλέφαρον, *eyelid*, σπασμὸς, *spasm*), spasm of the eyelids.

Buphthalmos (βους, *ox*, ὀφθαλμος, *eye*), **Oculus Bovinus**, dropsical enlargement of the eye.

Canthus (κανθος, *the rim of a wheel*), angle of the eye.

Cataract (καταράκτης, from καταῤῥάσσω, *to throw down with violence, to break or disturb*), opacity of the lens or its capsule.

Ceratitis (κέρας, *horn, cornea*), inflammation of the cornea.

Ceratocele (κέρας, *horn, cornea*, κήλη, *tumour*), hernia of the cornea.

Ceratome (κέρας, *cornea*, τομὴ, *section*), a knife for making an incision of the cornea.

Chalazion (χάλαζα, *grando, or hailstone*), a small tumour of the eyelid.

CHEMOSIS (χήμωσις, from χὴμη, *a gaping*, from χαινω, *to gape;* or χύμωσις, from χυμὸς, *humour, or fluid*), elevation of the conjunctiva like a wall round the cornea, from exudation into the subjacent cellular tissue.

CHOROIDITIS (choroid, from χόριον, *chorion, one of the membranes of the fœtus*, εἶδος, *likeness*), inflammation of the choroid.

CHROMATOPSY, or CHROMOPSY (χρῶμα, *colour*, ὄψις, *vision*), chromatic or coloured vision.

CHROOPSY, or CHRUPSY (χρόα, *colour*, ὄψις, *vision*), chromatic vision.

CILIA (celo, *to cover or conceal, because they cover and protect the eye*, or from cieo, *to move*), eyelashes.

CIRSOPHTHALMIA (κιρσὸς, *varix*, ὀφθαλμὸς, *the eye*), a varicose state of the blood-vessels of the eye.

CLAVUS (*the head of a nail*), a certain degree of prolapse of the iris, through an opening in the cornea; the prolapsed portion of the iris being pressed flat like the head of a nail.

COLLYRIUM (κολλύριον, from κολλύρα, *a cake; bread sopped according to Scaliger, this being a common application to the eyes*), a medicine for the eyes.

COLOBOMA (κολόβωμα, *mutilation*), applied to fissures of the eyelids and of the iris, congenital or traumatic.

CORECTOMIA (κόρη, *pupil*, ἔκ, *out*, τέμνω, *to cut*), operation for artificial pupil by excision.

COREDIALYSIS (κόρη, *pupil*, διαλύω, *to loosen*), operation for artificial pupil by separation.

COREMORPHOSIS (κόρη, *pupil*, μόρφωσις, *formation*), operation for artificial pupil in general.

COREONCION (κόρη, *pupil*, ὄγκος, *hook*), hook invented for the operation for artificial pupil by separation.

COREPLASTICE (κόρη, *pupil*, πλαστικὴ, *the art of making images*), operation for artificial pupil in general.

CORNEA (*cornu, horn*), the cornea is so called from its horny appearance.

COROTOMIA (κόρη, *pupil*, τέμνω, *to cut*), operation for artificial pupil by incision.

CURETTE (*French for a small spoon*), DAVIEL'S spoon, an instrument used to assist the exit of the lens in the operation of extraction.

DACRYOADENITIS (δακρύω, *to weep*, ἀδὴν, *gland*), inflammation of the lachrymal gland.

DACRYOCYSTITIS (δακρύω, *to weep*, κυστις, *sac*), inflammation of the lachrymal sac.

DACRYO-CYSTO-BLENNORRHŒA (δακρύω, *to weep*, κύστις, *sac*, βλέννα, *mucus*, ῥέω, *to flow*), blennorrhœa of the lachrymal sac.

DACRYOHÆMORRHYSIS (δακρύω, *to weep*, αἷμα, *blood*, ῥέω, *to flow*), sanguineous lachrymation.

DACRYOLITES (δακρύω, *to weep*, λίθος, *a stone*), calculous concretions deposited in the lachrymal passages.

DACRYOMA (δακρύω, *to weep*), stillicidium lachrymarum.

DIPLOPY (διπλόος, *double*, ὤψ, *vision*), double vision.

DISTICHIASIS (δὶς, *twice*, στίχος, *a row*), a form of trichiasis in which the mal-directed eyelashes form a second row, distinct from the others.

ECTROPIUM (Ἔκτροπιον, from ἐκ, *out*, τρέπω, *to turn*), eversion of the eyelids.

ENCANTHIS (ἐν, *in*, κανθὸς, *the corner of the eye*), enlargement of the lachrymal caruncle.

