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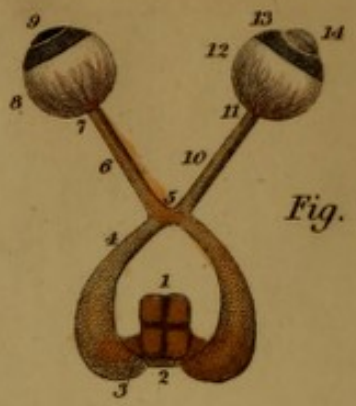

Fig. 2.

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As a mark of high esteem and respect for his distinguished talents, learning, perseverance, and zeal, and of gratitude for his excellent translation into German of my Works on the Ear, as well as the dedication to me of his valuable Encyclopædia of Anatomy,

This Work

Is inscribed

By his sincere Friend,

JOHN HARRISON CURTIS.

Soho Square, Feb. 23, 1833.

DESCRIPTION OF THE PLATE.

Figure I.

1. The globe of the eye and the lachrymal gland.
2. External auditory canal.
3. Semi-circular canals.
4, 4. Internal jugular vein, and its divers ramifications.
5. Third pair of nerves within the cranium.
6. Its superior branch.
7. Its inferior branch.
8. Branch of communication with the ophthalmic ganglion.
9. The pathetic nerve.
10. Sixth pair of nerves.
11, 11. Facial nerve.
12. Trunk of the trifacial nerve.
13. Its ganglionic part.
14. Ophthalmic branch.
15. Frontal branch.
16. Lachrymal branch.
17. Nasal nerve.
18. Ophthalmic ganglion, with the ciliary nerves.
19. Spheno-palatine ganglion.
20. Vidian nerve in its canal, which is laid open.
21. Palatine nerve.
22. Common carotid artery.
23. External carotid artery.
24. Trunk of the lingual, or hypoglossal nerve.
25. Occipital artery.
26. Its descending branch, with its distribution and anastomoses.

Figure II.

The Optic Nerves, from their origin to their termination.

1. The upper (nates).
2. The lower (testes) tubercula quadrigemina.
3. The optic nerves, as they appear to arise from the lateral parts of these tubercula.
4. Flattened portion of these nerves.
5. Commissure of the optic nerve.
6. Left optic nerve, surrounded by the sheath derived from the dura mater.
7. The same nerve entering the eye.
8. An upper view of the left eye—the sclerotic coat.
9. The cornea.
10. The right optic nerve, invested only by its neurilema.
11. Its contraction as it enters the globe of the eye.
12. The expansion of the retina, with its arteries.
13. The iris.
14. The lens.

Figure III.

The Internal Ear.—The Labyrinth laid open, so as to shew the parts it contains.

1. The cochlea, with its walls entirely removed, shewing the lines on its lamina spiralis.
2. The vestibule.
3. The posterior semi-circular canal.
4. The superior or vertical canal.
5. The canal formed by the junction of the contiguous limbs of the canals.
6. The horizontal semi-circular canal.
7, 8, 9. The three turns of the spiral lamella of the cochlea, seen from below.
10. Edge of the lamina spiralis becoming continuous with the periosteum of the rest of the cochlea.
11. The two foveæ of the vestibule, which on this side are united in one.
12. Membranous tube of the posterior semi-circular canal.
13. Its elliptical dilatation.
14. Membranous tube of the superior semi-circular canal.
15. Membranous tube common to the superior and posterior semi-circular canals.
16. The extremities of the membranous tube belonging to the horizontal canal.
17. The acoustic nerve.

INTRODUCTION.

TWENTY years have nearly elapsed since I first published my Treatise on the Physiology and Diseases of the Ear, which I have had the satisfaction to see reach a fifth edition, and which has met with a reception almost unprecedented. My other works on the Ear, both as regards its various affections and the treatment of the Deaf and Dumb, have likewise been very generally esteemed.

As calculated to instruct the junior practitioner, my Map of the Anatomy of the Ear, exhibiting its internal, intermediate, and external structure, with the bones *in situ*, together with the principal nerves and blood-vessels in its immediate vicinity; and also my Synoptical Chart of the various Diseases of the Ear, shewing, at one view, their order, classification, seat, symptoms, causes, and treatment, have been favourably received.

Having now completed the whole of my works on the Ear—seeing the Institution which I founded for the cure of its diseases completely

established,* and patronised by the KING, the QUEEN, and the ROYAL FAMILY, as well as by nearly all the principal Nobility, Men of Science, and Professional Characters,—and having given advice and assistance to upwards of 15,000 persons, the greater number of whom have been cured or relieved, by a mode of treatment which has not only been successfully employed in this country, but also in France, Germany, and America; while Otorrhœa, and Deafness and Dumbness, diseases of the most formidable description, have been more thoroughly investigated, and many cases of a nature hitherto deemed hopeless radically cured;—I have now leisure to turn my attention to what I have for some time contem-

* The Royal Dispensary for Diseases of the Ear was instituted in 1816, under the patronage of his Majesty George the Fourth, the Dukes of York, Kent, and Cumberland, and, among the distinguished members of the medical profession, Sir Walter Farquhar, Dr. Baillie, Dr. Sims, Mr. Cline, Dr. Babington, Sir Astley Cooper, Mr. Leese, &c.

At a late meeting of the Governors, it was resolved, in order to extend its sphere of usefulness, to enlarge the present building, to enable it to receive within it walls not only deaf and dumb patients, but also persons from the country afflicted with deafness or other diseases of the ear, destitute of a habitation in the metropolis.

plated, viz. Diseases of the Eye—an organ of exquisite sensibility, and of wonderfully beautiful construction.

Many discoveries are made by chance, others by observation; and the one I have now the satisfaction of communicating to the profession is of great importance to a large class of sufferers. While treating cases of deafness, in which the patient's sight happened also to be affected, I have often been agreeably surprised to find, that while removing the deafness by constitutional treatment, the healthy action of the nerves of the ear has extended its influence to the eye, which has in this way, in numerous instances, been restored to the exercise of its functions. This undesigned coincidence was too striking, and likely to be too important in its results, for me to overlook: I accordingly directed my attention in a more particular manner to the subject, and being convinced, by my subsequent practice, that I had not been mistaken in my estimate of the causes to which I had attributed the consentaneous cure of two maladies by one line of treatment, I determined to publish my views on a topic so interesting to humanity.

From many years' attentive observation, I

am persuaded that the diseases of both the eye and the ear may be cured by the very same remedies; and if remedial means be had recourse to in their incipient stages, beneficial results will in most instances follow: on the contrary, much misery is entailed by neglect of the premonitory symptoms of the maladies of both these organs.

It is the too common practice, in some affections of the eye, to consign the unhappy sufferer to the hands of an operator, before any attempt has been made to relieve him by milder means; a system which, in my opinion, should never be adopted, except under the most favourable circumstances as regards the age, general health, seat of disease, and constitution and habits of the patient.*

And here I have a few words to say on the present ineffectual mode of treating diseases of the eye; a singular fact, when we consider the recent progress in the cure of other diseases, and recollect the distinguished men who have made the eye the chief object of their study.

The principal thing I have to object to, is

* I am led to draw these conclusions from the fact of so small a number of persons recovering their sight by means of operations.

the copious general bloodletting, both from the temporal artery and the neighbourhood of the organ; which I have often known to aggravate, instead of alleviate, the disease.

I also strongly object to large doses of calomel; to the injudicious use of belladonna; to the slovenly manner in which external applications are often made to the eye; and to the performance of operations in cases which, from the nature of the disease, and the condition of the patient's health, present little prospect of success.

Some practitioners are, moreover, too fond of applying blisters and leeches to the temples. When we consider that the fifth pair of nerves gives off branches to the eye, we may well conceive how much preferable it would be to employ these remedies behind the ears.

On this interesting subject, I ought not to omit observing, that in no hospital in Europe have diseases of the eye been more skilfully treated than at His Majesty's Royal Hospital at Haslar, where I was employed as a medical officer for nearly six years during the late war; and no where were the remedies more mild and efficacious, or the practice more successful, and that in general without the use of

the knife.* Happily the history and mode of treatment of every individual case during the period alluded to are on record, highly to the credit of the commissioners and the medical authorities.

Although, for the reasons already stated, I intend henceforth to devote more of my attention to the cure of diseases of the eye, yet I trust that my long and persevering study of the ear and treatment of its maladies will shield me from the charge of vacillation of purpose. It forms no part of my plan to abandon the cure of diseases of the ear (which, the more I see of them, the more I am convinced admit of relief), but merely, owing to the increased facilities I now possess in the valuable assistance of my pupils, to combine in one practice the treatment of both organs. And whoever considers the nature of the eye and ear, and the

* The Royal Hospital at Haslar is one of the most extensive and commodious in Europe, at one time containing 2000 patients; its regulations are all excellent; and, as I have above remarked, its medical officers able and skilful men—a fact none will be inclined to call in question, when such names as Drs. Lynd, Hope, Maginnis, Babington of the City, Sir James Macgregor, Sir R. Hunter, Johnson, Weatherhead, Thomson, Clarke, Messrs. O'Reilly, Vance, Macintyre, Thompson, &c. &c. are mentioned as having served there.

intimate relation which they have to each other, will see the necessity and propriety of their diseases being treated in conjunction.

My experience in the cure of diseases of the ear furnishes me with another strong argument, which of itself would have been amply sufficient to induce me to join the treatment of the eye and ear, namely, that while curing deafness I have often learnt from patients that their sight was also improved.

This fact, as I have before stated, stimulated me to increased diligence; and I accordingly directed my researches to the structure and functions of these organs, with especial reference to what was mutual between them.

Indeed, this is the chief reason which has induced me to add the profession of the Oculist to that of the Aurist; and to all who feel for their suffering fellow-creatures, and to whom the relief of the afflicted affords more satisfaction than quibbling about imaginary encroachments, and the preference of private interest to the public well-being, I feel convinced that I have said sufficient to account for the step I have taken, and for the book now presented to the world.

There is no lack of learned and scientific

books on the eye; but hitherto I have met with no work that conveys, in a plain and intelligible manner, such information as it concerns every person to know. It is therefore my design, in the following pages, to lay before the public such a work as may be readily understood by the nonprofessional reader, while, at the same time, it shall contain whatever is necessary to the scientific treatment of the principal diseases of the eye.

I may here observe, that Professor Robbi, of Leipsic, who has done me the honour to translate my works on the Ear into the German language, and to dedicate his valuable Encyclopædia of Anatomy to me, has communicated some important information on the eye, of which I have taken advantage in the treatment of its diseases .

In relation to affections of the eye, I shall here merely add, that I conceive them to be all nearly the same disease, varying only in situation and degree, and that they are derived from similar sources. Still, we are not to consider them all as absolutely alike, and requiring precisely the same treatment; but must endeavour to trace the cause of disease, arrest it in its progress, and restore the healthy

functions. The late Mr. Abernethy also thought so, and in his treatment he was generally right.

These affections most commonly arise from derangement of the digestive organs, acting on the ganglia and great sympathetic nerve, which has such an extensive influence on the whole system. It is from medical men not bearing this in mind, that cases often seem incurable, and are found so troublesome.

No diseases are more acutely painful, or occasion greater privations, than those of the eye. It is therefore remarkable, that, though much has been written, and many elaborate treatises published on the subject, we are still far behind in the practice of ophthalmic surgery.

It must be confessed, that the moderns are better acquainted with the treatment of diseases of the eye than the ancients were; yet the *zeal* of the latter has not hitherto been surpassed. If we examine the works published since Scarpa's Practical Observations on the principal Diseases of the Eyes, which appeared about the end of the eighteenth century, we shall find very little new on the subject beyond what he or his predecessors have com-

municated.* There is, consequently, ample scope for improvement.

* Out of the many descriptions of the eye that have been published, I select the following, as deserving the attention of the practitioner : —

Fallopii Instit. Anat. Op. tom. i. pp. 454—6.

Fabricius de Oculo, Op. p. 187 et seq.

Kepler Paralipomena, cap. v. pp. 158—168.

Briggs Ophthalmographia.

Cheselden's Anatomy, ch. vi. p. 290 et seq.

Winslow's Anatomy, sect. 10. art. 2. vol. ii. p. 284 et seq.

Porterfield on the Eye, vol. i. Book 2.

Boerhaave, Prælect. § 508 et seq. tom. iv. p. 44 et seq.

Cowper, Anat. Corp. Hum. tab. 11.

Camper de quibusdam Oculi part.

Haller El. Phys. lib. xvi. sect. 2. Oper. Min. tom. iii. p. 218. et Arter. Oculi Hist. cum tab. in Icon. Anat. Fas. 7.

Warner's Description of the Eye.

Linn. Descrip. Anat. Oculi Hum.; et in Comment. Gott. tom. iv. p. 192.

Sœmmering's elaborate Icon. Oculi Hum., and the transcript of the same by Caldani, pl. 93—5.

D. W. Sœmmering de Oculis Hominis Animaliumque Commentatio.

Blumenbach Instit. Phys. sect. xvii. § 255—268.

Monro's (sec.) Three Treatises.

Bichât, Anat. Descript. tom. ii. p. 416 et seq.

Cuvier, Leç. d'Anat. Comp. No. 12, tom. ii. p. 264 et seq.

Young's Lect., No. 38, vol. ii. p. 447 et seq.

Bell's Anat. vol. iii. Part 2. Book 1. p. 224 et seq.

Monro's (tert.) Elements, Part 6, ch. iii. s. 2. p. 392 et seq.

In order to obtain a correct knowledge of the diseases of the eye, it is essentially necessary to have a thorough and intimate acquaintance with the anatomy* and functions of this intricate organ. Of the truth of this, every one must be sufficiently convinced who gives the subject even a moderate degree of attention.

Although this is obviously not the place to enter into a detailed account of the anatomy of the entire skeleton, and as I have embraced in the chapter on the physiology of the eye what

* The Greeks are the first people of whom we have any authentic account who studied anatomy as a science. It is probable that they first derived their knowledge from the eastern nations, particularly the Ethiopians and Egyptians, from the circumstance of anatomy in its infancy being so closely connected with astronomy, which those nations had peculiar opportunities of cultivating. Thales, surnamed the Wise, was the first anatomist we hear of, and he lived 500 years before Christ. No progress, however, was made in this science till the time of Hippocrates, who was contemporary with Socrates, Xenophon, and Plato, about 400 years before the Christian era.

The first dissection we have upon record was made by Democrates of Abdera, who had for his subject a hog. From the time of Hippocrates, however, the science was gradually improved till the time of Galen, who lived in the second century, that is, 600 years after Hippocrates. Galen cultivated

relates to the structure of that organ; yet it may not be uninteresting to the reader to give him here, in a condensed form, a general description of the component parts of the human body. It cannot fail to warm his heart with gratitude when he sees how fearfully and wonderfully we are made.

Man has an intellectual mind bestowed upon him; and the structure of the body is given him as a habitation for the soul. It must be provided with a peculiar residence: the brain is fit for this purpose. There the soul may hold its empire, as the mind holds an intercourse

the science more philosophically, as had also been done, about 250 years before Christ, by Herophilus and Aristratus of Alexandria, whither the Greeks went to finish their education, and where most probably the first human dissections were made. Galen applied himself diligently to anatomy, studied in Asia Minor, and thence went to Alexandria. He composed many books, which, for the time he lived, were probably valuable performances; but his dissections were chiefly confined to quadrupeds,—opportunities of dissecting human subjects, owing to the superstition of the times, being very rare. For a long series of years after Galen the science declined; and as the empire of Rome decayed, so did arts in general. Galen had, indeed, acquired so great a character as an anatomist, that his successors, despairing probably of going beyond so great a man, contented themselves for many years with explaining his doctrines.

with the body, to be a faithful monitor to it, and to direct its motions.

The mind must have servants for these purposes: the nerves give the power of sensation to enable it to pursue whatever objects are pleasing, and to avoid those that are displeasing.

Moving powers, muscles and tendons, must therefore be provided. Different bones are wanting to support the fabric. Ligaments must serve to bind and keep the bones together; and that the ends of these may move freely and easily upon each other, they must be furnished with smooth cartilages, and mucus to fill their intermediate spaces. The cellular membrane is required as a case to the whole, and to contribute to form the skin, which is also the organ of feeling.

This body is to live in society, and to hold an intercourse with the beings around it: it must therefore have the organs of speech and hearing. Those of sight also are absolutely necessary on a thousand occasions.

Thus far, then, nothing appears to be superfluous. But the machine is not yet complete: if the body were not continually recruited, it would soon be worn out; and therefore the fluid blood must be provided to repair the machine,

to wash away the old materials which are become useless, and to convey them to the various glands through which the noxious or useless particles are strained from the blood, and carried out of the body.

That the blood may perform these offices, it is necessary that it should circulate through every, even the most minute part. Thus is preserved the structure of the human frame in general; and thus are evident the advantages arising from the heart, and from the arterial and venous systems.

The blood itself, from performing these offices, would soon be expended, were it not continually recruited: this must be done by food. The earth accordingly abounds with animal and vegetable productions proper for this purpose; and men are provided with hands to enable them to procure subsistence.

Food in its crude state is very different from the blood into which it is to be changed; and this makes necessary the teeth, stomach, and, in short, all the organs subservient to digestion, as also the senses of smelling and tasting, that we may be able to choose proper aliment. The finer and more subtile parts of this prepared mass afford what is suitable for the formation of

blood, which is absorbed by the lacteals; while the grosser and useless part is conveyed away through the intestinal canal.

Now the body, like all that lives, has its duration: it is nourished, grows, arrives at the general stature, decays and falls to dust. That its species should be preserved, it is therefore necessary that it have the power of multiplying its kind.

Thus we see that there are different systems in the body; the vascular for nutrition, the nervous for sensation, the ligamentous for union, the osseous for strength, the muscular and tendinous for motion, the digestive for supplying nutriment, and the generative for the preservation of the species.

After taking this view of the constituent parts of the body, there still remain the organs of respiration, the mode of whose action it is greatly to be regretted we cannot so readily perceive as of that of some other organs.

But, wonderful as is this intricate structure of the human body, and much as our astonishment is excited by the nice adaptation of means to their various ends, yet another principle remains to be noticed, more wonderful than these: I mean the soul, the immortal φρην, about the seat

of which much has been written, hitherto unsuccessfully, and which some have supposed to be in the pineal gland, others in the corpus callosum, others in the cerebrum, and some in the cerebellum. Yet, much as this purely speculative question has engaged attention, it is strange that few endeavours have hitherto been made to answer the practically important query of, Where is the principal seat of disease? Instead of discussing what we *can* know nothing about, would it not be wiser and better to seek to solve this great problem? If it be in any one part more than another, I should be inclined to think that part is the semilunar ganglion and solar plexus,* situated near the stomach, and connected with the great sympathetic nerve, which exercises such a leading influence on all the organs of the body, and more particularly on those of the eye and ear. Hence we shall find, that derangements of the above-mentioned ganglia† are the source of nervous affections of the sight and hearing.

* Vide Manec's excellent plate and description of the great sympathetic nerve, shewing the various ganglia.

† The ganglia are small knots or masses of nervous matter, which are situated along the course of the nerves generally, where two or three of them form an angle, and

Diseases of the eye, as I have long ago remarked of those of the ear, when attended to in their incipient stage, and the seat and cause of the malady ascertained by careful inquiry and minute inspection, warrant our giving every hope of relief; but when neglected until they have become confirmed, the organ dulled by inaction, and the brain at length participating in the affec-

especially in the different parts of the thorax and abdomen. They are composed of a mixture of two substances, which appear analogous to the cineritious and medullary matter of the brain. They are of a redder colour, and are more copiously supplied with arteries than the nerves. They are also of a firmer consistence, and are covered with a denser membrane. Anatomists are generally agreed that the nerves which proceed from a ganglion are larger than those which enter into it, as if, in their passage through it, they had received an additional quantity of matter. With respect to their texture, we are informed by Monro, and the account which has been given by Scarpa is fundamentally the same, that the filaments of the different nerves which compose the ganglion proceed individually without interruption, but that they are all twisted together into an irregular bundle, and that filaments from different nerves are united in the formation of a new nerve. In this way, it would appear that a mechanical connexion is established between the parts that receive their nerves from the ganglia; and we may presume that this will contribute to a sympathy between their actions.

tion, there is no benefit to be expected from that advice which, if sought in time, might have preserved or restored the use of the most valuable faculties of man.

Before closing this Introduction, I may briefly acquaint the reader with the method I have followed in this work:—After describing the structure and uses of the different parts of the eye, with their principal diseases and treatment, (which I have endeavoured to do with as few technicalities as the nature of the subject would possibly permit,) I have given some observations on light and vision; together with practical remarks on the best means of preserving the sight unimpaired to old age; and on the use, abuse, and choice of spectacles. For want of proper information on glasses, many persons are unconsciously doing their eyes much mischief, by the use of such spectacles as are unsuited to them.