ENTROPIUM (ἐν, *in*, τρέπω, *to turn*), inversion of the eyelids.

EPICANTHUS (ἐπὶ, *upon*, κανθὸς, *angle of the eye*), a congenital peculiarity of a fold of skin extending over the inner canthus.

EPIPHORA (ἐπὶ, *upon*, φέρω, *to carry*), watery eye from excess of lachrymal secretion.

EXOPHTHALMOS and EXOPHTHALMIA (ἐξ, *out*, ὀφθαλμὸς, *eye*), protrusion of the eyeball. Exophthalmos is used when the eyeball is otherwise uninjured; exophthalmia, when, in addition to the protrusion, there is disorganization of the eyeball.

GERONTOXON (γέρων, *old*, τόξον, *a bow*), arcus senilis.

GLAUCOMA (γλαυκὸς, *sea-green*), a greenish opaque appearance behind the pupil.

GRANDO (*hailstone*), a small tumour of the eyelid.

GUTTA OPACA, name given by the Arabians to cataract, as they supposed it an opaque drop in front of the lens.

GUTTA SERENA (drop serene), name given by the Arabians to amaurosis, supposing it to depend on a clear drop fallen from the brain into the eye.

HÆMOPHTHALMOS, HÆMOPHTHALMIA (αἷμα, *blood*, ὀφθαλμὸς, *the eye*), sanguineous effusion into the eye.

HEMERALOPIA (ἡμερα, *day*, ὄψις, *vision*), night-blindness. It has been also employed to mean day-blindness (ἡμερα, *day*, α priv., or ἀλαὸς, *blind*, ὄψις, *vision*).

HEMIOPY (ἥμισυς, *half*, ὄψις, *vision*), a defective state of vision, in which one half of objects only is seen.

HORDEOLUM (hordeum, *barley*), stye.

HYALITIS, or HYALOIDITIS (ὕαλος, *glass*), inflammation of the hyaloid membrane.

HYDROPHTHALMIA, or HYDROPHTHALMOS (ὑδωρ, *water*, ὀφθαλμὸς, *the eye*), dropsy of the eye.

HYPERKERATOSIS (ὑπερ, *above*, κεράς, *cornea*), conical cornea.

HYPOÆMA (ὑπὸ, *under*, αἷμα, *blood*), blood in the anterior chamber.

HYPOCHYMA (ὑπὸχυμα, or ὑπὸχυσις, from ὑπὸ, *under*, χύμα, *effusion*), cataract.

HYPOGALA (ὑπό, *under*, γάλα, *milk*), effusion of a milky like matter in the anterior chamber.

HYPOPYON (ὑπὸ, *under*, πύον, *pus*), pus in the anterior chamber.

IRIANKISTRON (ἶρις, *iris*, ἄγκιστρον, *a fish-hook*), an instrument invented for performing the operation of artificial pupil by separation.

IRIDAUXESIS (ἶρις, *iris*, αὔξησις, *growth*), thickening or growth of the iris from exudation into its substance.

IRIDONCOSIS (ἶρις, *iris*, and ὄγκὸς, *tumour*), a name formerly proposed by Von Ammon for the same morbid state of the iris, as that to which he has since given the name IRIDAUXESIS; but now applied to an abscess of the iris.

IRIDECTOMIA (ἶρις, *iris*, ἔκ, *out*, τέμνω, *to cut*), operation for artificial pupil by excision.

IRIDECTOMEDIALYSIS (ἶρις, *iris*, ἔκ, *out*, τέμνω, *to cut*, διάλυσις, *separation*), operation for artificial pupil by a combination of excision and separation.

IRIDENCLEISIS (ἶρις, *iris*, ἐν, *in*, and κλείω, *to close*), the strangulation of a prolapsed portion of the iris between the lips of an incision in the cornea in certain operations for artificial pupil.

IRIDODIALYSIS (ἶρις, *iris*, διάλυσις, *separation*), the operation for artificial pupil by separation.

IRIDOSCHISMA (ἶρις, *iris*, σχίσμα, *fissure*), a fissure of the iris. See COLOBOMA IRIDIS.

IRIDOTOMIA (ἶρις, *iris*, τομὴ, *section*), the operation for artificial pupil by incision.

IRIDOPERIPHAKITIS (ἶρις, *iris*, περὶ, *over*, φακος, *a lens or lentil*), inflammation of the uvea and anterior wall of capsule of the lens.

KERATITIS (κέρας, *horn*, *cornea*), inflammation of the cornea.

KERATONYXIS (κέρας, *cornea*, νύξις, *a puncture*), corneal puncturation in needle operations for cataract.

KORECTOMIA. See CORECTOMIA.

KOREDIALYSIS. See COREDIALYSIS.

KOROMORPHOSIS. See COROMORPHOSIS.

KOREPLASTICE. See COREPLASTICE.

KOROTOMIA. See COROTOMIA.

LAGOPHTHALMOS (λαγὸς, *a hare*, ὀφθαλμὸς, *the eye*), oculus leporinus, or hare's eye. Retraction or shortening of either eyelid.

LEUCOMA (λευκόω, *to whiten*, or λευκός, *white*), opacity of the cornea from a cicatrice.

LIPPITUDO (lippus, *blear eyed*), blear eye.

LUSCITAS (luscus, *blind of one eye*), fixed misdirection of the eye.

MADAROSIS (μαδάρωσις, from μαδὸς, *bald*), a falling out of the eyelashes.

MARMARYGE (μαρμαρυγὴ, *splendour*), an appearance of sparks or coruscations before the eyes.

METAMORPHOPSY (μεταμορφόω, *to transform*, ὄψις, *vision*), distorted appearance of objects.

MICROPHTHALMOS (μικρὸς, *small*, ὀφθαλμὸς, *the eye*), smallness of the eye from imperfect development.

MICROPY (μικρὸς, *small*, ὄψις, *vision*), a state of vision in which objects appear smaller than natural.

MILIUM (*a millet seed*), a small white tumour of the eyelids or their neighbourhood.

MONOBLEPSIS (μόνος, *single*, βλέψις, *view*), state in which vision is distinct only when one eye is used.

MUCOCELE (μυξα, *mucus*, κήλη, *a tumour*), dropsy of the lachrymal sac.

MUSCÆ VOLITANTES (musca, *a fly*, volito, *to fly about*), the appearance of grayish motes before the eyes.

MYDRIASIS (ἀμυδρὸς, *obscure*, or μυδάω, *to abound in moisture*, because it was supposed to be owing to redundant moisture), preternatural dilatation of the pupil.

MYOCEPHALON (μυῖα, *a fly*, κεφαλὴ, *the head*), a small protrusion of the iris, like a fly's head, through an ulcerated opening in the cornea.

MYODESOPSIA (μυῖα, *a fly*, ὄψις, *vision*), muscæ volitantes.

MYOPY (μύω, *to shut*, ὤψ, *the eye*), near-sightedness.

MYOSIS (μύω, *to shut*), preternatural contraction of the pupil.

MYOTOMY (μῦς, *a muscle*, τέμνω, *to cut*), section of muscles. Ocular myotomy, section of muscles in strabismus.

NYCTALOPIA (νὺξ, *night*, ὄψις, *vision*), day-blindness. Employed also for night-blindness (νὺξ, α priv., or αλαος, *blind*, ὄψις, *vision*).

NYSTAGMUS (νυσταγμὸς, *steep*), oscillation of the eyeball.

OCULUS BOVINUS (bos, bovis, *an ox*), ox-eye; see BUPHTHALMOS.

OCULUS LEPORINUS (lepus, leporis, *a hare*), hare's eye; see LAGOPHTHALMOS.

ONYX (ὄνυξ, *a nail*), deposition of matter in the substance of the cornea.

OPHTHALMIA (ὀφθαλμὸς, *the eye*), a general name for inflammation of the eye.

Ophthalmia Neonatorum (νέος, *young*), purulent ophthalmia of newborn infants.

Ophthalmitis, inflammation of the whole eyeball.

Ophthalmodynia (ὀφθαλμὸς, *eye*, ὀδύνη, *pain*), pain in the eye.

Ophthalmology (ὀφθαλμὸς, *eye*, λόγος, *a discourse*), the science of ophthalmic medicine and surgery.

Ophthalmoplegia (ὀφθαλμὸς, *eye*, πληγὴ, *a blow or stroke*), paralysis of the muscles of the eyeball.

Ophthalmoptosis (ὀφθαλμὸς, *eye*, πτῶσις, *a falling down*, from πίπτω, *to fall*), the protrusion of the eyeball, resulting from paralysis of its muscles.

Oxyopia (ὀξὺς, *sharp*, ὤψ, *the eye*), preternatural acuteness of vision.

Pacheablephara, Pachytes (παχύτης, *thickness*, from παχὺς, *thick*, βλέφαρον, *eyelid*), enlargement and thickening of the eyelid.

Palpebræ (a palpitando, *from their frequent motion*), the eyelids.