In order to render the work more generally useful, as well to the practitioner as to the general reader, I have added, in the chapter on the diseases of the eye, prescriptions in Latin and English, for the treatment of many of its maladies.

A TREATISE,

ETC.

CHAPTER I.

ON THE STRUCTURE AND USES OF THE DIFFERENT PARTS OF THE EYE.

THE eye is the organ of vision, and may be compared, in its construction, to an optical instrument: it consists of a number of parts, external and internal. These are the eyebrows, the orbit, the socket, the muscles, the lachrymal gland, the puncta lachrymalia, the lachrymal sac and duct, the eyelid, the eyelashes, the conjunctiva, the caruncula, the eyeball with its coats, chambers, and humours, and the optic nerves; which I shall now describe.

The *supercilium*, or eyebrow, is an arched projection of the frontal bone of the cranium, over which certain muscles run; and is externally furnished with short, rather stiff, and

thickly set hair, placed in an oblique direction, to prevent the condensed perspiration from running off the forehead into the eye.

The eye is lodged in the socket formed by the orbital processes, and is abundantly furnished with a quantity of adipose substance, serving to facilitate its varied movements. The inner surface of the bone is covered by the same strong membrane which lines the cranium and covers the cerebrum. We can accordingly, from this connexion, trace the cause of inflammation affecting this membrane when the eye is much injured, and can explain the origin of the pains thence arising in the face, as the covering of the facial bones unites with the lining of the socket of the eye.

In each eye there are six muscles, four straight and two oblique. The four straight muscles are intended to roll the eye inwards, one being above, one below, and one on each side of the ball. The upper one raises the eye upwards and backwards, the lower draws it downwards and inwards, the outer moves it towards the temple, and the inner pulls it towards the nose. When all four act together, they sink the eye in the socket, and keep it fixed and motionless.

Within the inner canthus of the eye, the lower oblique muscle takes its rise, and running obliquely backwards below the eyeball, is inserted about the middle of it, or farther inwards than the lower straight muscles.

The upper oblique muscle merits particular attention on account of its singular mechanism. It can easily be conceived in what manner the eye may be pulled backwards and inwards, and even on one side, by the straight muscles placed in the posterior part of the socket. But we often see the eye move outwards; and as no motion in the body can take place without muscles as the immediate moving power, how, it may well be asked, can the eye move outwards, when there is nothing without to which a muscle can conveniently be attached?

In order to effect this motion, the tendon of the muscle is very long, and is made to pass through a cartilaginous substance, or a process of the bone of the eyebrow, near to the angle which it forms with the nasal bone, much in the same way as a cord is passed through a pulley; and when it has passed through this, the tendon runs back again, and is inserted into the upper and middle part of the eyeball. This curious and interesting muscle,

together with the other oblique muscle, then causes the eye to roll outwards, as in the effort to perceive a distant mountain or an island far at sea.

In order further to facilitate the numerous motions of the eyeball, it is furnished with a constant supply of moisture from a gland called the lachrymal gland, situated within the upper and outer part of the bony socket. The lachrymal gland is composed of a great number of small globular bodies, from which seven or eight ducts, not much thicker than a hair, run into the inner surface of the eyelid. In twenty-four hours, it has been computed that the two lachrymal glands discharge about four ounces of the fluid well known by the name of tears. The tears are very limpid, of a saltish taste, and when chemically analysed are found to contain water, mucus, common salt, and a very little soda and lime.

From the tears constantly running into the eyes, it is requisite there should be some contrivance to carry off any quantity which might be found superfluous; and for this purpose, when the eyelids come together in the incessant process of winking, they form a channel, which runs in front of the eye, having some-

what of a sloping direction towards the nose, or the inner canthus. I may also remark, that the eyelids begin first to touch each other at the outer angle, and the pressure proceeds successively to the inner, and this consequently impels the tears along the channel towards the inner canthus.

As soon as the tears have reached the end of the channel, there is a passage for them through the *puncta lachrymalia* in two directions,—one above and another below the corner of each eye. Each of these puncta consists of a minute foramen, or hole, with a whitish cartilaginous circle around it, capable of admitting a bristle or a small pin, and placed on the very point of the angle of the eyelid, opposite the last hair of the eyelash towards the inner canthus. These puncta absorb the tears, not, as has been supposed, by the mysterious power termed capillary attraction, but by the same vital power as the lacteals of the intestines take up the chyle and carry it into the blood through the channel of the thoracic duct.

The puncta lachrymalia lead to two canals, just wide enough to admit a bristle, running above and below the sides, which form the

angle of the eye at the canthus, in the shape of a bifurcation, till they reach the nose, where they unite into one, and form the lachrymal sac. The ducts thus united now take a downward course along the exterior parietes of the nose for about an inch; and the lachrymal duct here penetrates the bone, and discharges the tears into the side of the base of the nose, about an inch from the orifice of the nostril. Here the superfluous moisture is carried off by the stream of air constantly passing in the act of respiration.

The *palpebræ*, or eyelids, are lined on their internal surface with a very delicate skin, full of ramified blood-vessels. This is termed the *conjunctiva*, and is considerably larger than the parts it covers, and loose, so as to admit of motion.

Besides the tears, the eyes are furnished with a sebaceous substance readily soluble. This is secreted in certain beautiful little glands, interspersed within the conjunctiva of the inner eyelid, near the roots of the eyelashes, appearing under the microscope like small pearls. According to M. Majendie, it is prepared in these glands, and is of a glairy consistence, of the nature of albumen, and capable of being dis-

solved in the tears. It may be supposed to be intended to neutralise the acrimony of the salts contained in the tears, which might, without this addition, prove too harsh for the eye. During sleep, when the tears are deficient in quantity, this substance is not dissolved, but is collected in the corners of the eyes; and sometimes, when it is abundant and thicker than usual, it glues the eyelids together.

This substance, together with the tears in which it is dissolved and diluted, is constantly spread over the eyeball by the sweep of the eyelids, which act like valves, and are composed of semi-transparent muscular membrane, attached to the cartilage that is articulated with the adjacent bone of the socket, giving them firmness, and preserving their shape. Under the skin here, there is a thin fluid, which, after excess of fatigue, as well as a consequence of various diseases, becomes thicker and more abundant, and gives the eyelids a dark leaden hue, which, whenever it appears, is a sure mark of exhaustion and weakness.

The eyelids are elegantly fringed with short hairs, termed *cilia*, or eyelashes, either to defend the eye from any thing falling into it, or to modify the effect of the rays of light. When

these hairs are removed, the sight is always impaired. When they are wet with tears, the little drops act upon the light like dew-drops, and produce beams of iridescent colours.

When the eye is opened, the upper eyelid only is raised—an effect produced by the action of a small fan-shaped muscle attached to the inner part of the bone of the socket. The eye is shut by another muscle, which surrounds the eyelids, and is termed the *orbicularis palpebrarum*.

At the inner canthus of the eye there is a little red fleshy membrane, named the *caruncula*, in the form of a half-moon, which, when the eye is turned away, is spread over its inner part; and when any dust has fallen upon the ball, it sticks to this, and is carried into the corner of the eye by the membrane folding back. All dust and offensive matter is, by this means, thrown out at the corner of the eye, *beyond* the small holes of the entrance to the lachrymal ducts, otherwise these might be obstructed. The caruncula is formed of seven or eight folds, arranged in a semicircle, and studded with small hairs. The use of these hairs appears to be to throw out dust, or other foreign bodies, carried thither by the mechanism

just described. It is also useful in directing the tears through these canals into the nose; and gives out a sebaceous substance like that of the eyelids, which is a good test of strength or weakness, being pale when the constitution is debilitated, but florid in high health. The ancients thought it was the source of the tears. In some of the inferior animals, particularly in birds, this spreads over the whole eye, and performs the office of a second eyelid by veiling the eye.

The ball of the eye is considerably smaller than the socket, to give room for its motions, and is not quite globular, but a little elongated. It is made up of several tunics, somewhat like the coats of an onion, which enclose several humours. Next to the transparent skin, which I have described as lining the eyelid and covering the eyeball, there is a hard, opaque, pearly, or bluish white, insensible coat, which surrounds the ball, except the central circle, where the eye is transparent, and is termed the *sclerotica.*

The descriptions which are given of this coat in books are often very inaccurate, and even contradictory. Some confound it with the reflected skin of the eyelids, already de-

scribed, because this closely adheres to it; and others take no notice of the obvious cause of its white colour, and, consequently, give a very partial account of its texture; others, again, confound it with the cornea, or outer transparent coat of the central circle.

The white or sclerotic coat of the eye is a very strong membrane, having the texture and firmness of tanned leather. It is somewhat extensible and elastic, as appears in dropsy of the eye. The sheath of the nerve of the eye is intimately interwoven with this coat, which caused the ingenious M. Bichât to consider it as actually the sheath blown out into a globe. It is this coat which binds the eyeball firmly round, and preserves its figure; and particularly it affords a strong substance for the insertion of the tendons and muscles that move the eye. It is the termination of these muscles which, being spread over the fore part of this coat, gives it that pearly or enamelled appearance, and which is sometimes described as a separate coat. Almost all the terminations of the muscles, in every part of the body, are of this appearance, or somewhat silvery, and nearly insensible, being destitute of nerves. It follows, that both the coat itself, and the ends of the muscles inserted

into it, are insensible. In consumption, the white of the eye, as well as the teeth, become more distinctly of a pearly hue. In some cases of palsy, it has turned quite black. When any of the parts within the eye swell, this coat, from its firmness, resists their expansion, and is, in this manner, productive of great pain.

The middle or choroid coat lies within the white of the eye, adhering to it by an abundant tissue of cells. This middle coat is thin, rather soft, and so full of blood-vessels that its inner surface is velvet-like, from their terminations; and when the eye of a young subject is injected with red wax, it appears like scarlet cloth. It is, indeed, almost a tissue of blood-vessels, particularly on the surface next to the white or sclerotic coat. It is very sensible. The inner surface gives out the *pigmentum nigrum*, a dark-brown paint, or varnish, which is, in fact, the colour of the whole coat. This is spread over the outer surface of the innermost coat, or expanded nerve, of the eye, and is an important provision in producing sight, as the following facts from Dr. Monro demonstrate:—In the ox, this paint is green; in the cat and owl, it is white and silvery; in the lion, it is golden yellow; in the dog, it is greyish; in man, it is dark brown or

black during youth or manhood, and in old age it becomes deficient.*

We infer from these facts, that the pigmentum given out by the middle coat of the eye is intended to modify the intensity of light.

* The three principal colours of the human eye were well laid down by Aristotle, viz. blue, passing in its lighter tints to what we call grey; an obscure orange, which he calls the colour of the eye in the goat—a kind of middle tint between blue and orange, and sometimes remarkably green in men with very red hair and freckled skin; and, lastly, brown in various shades, forming, in proportion to its depth, what we call hazel, dark, or black eyes. The red eyes of the leucæthiopic constitution may constitute a fourth division.

These may all occur in different individuals of the same race, or even of the same family; and again, they are sometimes confined to the distinct tribes of the same country, within the limits of a few degrees. Thus, Linnæus describes, in Sweden, the Gothlander, with light hair, and greyish blue eyes; the Fin, with yellow hair, and brown iris; and the Laplander, with black hair and eyes.

Blue eyes, as well as yellow hair, (*cærulei oculi, rutilæ comæ*,) have characterised the German race from the earliest times; and the same combination is met with, in scattered instances, in the most remote nations. The iris of the negro is the blackest we are acquainted with; so that close inspection is necessary, in living individuals, to distinguish it from the pupil. It is invariably dark in all the coloured tribes of men, as well as in the dark-complexioned individuals of the white variety.

White and pale colours reflect light, while black and deep colours absorb it; hence, animals which prey in the night have this pigment of a paler colour than man, who sees worse in the dark than any other perfect animal. It is from this circumstance that the eyes of cats are observed to gleam in the dark; for they concentrate all the light which falls upon them, and the white parts reflect it back on the objects near them.

The singular variety of the human race called Albinos, who have their hair and skin perfectly white, as well as ferrets, white rabbits, and pigeons, want the pigmentum nigrum altogether; and hence their eyes appear red. It therefore happens that no animal having this peculiarity can see perfectly in bright sunshine or strong light, from the want of its modifying power.

For the purpose of seeing, in a living animal, the blood-vessels of this middle coat, and the beautiful ones also of the next coat in succession, M. Mery plunged a cat into a tub of water. The eye, by this means, was rendered more transparent, and the circulation of the blood could be distinctly perceived.

The expansion of the nerve of the eye,

which covers the whole of the back part of its globe within the middle coat, forms the innermost coat, reckoning from the front inwards. This is well known as the *retina*, which, as the name implies, has a sort of netted appearance; but this does not belong to the nervous expansion itself, in which no fibres or threads can be detected, but to the blood-vessels interwoven with the nerve, and giving to the whole a faint pink tinge. These are minutely divided, and very numerous; and it is not improbable that it is their netted appearance which is seen upon pressing the eye in a particular manner. For example, when we shut our eyes, and press slightly on the eyelids for a short time, we begin to see a number of luminous points dispersed through the artificial darkness thus produced. These points are, by degrees, observed to unite into lines, becoming more luminous, and crossing each other in many directions. By continuing the pressure of the finger somewhat longer, the luminous lines appear to radiate from a central circle about a quarter of an inch in diameter, which is also variously netted, but darker than the rest of the field of vision, if we may use such an expression under these circumstances. When the eye is strained, as if

in the act of attentive vision, these luminous lines are seen tremulous and fluttering, in consequence of the irritation of the nerves.

These netted and luminous radiations, observed on thus pressing the eye when shut, are all colourless, or rather are between a yellowish white and a silvery hue; but sometimes there are small pale blue spots observable, not larger than a millet-seed. The phenomena, moreover, are not confined to a definite circle, but extend over an apparent space of several feet in diameter, though varying in extent according to the contrivance or magnitude of the pressure which is employed. It is not, however, indispensable to make pressure at all, though it renders the effects more distinct; for we may see the same appearances by day or by night, whenever our eyes are closed.

M. Sauvage mentions having observed a similar net-work on looking attentively at a white wall exposed to sunshine. It was darker than the other parts of the wall, and vanished and reappeared at each beat of his pulse. These phenomena, I may remark, are very different from what are termed *ocular spectra*, which have given origin to many curious experiments, detailed by Buffon, Darwin, Wells, D'Arcy, Young, and Bingham.

The retina is usually supposed to be the seat of vision. In the axis of the eye, between the two principal branches of the central blood-vessel, and a little nearer the temple than the nerve of the eye, is a small foramen, surrounded by a yellow edge, which was first discovered by the celebrated Sömmering. Its use is not well understood, though perhaps it may be intended to modify the intensity of light, by contracting or enlarging, according to circumstances. It is only to be found in animals whose eyes are parallel, like those of man; and this might lead us to conjecture that it is instrumental in directing their parallelism. There is in front of the coloured central circle of the eye a hard transparent coat, in the form of a watch-glass, being more convex and prominent than the white of the eye. This is called the *cornea*, because it is supposed to be of the texture of horn. Some have compared it to the nails, without reflecting that the nails are not, like it, separated into plates or scales by a peculiar fluid; nor are they subject to inflammation. Like the white of the eye, it is insensible; and is also covered by the conjunctiva or reflected skin of the eyelids, which gives it a polish and brilliancy, and sometimes much increases the ap-

pearance of inflammation when the cornea is so affected. It is proper to mention, however, that authors differ as to the sensibility of the cornea. Haller says it is insensible. It is composed of several concentric transparent plates or scales, slightly adhering together, and having transparent vessels running through them, which give out a limpid fluid, like pure water. To this fluid the eye in health and in youth owes all its lustre. In ill health, and in old age, it becomes muddy, or deficient in quantity, and the eye in consequence loses its brilliancy. The cornea readily imbibes water, and gives it out again in diseases, and particularly at death, when it produces the glassy film seen in the eyes of the dead.

One of the most beautiful parts of the eye, which is fancifully called the *iris*, or rainbow, from its varied colour, lies behind this transparent horn or eye-glass. It is this which in some eyes is blue, in others dark brown or nearly black, and in others hazel or grey. It is a delicate and very sensible coat or membrane, which partitions the eyeball into two chambers, one before, and the other behind it. M. Milne Edwards says it is made up of four plates. Around the margin of the iris is an

elegant arrangement of the middle coat of the eye, it being beautifully plaited. There are about seventy of these triangular folds. This may be called the *ciliary circle.* The fringes are spread over the glassy humour and around the crystalline lens. They cannot have any power to move the lens, as has by some been supposed, for they do not adhere to it, nor are they contractile; besides, the lens itself is immovably fixed in the vitreous humour.

The colour seen in the iris through the cornea is produced by a colouring matter, similar to the pigmentum described as spread between the middle and the inner coat or retina. This is usually brown, even in light-coloured eyes; and, as it is spread over the back part of the iris, the colour of the eyes is modified by the degree of transparency possessed by this membrane. The more transparent it is, the darker the eyes. When it is milky or cloudy, the colour of the eyes is blue, grey, or hazel. In bright blue eyes it is white.

The varied shades and elegant marbling, however, arise from the fleecy texture of vessels and nerves, producing a velvet-like surface, from which the brown paint is given out.

The black paint is indispensable to our perceiving colours; for when the membrane is detached from the paint, it is transparent and colourless.

If we examine the coloured part of the eye, three circles, of different shades, are observable, the two outer being on the iris, the middle one the palest, whilst the inner one is very variable in size, and is produced by an aperture in the iris, which is always deep black when the eye is healthy and sound, whatever the colour of the iris itself may be. This aperture is termed the pupil, and popularly the sight of the eye.

The pupil, in some rarer cases, will appear active, though the eye be otherwise totally insensible to light. Parrots and some other animals are said to have, independent of light, a voluntary power over the pupil. Some instances, however, are recorded of this voluntary power in man, which, though not common, is curious.

The pupil varies in magnitude according to the intensity of light which falls on the eye. It is by this test that we try the sensibility of diseased eyes; for when the sensibility is injured, this contraction either does not take place at all, or is very partial. It has long been dis-

puted among the ablest writers, whether the motion of the iris, in enlarging and contracting the pupil, is caused by muscles or not. On this point I may remark, that if muscles are the moving power, their action is very different from what is usual in other parts of the body; for, in the iris, excitement, so far from producing contraction, causes relaxation of the fibres, and the contrary. At death, this relaxation is most obvious in the great dilatation of the pupil, which is, indeed, one of the most certain marks that life is extinct. The inner ring of the iris seems to be elastic. When a beam of light is made to fall on it, there is no motion.

Having thus described the several coats of the eye, it will next be requisite to notice what are termed its chambers, and the different humours which they contain. The space before the iris, and behind the cornea, is named the first or anterior chamber; and is filled with a limpid, colourless fluid, like water, hence called the aqueous humour. It weighs in a grown person about five grains, and about half as much in an infant. Various accounts are given by authors of the origin of the aqueous humour; some tracing it to the fleecy surface

of the iris, and others to the ciliary circle round its margin.

The aqueous humour seems to be intended to distend the cornea, and keep it full and convex. This may be inferred from the fluid becoming less in quantity, as it does in old age; and in some diseases the cornea at the same time becomes flatter: in infancy also, when the cornea is much thicker and stronger than in after-life, the fluid, not being so requisite, is less abundant. Another use of the watery humour appears to be that of affording a medium for the iris to float in. This is, perhaps, its most important use; for the contraction and dilatation of the pupil require the greatest nicety to meet the quantity of light, which is so frequently varying. When the fluid escapes, the pupil contracts for want of support; the watery humour accordingly fills the opening of the pupil, and a small quantity of it also lies behind the iris. Formerly, the quantity of the fluid behind the iris was thought to be considerable; but this was proved to be a mistake, by the ingenious experiment of freezing the eye before dissecting it. In this case only a very thin flake of ice is found behind the iris. On deficiency of the vitreous,

the aqueous humour becomes proportionally more copious.

When, by any accident, or by an operation, the cornea is torn or cut through, the aqueous humour escapes by the opening. It is, however, very speedily renewed; about eight or ten hours being sufficient for again filling the chamber of the eye.

The next chamber is much larger than the front one, forming the whole inner ball of the eye, while the other extends only to the iris. This chamber is chiefly filled with a fluid, which, from its appearance, is called the vitreous or glassy humour. There is, besides, a small round transparent body set into the front of this humour, like a diamond in a ring, immediately behind the pupil, which is called the crystalline lens. The vitreous humour will sink in water, is considerably heavier than the aqueous humour, and looks glairy, almost like melted glass. It does not float free like the aqueous, but is contained in a very lucid membrane, which divides within into innumerable little sacs, so transparent as not to break the course of a ray of light. Their density must be nearly the same with that of the fluid. No art of man could imitate this; for

the nicest of our artificial joinings of transparent bodies break the light, and throw it out of its track. Around the border of the cup in which the crystalline is set, the membrane is doubled in form of a ring, forming a canal, that may, after death, be inflated. It is thus discovered not to be uniformly tubular, but puckered, or rather divided into conical pouches by membranous partitions.