Pannus (pannus, *cloth*), a thickened and vascular state of the conjunctiva corneæ.

Periorbita (περὶ, *over*), the periosteum of the orbit.

Phlyctenula (φλῦκταινα, *a vesicle*, from φλύζω, *to gush forth*), vesicle filled with a watery fluid.

Photophobia (φῶς, *light*, φοβέω, *to dread*), intolerance of light.

Photopsia (φῶς, *light*, ὄψις, *vision*), subjective appearance of light before the eyes.

Phtheiriasis (φθειρίασις, *morbus pedicularis*, from φθεὶρ, *a louse*), pediculi among the eyelashes and hairs of the eyebrows.

Pinguecula (pinguis, *fat*), a small tumour on the white of the eye near the edge of the cornea, apparently but not really adipose.

Pladarotes (πλαδαρὸς, *flaccid*), thickening of the palpebral conjunctiva.

Presbyopy (πρέσβυς, *old*, ὤψ, *the eye*), farsightedness.

Proptosis (πρὸ, *before*, πτῶσις, *a falling down*, from πιπτω, *to fall*); see Ophthalmoptosis.

Psorophthalmia (ψώρα, *scabies*, ὀφθαλμὸς, *the eye*), ophthalmia tarsi.

Pterygium (πτερὸν, *a wing*, πτερύγιον, *a small wing*), thickened and vascular state of a portion of the conjunctiva, of a triangular shape, the apex encroaching more or less on the cornea.

Ptilosis (πτίλωσις, *bald*), falling out of the cilia; see Madarosis.

Ptosis (πτῶσις, *a falling down*, from πιπτω, *to fall*), falling down of the upper eyelid.

Pupil (*pupilla*), the aperture in the iris.

Retinitis (rete, *a net*), inflammation of the retina.

Rhexis, or Rhegma Oculi (ῥῆξις and ῥῆγμα, *a rupture*), rupture of the eyeball.

Rhytidosis (ῥυτίδωσις, *a wrinkling*, from ῥυτιδόω, *to wrinkle*), collapsed or contracted state of the cornea.

Sclerotitis (σκληρὸς, *hard*,) inflammation of the sclerotica.

Scotomata (σκότωμα, *dizziness*, from σκοτόω, *to darken*), dark spots seen before the eyes; see Muscæ Volitantes.

Staphyloma (σταφυλὴ, *a grape*,) a projection of some part of the eyeball, generally of the cornea and iris, or sclerotica and choroid.

Staphyloma Racemosum (racemus, *a bunch of grapes*), staphyloma is so called when there is an appearance of several projections.

Stenochoria (στενοχωρία, *narrowness of space*, from στενὸς, *narrow*, χῶρος, *space*), a contraction; applied to the derivative lachrymal passages.

STEREOSCOPE (*στερεὸς, solid*, and *σκοπέω, I look at*), the instrument described at § 1915.

STILLICIDIUM (stillo, *to drop*, cado, *to fall*), dropping of tears from the eye, in consequence of obstruction of the derivative lachrymal passages.

STRABISMUS (*στραβίζω, to squint*, from *στραβὸς, twisted*), squinting.

SYMBLEPHARON (*σὺν, together, βλέφαρον, eyelid*), adhesion of the eyelids to the eyeball

SYNCHESIS (*σύγχυσις, mixture*, from *σὺν, together*, and *χύω, to pour*), dissolution of the vitreous body.

SYNECHIA (*συνέχεια, continuity*, from *συνέχω, to keep together*), adhesion of the iris to the cornea or capsule of the lens; in the former case it is distinguished as anterior synechia, in the latter as posterior synechia.

SYNIZESIS (*συνίζησις, a falling together*, from *συνίζέω, to set together*), closure of the pupil.

TARSORAPHIA (*ταρσος, tarsus, ῥαφὴ, a suture*), suture of the tarsal margins in ectropium of the external angle.

TARAXIS (*τάραξις, disturbance*, from *ταράσσω, to disturb*), slight external ophthalmia.

TRACHOMA (*τραχομα, roughness, τραχόω, to make rough*), granular conjunctiva.

TRICHIASIS (*θρίξ, a hair*), inversion of the eyelashes.

TRICHOSIS (*θρὶξ, a hair*), TRICHOSIS BULBI, a small tumour on the front of the eyeball, with hair growing from it.

TYLOSIS (*τύλος, callosity*), thickening and induration of the borders of the eyelids.

XEROMA, XEROPHTHALMIA, XEROSIS (*ξυρὸς, dry*), dryness of the eye, of which there are two kinds, viz: conjunctival and lachrymal.

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