In what manner the substance of the humour and its membrane is produced and nourished, we cannot tell, as no vessels can be traced into it after birth. Before that period, blood-vessels are, on dissection, seen running through the transparent membranes. It is certain that all fluids are derived from the blood, and as they are constantly requiring to be renewed, the renewal must come from the same source. That we cannot detect them, is no proof, therefore, of the non-existence of vessels in the vitreous humour. This humour also sometimes becomes cloudy, and of a sea-green colour; although this complaint is uncommon.

The crystalline humour, or lens, as it is usually called, is a substance of the appearance of very transparent ice or crystal. In form it is like a very small thick spectacle-

eye, or the doubly convex glass of a spy-glass, or of a microscope; and serves a similar purpose to these in modifying the rays of light. The structure of the crystalline lens has been variously described; and as it is frequently the seat of disease, it has been very minutely examined. We may consider it as made up of very transparent threads, beautifully figured and waved. Between the scales there is a transparent fluid, clear and colourless in youth, but becoming yellowish, or topaz-coloured, in advanced age. In the centre of the lens the scales lie closer together, and form a small fibula, nearly solid, which will protrude if the outer scales be cut into. The whole lens is surrounded by a strong, thick, transparent, and elastic skin or membrane, enclosing a clear fluid, and by several other little pellicles or membranes, so delicate, that anatomists are not agreed about their distribution. The lens, however, is well ascertained to adhere behind to the membrane of the vitreous humour, which keeps it fixed opposite to the pupil, and prevents it from rolling. It is thought by some to be further steadied and compressed by the points of the ciliary fringe, which lie around it.

The optic nerves are to the eyes what the

auditory nerves are to the ears. The former are the largest that arise from the brain, if we except the fifth pair, and give off no branches from their origin to their termination on the retina. They proceed from the thalami nervorum opticorum, two white oval-shaped bodies covered by the plexus choroides, and situated on the lateral ventricles. Besides the thalami, the nates and testes, or tubercula quadrigemina, appear to furnish part of their origin. In their passage from the brain to their entrance into the orbit, they are covered only by the tunica arachnoides and pia mater; but when arrived at the optic foramen, they receive an additional envelope, formed by the dura mater, which we find in the orbit, as the sheath of the nerve, and said to be finally expanded into the sclerotic coat of the eye.

We may presume (says Dr. Bostock) that the specific and sole purpose of the optic nerve is to convey the visible impressions received by the retina; for it may be presumed that all the other functions to which the nervous system is subservient, are performed by the other nerves, with which the eye is so plentifully furnished. But, as is the case generally with nerves which possess specific powers, we do not observe any

peculiarity in the structure or fabric of the optic nerve, which could have led us previously to form any conclusion respecting the nature or mode of its action.

The two nerves, which at first are distinct, before entering the eyes meet together, and immediately separate again, making almost the form of an ⋈. At a short distance from the junction, the nerve passes through several small holes in the outer coats of the eye, but unites again and forms a small ganglion,* whence it goes to be distributed through the retina, accompanied with the numerous branches of its artery. As, in passing through the convex eye-glass of a pair of spectacles, all the beams of light are brought nearer to one another than before entering it, the same will accordingly take place in the eye; for the cornea, and the aque-

* "The ophthalmic ganglion, placed in the orbit, occupies the external side of the optic nerve; it communicates, by its posterior and inferior angle, with the common oculo-muscular nerve, by means of a twig. This twig is generally thick and short. By its posterior and superior angle, it communicates, by means of a long and slender thread, with the nasal branch of the ophthalmic of Willis. I have never seen the ophthalmic ganglion communicate directly with the cavernous plexus; nor have I seen the communication which Arnold states to

ous humour behind it, as well as the crystalline lens and the vitreous humour, are all much denser than the air external to the eye, through which the light passes; beams of light, on entering the eye, will, consequently, be bent or refracted from the course which they held through the air.

Now, as light always proceeds in straight lines, and never in curves, the beams which are thus broken from their former course in the humours of the eye, will take a new direction, but still continuing in a straight line. They will, as in the spectacle eye-glass, take the form of a cone, the point of which will go to the bottom of the eye, while its base is on the outside of the cornea. As no light can enter the eye except through the pupil, its interior is like a dark chamber.

exist between the ganglion of Meckel and that which I am describing. From the anterior part of the ophthalmic ganglion spring the ciliary nerves, from the number of ten to fifteen. These nerves are flexuous, disposed in two parcels, more or less distinct, round the optic nerve. They then gain the posterior part of the eye, and, traversing the sclerotica, distribute themselves over the ciliary ligament and the iris. In their passage along the optic nerve, they anastomose, and sometimes form one or two small ganglions."—MANEC.

In looking at objects which differ in their distances, the eye is supposed to undergo some change in its parts or relations. In short, it is conjectured to do for itself what spectacles or glasses accomplish for those who are very long-sighted, or who are very near-sighted. The change, whatever it is, has been the subject of minute investigation and of learned discussion; but still there is little known respecting it with certainty.

Several ingenious experiments were made by Dr. Thomas Young, to discover in the eyeball the change alleged to take place. He forced upon the ball the ring of a key, so as to cause by its pressure a luminous spot; and, looking at objects of different distances, he expected the spot would become greatly larger. He was disappointed, for it remained the same. He placed, in another experiment, two candles, corresponding to the extent of the nerve of the eye, and then made the highest change of its focus, expecting that, in consequence, the outer candle would appear to move away from him; but in this also he was disappointed.

On the assumption of a change in the eye, several suppositions have been made concerning the nature of that change; most, if not all,

of which are liable to weighty objections. For example, if the globe of the eye is changed, it must be compressed or relaxed by the surrounding muscles of the eyeball, in order to render its axis longer or shorter. If this were so, however, the retina would be puckered up into folds; while we should, moreover, be more conscious of the change from the muscles being under the power of the will.

Mr. Ramsden seems to have proved that the cornea is partly affected. He invented an apparatus, by which he found that the cornea moved one eight hundredth part of an inch from the nearest point of distinct vision, to a distance of ninety feet.

It is also supposed that the muscular power of the ciliary processes, in drawing the crystalline lens forwards or backwards, is the principal change produced; but this is disproved by the want of any contractile power in these very processes.

That we may see well, it is obviously essential for the eye to be perfect, which it cannot be unless the body is in health. A remarkable proof of the truth of this observation may be found in the acuteness of the external senses, especially the vision, of the savage tribes, which,

when compared with the sight of those pent up in cities, may well excite our wonder, even to the extent of incredulity.*

Having now given a description of the anatomy of the eye, stated the uses of its various parts, and interspersed such remarks and illustrations as seemed to be suggested by the subject, I shall close this chapter with some comparisons of the organ in quadrupeds, birds, fishes, and insects. I adopted a like course in my "Treatise on the Ear;" and the

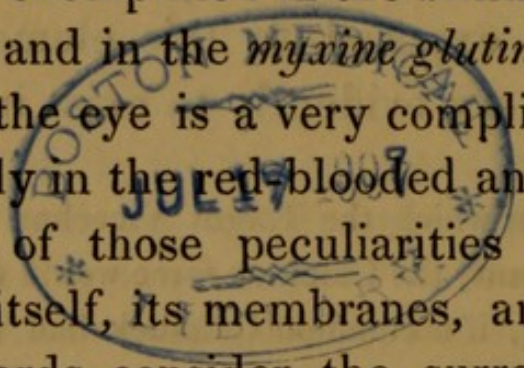
* Pallas, in his frequent intercourse with the nomadic tribes of Asia, had the best opportunities of observing their capabilities in various respects. "The Calmucks," he says, "have a fine nose, a good ear, and an extremely acute eye. On their journeys and military expeditions, they often smell out a fire or a camp, and thus procure quarters for the night, or obtain booty. Many of them can distinguish, by smelling at the hole of a fox or other animal, whether the creature be there or not. By lying flat, and putting their ears to the ground, they can catch, at a great distance, the noise of horses, of a flock, or of a single strayed animal. But nothing is so surprising as the perfection of their eyes, and the extraordinary distance at which they often perceive, from inconsiderable heights, small objects, such as the rising dust caused by cattle or horsemen, more particularly as the undulation of the boundless steppes or plains, and the vapours which rise from and float upon them in warm weather, render things very obscure.

reception it has met with, convinces me that similar illustrations in relation to the eye will not be unacceptable to the reader. For many of these remarks, I am indebted to that excellent German physiologist, Blumenbach, and to my late respected friend Mr. Joshua Brooks, who has probably seldom been equalled for his zeal and skill in comparative anatomy.

A sensibility to the impressions of light is common to all those animals which in a natural state are exposed to this element; it appears at least very evidently to exist in some

" In the expedition which the Torgot Vicechan Ubaschi led against the Cubanians, the Calmuck force would certainly have missed the enemy, if a common Calmuck had not perceived, at the estimated distance of thirty versts, the smoke and dust of the hostile army, and pointed it out to other equally experienced eyes, when the commander, Colonel Kischinskoi, could discern nothing with a good glass. They pursue lost or stolen cattle or game by the track over deserts: Kirgises, or even Russians, in the wild parts of the empire, are equally able to follow and discriminate tracks by the eye. This, indeed, is not difficult on soft ground, or over snow, but it requires great practice and skill to choose the right out of several intermingled traces, to follow it over loose sand or snow, not to lose it in marshes or deep grass, but rather to judge from the direction of the grass, or from the depth of the print in the snow or sand, how long it has been made." —*Vide Essay on the Deaf and Dumb*, pp. 51, 52.

of the most simple zoophytes, as the armed polypes; but the power of perceiving the images of external objects is confined to such as are provided with eyes for the reception of those images. Nature has bestowed on some species, even of red-blooded animals, a kind of rudiment of eyes, which have not the power of perceiving light, as if in compliance with some general model for the bodily structure of such animals. This is exemplified in the blind rat among mammalia, and in the *myxine glutinosa* among fishes. Since the eye is a very complicated organ, particularly in the red-blooded animals, I shall first speak of those peculiarities which affect the globe itself, its membranes, and humours; and afterwards consider the surrounding parts, as the eyelids, lachrymal passages, &c.



Mammalia.

It has been known that the sclerotica in several quadrupeds of this class, as in the human subject, is not throughout of equal strength; but that its posterior is much thicker than its anterior part. It has also been conjectured that this structure might influence what are called the internal changes of the eye, by which the form of the eyeball, consequently

the length of its axis and the respective situation of the lens, are adjusted according to the proximity or remoteness of the object, or in reference to any other relations. Warm-blooded animals have not only the power of seeing at various distances, but also in two media of such different density as air and water. In the eye of the Greenland seal, where M. Blumenbach first noticed the fact, the cornea was thin and yielding, the anterior segment of the sclerotica, or that which is immediately behind the latter membrane, was thick and firm, its middle circle thin and flexible, and lastly, the posterior part very thick and almost cartilaginous. The whole eyeball is surrounded with very strong muscles, and we can easily understand how their action, varied according to circumstances, produces the requisite changes; how the axis of the eye is shortened when the animal sees in air, by bringing the lens nearer to the back of the globe, in order to obviate the strong refraction which the rays of light experience in passing from the thin medium of air into the thicker one of the eyes, and *vice versâ*.

The sclerotic coat of the cetacea is distinguished by the great thickness of its posterior part; when the eyeball equals an orange in size,

the back of this membrane is an inch thick, so that, although the globe be spherical, the space containing the vitreous humour is of a different form. As the sclerotic approaches to the cornea it becomes thinner. Its posterior part presents a singular structure, consisting of very firm tendinous threads and laminæ most closely interwoven, and of more than cartilaginous hardness towards the sides. The extent of the cornea, when compared to that of the sclerotica, varies in the different species of mammalia. It seems to be the greatest in the porcupine, where the cornea extends over half the globe.

The choroid coat consists more plainly in the cetacea than in any other mammalia, of two distinct laminæ, of which the internal (*membrana Ruyschiana*) is covered with a dull tapetum. The inner surface of the choroid coat possesses towards the back of the eye, in several genera of this class, particularly in those carnivorous animals which prey by night, and even in the bisulca, the most brilliant yellow-green and sapphire-blue colours, forming what is called the *tapetum lucidum*. The coloured portion of the choroid is only partial, and the rest of the membrane is covered with

a black pigment, as usual. In consequence of this structure, less light will be absorbed, and it must, on the contrary, be reflected from the tapetum against the retina, which lies in front of the membrane.

The retina exhibits in some quadrupeds, viz. the hare and rabbit, very distinct and elegant fibres or striæ of medullary substance, taking, for the most part, a transverse direction. The remarkable central foramen, which Sömmering discovered in the human retina, has been since demonstrated to exist in the eyes of several quadrumana, where these organs are directed forwards, and have their axis parallel. It is, for instance, very plain in the eye of the common Barbary ape: the entrance of the optic nerve formed a small yellow circle on the retina, near this a large grey fold appeared, with the central foramen in its middle. Man, and such animals as have the two eyes placed with their axes parallel, thereby gain the advantage of seeing objects with both eyes at once, and therefore more acutely. But at the same time they are exposed to this inconvenience, that in a strong light both eyes become dazzled at once; and this happens so much the sooner, because the light falls on the cor-

responding principal focuses of the eye both at once, the organ not possessing a nictitating membrane. This inconvenience seems to be obviated by the central foramen, since that part which constitutes the principal focus of the eye opens in a dazzling light, so as to form a kind of small pupil, through which the concentrated rays pass, and fall on the choroid, where they are absorbed by the black pigment.

The iris, an organ of very peculiar structure, exhibits in the different genera and species of mammalia more numerous and interesting varieties than any other part of the eye. The colours of its anterior surface, which are peculiar to the different genera, vary in the races and varieties of domestic animals, although less strikingly than in the human structure. These variations are connected with the colour of the hair, so that in spotted dogs, rabbits, &c. a mixture of colours will be seen in the iris. The substance of the part varies in thickness in the different genera. In no instance have true muscular fibres been discovered; the examination of the part in the elephant and whale having afforded in this respect the same result as the tender and almost transparent iris of the white rabbit. In the eye of the seal, the ciliary ves-

sels are not distributed in the substance of the iris, but lie in its anterior surface, and form a considerable plexus, which is visible without any injection. The pupil in the bisulca, solid-ungula, cetacea, &c. is transverse; in animals of the cat kind, particularly in a clear light, it is oblong; not to mention various other trivial peculiarities, as the small villous appendix, covered with a black pigment, which is sometimes seen in the middle of the superior margin of the pupil, particularly in the horse.

The corpus ciliare, or ciliary body, and particularly the folds of its internal surface, with their numerous and elegantly arranged blood-vessels, constitutes one of the most wonderful parts of the eye, although its functions, which must undoubtedly be of the highest importance, are hitherto involved in mystery. Its more minute differences in the genera which have been hitherto examined, are too numerous to be recounted, and they could not be understood without delineations. Among other instances, those of the elephant and horse may be mentioned, on account of the remarkable beauty and delicacy of their structure.

The size of the crystalline lens varies in

proportion to that of the vitreous humour, and sometimes very considerably. My friend Dr. Weatherhead found the largest lens, in this point of view, in the eye of the opossum, one of which he presented to the Zoological Society, which is now in their gardens. The whale has the smallest. No mammalia have it so slightly convex on the surface as man. In the cat, hare, the bisulca, the horse, opossum, and seal, it becomes more and more convex, according to the series in which these animals are named. Lastly, in the cetacea it is nearly spherical. It is curious to observe the regularity with which, in some species, the lens divides into certain segments, commencing from its centre, in consequence of being dried, or immersed in acids.

A lachrymal gland exists in all animals of this class. Several quadrupeds have, indeed, an additional one, besides that which is found in the human subject. Some have no puncta lachrymalia, and the elephant has neither lachrymal bag nor os unguis.

The nictitating membrane, of which only a rudiment exists in the quadrumana and the human subject, is very large and movable in some quadrupeds. This is the case in animals

of the cat kind, in the opossum, the seal, and particularly in the elephant.

The relative magnitude of the true eyelids varies considerably in animals of this class. The lower, which is very large in elephants, is very small in the horse. In the latter animal, as well as in most quadrupeds, it has no cilia; while in the quadrumana, the elephant, giraffe, and others, both eyelids possess eyelashes.

Birds.

The eyes are very large in this class of animals, and consequently the bony orbits are of great magnitude in proportion to the skull. In the birds of prey they have a peculiar form, which is similar to that of the chalice or cup used in the communion service; the cornea, which is very convex, forms the bottom of the cup, and the posterior segment of the sclerotica resembles its cover.

This peculiar form arises from the curvature and length of the bony plates, which, as in all other birds, occupy the front of the sclerotic coat, lying close together, and overlapping each other. These bony plates form in general a flat, or slightly convex ring, which gives the whole eyeball the above-mentioned form. Dr.

Albus observes, that the orbit is very imperfect in birds, and that this bony ring may supply the deficiency.

The distinction between certain parts of the eye, when the membranes have been supposed to be continuous, appears more plainly in some birds than in any other animals. Thus M. Blumenbach found the boundaries of the choroid coat and iris very clearly defined in the horned owl; and those of the margin of the retina, and the posterior border of the ciliary body, very distinct in the toucan.

A great peculiarity in the eye of birds consists in the marsupium, the use of which has not hitherto been very clearly ascertained. It arises in the back of the eye, proceeding apparently through a slit in the retina; it passes obliquely into the vitreous humour, and terminates in that part, reaching in some species to the capsule of the lens. The figure of its circumference is a truncated quadrangle. Numerous blood-vessels run in the folds of membrane which compose it, and the black pigment by which it is covered suggests an idea that it is chiefly destined for the absorption of the rays of light, when they are too strong or dazzling. Others believe that it serves in this class for

the internal changes of the eye; but Crampton has contested this opinion, and described a peculiar circular muscle in the eyeball of the ostrich and several large birds, by which these changes are effected.

Birds have large lachrymal passages, which terminate in the surface of the palate. In some species, as the common fowl, the turkey, goose, and duck, the lower eyelid, which contains a peculiar small lamina of cartilage, is the most movable; in others, on the contrary, as in the ostrich* and parrot, the upper has the most extensive motion. Very few birds have cilia in both eyelids; they are found in the ostrich, the razor-billed blackbird, and in some parrots.

Amphibia.

Little is hitherto known concerning the peculiarities in the structure of the eye of this class. In some reptiles and serpents, the common integuments form, instead of eyelids, a

* I was present at the dissection of an ostrich by Mr. Brooks, in the Gardens of the Zoological Society; and was afterwards favoured with a more particular examination of the eye and ear of this gigantic bird, called by the Arabs "the ship of the desert."

kind of firm window, behind which the eye-ball has a free motion. In the green turtle the sclerotica has a bony ring at its anterior part, composed, like that of birds, of thin osseous plates. These animals possess very large lachrymal glands, and a very movable membrana nictitans, in which circumstance the frog resembles them.

Fishes.

The peculiarities in the eye of fishes, which belong either to the whole class, or to most of the genera and species, consist in the division of their choroid coat and retina into several manifestly distinct laminæ, and in the existence of two small organs within the eye, which belong exclusively to this class.

The choroid coat, which in man is a simple membrane, and in some other warm-blooded animals, particularly in the cetaceous tribe, a double one, consists in fishes of three distinct laminæ. The inner layer forms a tunica Ruyschiana; the middle one is perfectly distinct, both from the former and from the exterior coat, which latter must be compared with the proper choroid of all red-blooded animals. Even this last is continued anteriorly into the iris, and possesses in many

species the well-known brilliant gold and silver colours. The retina is easily separable into two laminæ, of which the external is medullary, and the internal consists of a fibrous texture.

The two other peculiarities belong exclusively to the eye of fishes, and are common at least to the whole bony division of these animals. A body, generally resembling in shape a horse-shoe, lies between the internal and middle layers of the choroid; some have thought it muscular, and others glandular. The tunica Ruyschiana gives origin to a vascular membrane, resembling in its form a bell. This goes towards the lens, and has therefore some resemblance to the marsupium of birds. No true ciliary body is found, at least in the bony fishes.

The crystalline lens of most fishes is very large in comparison with the size of the eye-ball, and nearly or entirely spherical. The vitreous humour, on the contrary, is small, and the aqueous in many instances is hardly discernible.

The following may be enumerated as instances of remarkable peculiarities in the eyes of particular genera and species of fishes. The firm transparent laminæ of common integuments, behind which the eyeballs move, as in

some amphibia; the articulation of the globe on a stalk of cartilage in the skate and shark; the curtain in the eye of the skate, which can be let down so as to cover the pupil; and the unique structure of the lobitis anableps, where the cornea is divided into two portions, and there is a double pupil with a single lens.

Insects.

Two kinds of eyes, very dissimilar in their structure, are found in this class. One sort is small and simple; the others, which are large, seem to consist of an aggregation of smaller eyes; for their general convexity is divided into an immense number of small hexagonal convex surfaces, which may be considered as so many distinct corneæ. The first kind is formed in different numbers in most of the aptera, as also in the larvæ of many winged insects. When these undergo the last or complete metamorphosis, and receive their wings, they gain at the same time the large compound eyes. Several genera of winged insects and aptera have stemmata besides their compound eyes.

The internal structure has hitherto been investigated only in the large polyedrous eyes. The back of the cornea is covered with a dark

pigment. Behind this are numerous white bodies of a hexagonal prismatic shape, and equal in number to that of the facets of the cornea. A second coloured membrane covers these, and appears to receive the expansion of the optic nerve. Further investigation is, however, required, in order to shew how these eyes enable the insect to see, and to determine the distinctions between two such very different organs.

Vermes.

The cuttle-fish only, of this whole class, has been hitherto shewn to possess true eyes, the nature of which cannot be disputed. They resemble, on the whole, those of red-blooded animals, particularly fishes; they are at least incomparably more like them than the eyes of any known insects, yet they are distinguished by several extraordinary peculiarities. The front of the eyeball is covered with loose membranes instead of a cornea; the iris is composed of a firm substance, which seems like a continuation of the sclerotic; and a process projects from the upper margin of the pupil, which gives that membrane a semilunar form. The corpus ciliare is very completely formed. In all

other vermes the eyes are entirely wanting, or their existence is very doubtful. Whether the black points at the extremities of what are called the horns of the common snail, are organs which really possess the power of vision, is still problematical.

CHAPTER II.

OF THE DISEASES OF THE EYE.

HAVING in the Introduction pointed out the circumstances which led me to direct my attention to diseases of the eye, and having, as in my work on the ear, described the parts of the eye essential to the perfection of its leading functions,—I shall now proceed to examine the principal diseases of the eye: these, like those of the ear, may be classed according to the different parts of the organ in which they are seated,—namely, external, comprehending inflammation of the eyelids, of the sclerotic coat and cornea, with the sequelæ of epiphora, ulceration, specks, and opacities; and internal, viz. cataract, cancer, and amaurosis or gutta serena.

In so doing, I shall follow the anatomical arrangement, and consider the various morbid

affections of the different parts of this important organ and its appendages; commencing with the exterior, and carrying on my observations to the interior portions. I consider it better to follow the order of nature than to adopt any arbitrary arrangement, as there is not so clearly defined a line of demarcation between the external and internal parts of this organ as there is in the ear.

Diseases of the External Eye.

These, like the diseases of the external ear, depend on the nature of the structures affected. The reader may be reminded that the eyelids are partly cartilaginous and partly muscular, the tarsus being besides furnished with mucus-glands, and the lachrymal gland furnishing a serous fluid.

I. *Of Ophthalmia.*

It may be correctly said, that inflammation affects equally all the membranes of the eye, exhibiting, in addition to the usual characteristics of general inflammation in other textures, great sensibility to light, and an increased flow

of tears. After the occurrence of pain, the sclerotic coat is seen to be slightly red, the eye is dry, hot, becomes somewhat inflamed, and moves with difficulty in its socket, owing to the distended state of its conjunctival covering. The pain through the eyeball and orbit is at first lancinating, but becomes throbbing as suppuration approaches—the redness is diffused, and there is a solid deposit of lymph in the conjunctiva, which becomes indurated, producing chemosis.

When there is an extravasation of blood from external violence, the colour of the eye is of a deeper red than in inflammation, from the coagula it contains. As the inflammation proceeds, the neighbouring glands, which were primarily stimulated to increased secretion, become dry; but towards the termination of the disease they pour forth an increased quantity of matter. As the second stage approaches, an effusion of blood, or pus, frequently takes place in the chamber of the aqueous humour, and if to any extent, is accompanied with high sympathetic fever, and total destruction of the organ.

The various causes of inflammation of the eye are, derangement of the digestive organs,

atmospheric changes, the presence of foreign bodies, and the propagation of the inflammation from the brain itself through the medium of its tunics investing the optic nerves. The conjunctival coat of the eye being a similar and continuous membrane with that lining the intestinal canal, satisfactorily explains their existing sympathies. No state of atmosphere predisposes more to ophthalmia than the union of heat with moisture, and exposure to the night air.

There are certain inflammations which have their seat in the conjunctiva, and which are easily distinguishable both from each other, as well as from the ophthalmia which attacks the deeply seated parts. There is, for instance, an erysipelatous inflammation of the conjunctiva, constituting one of the kinds of ophthalmia. In this disease the conjunctiva assumes a pale red colour, and elevates itself in yellowish red vesications round the cornea, while blood is extravasated here and there into the cellular substance which binds the conjunctiva to the sclerotica. As the disease subsides, the detached conjunctiva reapproaches the sclerotica, and the redness gradually fades.

On the other hand, the conjunctiva is exposed to a very dangerous inflammation as

being a mucous membrane, in which one of the chief symptoms is an increased and puriform secretion from the surface of the tunic.

The sclerotica, being of a very different structure from the conjunctiva, presents very different phenomena when it becomes the focus of ophthalmia; as it is extremely apt to do, both from the causes which excite rheumatism in other parts of the fibrous system, and also from slight mechanical injuries. It is difficult, indeed, at any period, to confound it with either of the above-mentioned species.

The blood-vessels of an inflamed conjunctiva are evident to the eye of the observer at a considerable distance: they are of a scarlet-red colour, many of them are exceedingly tortuous; they have a tendency to fill equally every part of the conjunctiva, and to ramify and anastomose through it in every direction, and with no particular or distinct arrangement: in the motions of the eyeball they seem but little to participate; whereas, if by means of the finger we move the eyelids in different directions, the blood-vessels of the conjunctiva are seen following the motions which we give to the eyelid.

The blood-vessels of the inflamed sclero-

tica, on the other hand, are of the smallest diameter: from their deep situation and their fineness, they are not evident except on near inspection; they are of a carmine or rose-red colour; they constantly incline to appear in the form of a zone around the cornea; and they follow all the motions of the eyeball, but take no part in the motions of the conjunctiva produced by drawing the eyelids to either side.

As the inflammation of the sclerotica advances, the effusion of serous fluid takes place upon its surface, which occasions chemosis; and the cornea, taking part in the disease, becomes cloudy. The pain and pulsation felt in the eye are extremely distressing. Points of suppuration form in the conjunctiva, and not unfrequently the cornea ulcerates and bursts.

Inflammation of the iris is characterised by symptoms as striking as those of any of the other species of ophthalmia, as shall be afterwards described. All these distinctions are of the utmost importance in regard to the treatment.

Inflammation of the eye in a purulent form frequently occurs in infants, beginning in the

conjunctiva palpebralis, to which it is often confined. The cornea, when the disease is mild, is not endangered, unless it be neglected; and the lotion given below has often been found of service.* A very slight haze of the cornea is the worst direct result of this malady, as has been well explained by Mr. Saunders and by Weller. If the inflammation has been severe, and the secretion of puriform mucus considerable, the cornea exfoliates, and is converted into a mass of matter, which at last bursts in the centre, either suddenly with severe pain, or slowly without pain; and the aqueous humour being now discharged, the iris lies in the aperture. Should the ravages proceed further, the iris may even fall out of the eye, along with a greater or smaller part of the vitreous humour, and complete colliquation of the latter ensue.

The disease does not always stop here; for,

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* ℞ Cupri Sulphat. gr. iv.
Camphoræ, gr. iij.
Bol. Armen. gr. viij.
Aq. Rosæ fervent. ℥viij.

M. et cola: ft. lotio, ter in die utenda.

Take Sulphate of Copper, four grs.
Camphor, three grains.
Armenian Bole, eight grains.
Boiling Rose-water, eight ounces.
Mix and strain: make a lotion, to be used three times a day.

even in less destructive degrees of this affection, children often in consequence become consumptive. The cornea, however, will not pass into a sloughy state in every instance in which during the course of this disease it is affected with opacity: on the contrary, a slight degree of opacity is sometimes the sign of a commencing healthy action.

Of scarification, in such cases, of the inner surface of the conjunctiva lining the eyelids, recommended by Reil and others, Dr. Monteath speaks in high terms, as a method which he almost invariably practised. This is a point, however, which can only be settled by experience: that of Mr. Saunders was decidedly at variance with what Dr. Monteath has observed. According to him, scarifications, as far as he has seen them employed in the active state of the inflammation, are certainly injurious: they have manifestly aggravated the symptoms; and he conceives that the infliction of mechanical injury on a part already actively inflamed, can hardly be advantageous. His argument is plausible: a similar practice does not apply in surgery to the other parts of the body.

In this disorder, however, severe antiphlo-

gistic measures are scarcely ever necessary; but the chief attention should be directed to restoring the secretions of the body. He recommends, for this purpose, the liquor ammoniæ acetatis, with antimonial wine and a small quantity of the syrup of poppies; the compound powder of ipecacuanha in small doses; calomel and opium; and when the cornea is opaque, calomel or blue-pill; and if the disease does not yield to this plan of treatment, tonics, the best of which he thinks are the mineral acids, and, above all, sea-bathing or the shower-bath.

The remedies which have been found most beneficial in this disease are, in the early stages, leeches, nitre with tartar emetic, and afterwards rhubarb and prepared chalk in combination; the application of blisters behind the ears, or to the nape of the neck, kept discharging, and the eyelids anointed with red precipitate ointment.

The glands along the edges of the eyelids are always affected in this disease, as is shewn by the straggling appearance of the eyelashes. The most striking benefit has been derived from the use of this ointment in these cases. The strictest attention

to diet should be observed, the patient kept in a darkened room, and all bandaging of the eyes forbidden, as they are invariably injurious.

The treatment, however, must always be modified by the nature of the exciting cause, the removal of which ought to be the primary object. Should a febrile disturbance of the constitution exist, general and local blood-letting is to be premised, followed by saline cathartics and antimonials.* There is great difference of opinion as to the mode of detracting blood by leeches. Ware prefers their applica-

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* ℞ Hydrarg. Submuriat. gr. ij.	Take Submuriate of Mercury, two grains.
Pulv. Antimonialis, gr. v.	Antimonial Powder, five grains.
Confect. q. s. ut fiant pilulæ ij. horâ decubitûs sumendæ; et posterâ aurorâ propinet æger haustum sequentem :	Confection sufficient to make two pills, to be taken at bed-time. The next morning let the following draught be taken :
℞ Infus. Sennæ, ℥iss.	Take Infusion of Senna, an ounce and a half.
Magnesiæ Sulphat. ʒiij.	Sulphate of Magnesia, three drachms.
Antimon. Tartar. gr. ¼.	Tartarised Antimony, fourth of a grain.
Tinct. Sennæ, ʒij.	Tincture of Senna, two drachms.
Fiat haustus catharticus.	Make a cathartic draught.

tion to the temple; Vetch to the lower lid; Dr. Frick adopts the practice of Beer and Scarpa, in applying them over the facial vein, as producing the most rapid abstraction of blood; but I am of opinion, that from behind the ears is the best situation in these affections. Blisters are to be applied behind the ears, or to the nape of the neck, in preference to the temple; as they increase the action of the subjacent arterial trunks in the latter situation. Stimulant collyria ought not to be used during the acute stage; and tepid applications are preferable to cold,* on the ground that cold, being a tonic, causes a reaction, with an increase of pain. As soon, however, as the capillaries are in a state of congestion, warm applications are to be suspended; and cold

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* ℞ Dec. Papav. Alb. ℔j.

Flor. Samb. ℥ss.
Coque et cola, sæpè utend.

Vel,
℞ Ext. Opii, gr. xxiv.

Solve in Aq. puræ tepidæ ℥vj.
Cola et adde Liq. Ammon. Acet. ℥ij.

M. ft. collyrium.

Take Decoction of Poppies, one pint.
Elder Flowers, half an ounce.
Boil and strain them. To be used frequently.

Or,
Take Extract of Opium, twenty-four grains.
Dissolve it in six ounces of pure tepid Water, and add acetated Liquor of Ammonia two ounces.
Mix them, and make a wash for the eyes.

lotions, astringent collyria,* or stimulating ointments, are to be employed.†

The two most important indications are, in the first stage, to preserve the soundness of the cornea, the appearance of which should always regulate the extent of the antiphlogistic regimen. In the second, or subacute stage, to avoid the tendency in the organ favourable to the suppurative process. In the former we have much to expect from the free use of antimonials; in the latter, from frequent exposure of the eye to the dry air.

Errhines have been recommended in instances of habitual ophthalmia, and probably may sometimes prove good auxiliary remedies. The compound powder of asarabacca may be

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* ℞ Alumin. purif. ℈ij.
Aq. distillat. ℥vj. M.
ft. collyr.

Vel,

℞ Zinci Sulphat. gr. viij.
Plumbi Acetat. gr. x.
Aq. distillat. ℥vj. M.

Take Purified Alum, two scruples.
Distilled Water, six ounces.
Mix them for a wash for the eyes.

Or,

Take Sulphate of Zinc, eight grs.
Acetate of Lead, ten grains.
Distilled Water, six ounces.
Mix them.

† ℞ Ung. simpl. ℥ij.
Hydrarg. Nitrico-Oxydum, gr. xv.
Tutiæ præp. gr. iv.
Misce exactissime, pauxillum nocte applicandum.

Take Simple Ointment, two drachms.
Nitrico-Oxyde of Quicksilver, fifteen grains.
Prepared Tutty, four grains.
Mix them well, a little to be applied night and morning.

used on the occasion. The powder of foxglove will likewise excite a copious excretion from the membrane lining the nostrils, although not generally known to possess such a power.

In ophthalmia the eyelids are apt to be glued together, particularly during sleep, by a thick glutinous matter which is secreted. To prevent this inconvenience, their edges should be anointed with a little soft ointment every night, or every night and morning.* In the ophthalmia tarsi, arising from a scrofulous habit, the nitrated mercurial ointment, mixed with an equal quantity of hog's lard to render it milder, is one of the most efficient remedies we can employ.

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* ℞ Adipis Præparat. ℥ss.
Zinci Sulphat. gr. xv.

M. ft. unguentum.

Vel,

℞ Tutiæ Præparat. ℈ij.
Ung. Simpl. ℥ss. M.

Vel,

℞ Ung. Cetacei, ℥ss.

Liquor Plumbi Subacet. ♏xl.
M.

Take Prepared Lard, half an ounce.
Sulphate of Zinc, fifteen grains.
Mix them into the form of an Ointment.

Or,

Take Prepared Tutty, two scruples.
Simple Ointment, half an ounce.
Mix them.

Or,

Take Spermaceti Ointment, half an ounce.
Solution of Subacetate of Lead, forty drops.
Mix them.

Epiphora.

If the inflammation extends along the tarsus to the puncta lachrymalia, or affects the lachrymal duct, the natural passage of the tears will be obstructed, and they will overflow upon the cheek, producing the annoying complaint termed epiphora, or the weeping eye. In incipient cases, the removal of the inflammation ought to be effected on general principles, in the manner already indicated. When the obstruction in the passage cannot be removed, the complaint can only be remedied by making an artificial one directly into the nostril at the corner of the eye; for which purpose the bone must be bored through, and a silver wire constantly worn in it, to guide the tears. Even this, however, is not always successful: the fifth pair of nerves, which send one branch to the lachrymal gland, and another to the nostrils, are irritated. The same connexion of the nerves also explains why bright sunshine produces sneezing. Dr. Darwin supposes it is from this nervous connexion that the first flow of tears in a new-born infant is produced, by the air acting on the portion of the nerve which is spread over the nostril, and causing most in-

fants to sneeze when they begin to breathe. A similar effect is produced in after-life by air dryer or colder than that which we are accustomed to; or by snuff, or by strong smells, as that of garlic, onions, &c.

According to Mr. M'Kenzie, epiphora is occasionally a symptom of disordered digestion, especially in children, and of worms in the intestines. Indeed, even when connected with strumous ophthalmia, we may regard both the ophthalmia and the epiphora as originating, in many cases at least, in improper food, and disorder of the digestive organs.

We scarcely require to prescribe for epiphora alone. I have seen it completely and permanently removed by an emetic. Purgatives followed by tonics, and occasionally antacids, will be found highly useful in removing some of the more common causes of the disease. A mixture of rhubarb and supercarbonate of soda, repeated every day, or every second day, and followed up by a course of the sulphate of quinine, is a plan of treatment which I have often found effectual. Of local remedies the most useful are, the vapour of laudanum, and the lunar caustic solution. Into a cup of boiling water, a teaspoonful of

laudanum is mixed, the cup held under the eye, the eyelids opened, and the vapour allowed to come into contact with the conjunctiva. This may be done twice or thrice a day. Nothing relieves more the irritability of the conjunctiva, on which epiphora so frequently depends, than a solution of two or three grains of lunar caustic in an ounce of distilled water, dropped on the eye with a camel-hair pencil.

Ulceration.

Ulceration of the cornea is of two kinds, the superficial and the deeply seated. The superficial commonly extends over a considerable part of the cornea, seeming in many cases to destroy only its conjunctival covering. The deep ulcer is generally far less extensive, though it affects the substance of the cornea, and not unfrequently penetrates through it, opening into the anterior chamber, and letting out the aqueous humour.

In consequence of various injuries, not only inflammation but ulceration is produced, which requires, according to circumstances, the utmost attention to prevent its spreading, and ultimately destroying the eye altogether. The

first object must always be, in such cases, the same as in purulent ophthalmia, namely, to arrest the progress of the inflammation, by relieving the engorged vessels; to accomplish which, venesection is the most effectual means. I object to the practice of bleeding ad deliquium, and prefer a small bleeding, to be occasionally repeated. Membranes like the conjunctiva, admitting of great distension, although partially emptied, will readily resume their former condition; and therefore an active mode of treatment should be adopted at the onset of the disease. Free evacuations* from the bowels are to be promoted; but in patients of a weak

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* ℞ Ext. Colocynth. Comp. 3j.

Ext. Jalapii,
Pulv. Rhei, āā 3ss.

Ol. Cinnamomi, ℿv.
M. ft. pilulæ xxiv.; ij. vel iij. pro re natâ sumendæ.

Vel,
℞ Hydrarg. Submuriat. gr. jss.

Ext. Colocynth. gr. v.

Ol. Caryoph. ℿj.
M. ft. pil. ij. nocte sumendæ.

Take Compound Extract of Colocynth, one drachm.
Extract of Jalap,
Powdered Rhubarb, of each half a drachm.
Oil of Cinnamon, five drops.
Mix them, and make twenty-four pills: two or three to be taken as occasion requires.

Or,
Take Submuriate of Mercury, a grain and a half.
Extract of Colocynth, five grains.
Oil of Cloves, one drop.
Mix them, and make two pills, to be taken nightly.

constitution, in whom the discharge is profuse and ichorous, and the conjunctiva flabby, general tonics* and a nourishing diet are to be substituted, which will frequently arrest sloughing of the cornea, after it has commenced.

As local applications, any of the styptic solutions, as alum, or sulphate of zinc, will be sufficient.† Blisters, or tartar emetic ointment,

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Vel,

℞ Magnes. Sulphat. ℥ij.

Inf. Rosæ, ℥iss.

Sp. Myristicæ, ℥j. M.

ft. haust. mane sumend.

* ℞ Dec. Cinchon. ℥v.

Tinct. Cinchon. Comp.
Syr. Aurant. āā ℥ss.

Tinct. Ferri Mur. ♏xx. M.

ft. mist. sumat cochl. iij. bis die.

† ℞ Zinci Sulphat. gr. xij.

Aq. Rosæ,
Mist. Camph .āā ℥iij. M

ft. collyr.

Or,

Take Sulphate of Magnesia, two drachms.
Infusion of Roses, one ounce and a half.
Spirit of Nutmegs, one drachm.
Make a draught, to be taken in the morning.

Take Decoction of Bark, five ounces.
Compound Tincture of Bark,
Syrup of Orange-peel, of each half an ounce.
Tincture of Muriate of Iron, twenty drops.
Mix them, and take three large table-spoonsful of the mixture twice a day.

Take Sulphate of Zinc, twelve grains.
Rose Water,
Mixture of Camphor, of each three ounces.
Mix them, and make a collyrium.

applied behind the ears, and the free exposure to dry air, are never to be omitted.

Ulcers of the cornea either primarily occupy the external surface, or are interstitial. They often gradually deepen and enlarge, and penetrate the inner coat of this membrane; the aqueous humour then escapes, and the iris approximates, constituting procidentia iridis. As there is usually considerable inflammation of the conjunctiva, antiphlogistic treatment is called for. The ulcer should be touched with a solution of the lapis infernalis, otherwise called the potassa cum calce; and in urgent cases the system put under the influence of alteratives. When the ulcer is interstitial, and the constitution feeble, tonics are to be employed, together with opiates and local stimulants. Procidentia iridis is either to be touched with an escharotic, or snipped off with a pair of scissors.

Vel,

℞ Alum. Purif. ʒss.
Aq. Flor. Samb.
Aq. Distillat. āā ℥iij. M.

Or,

Take Purified Alum, half a drachm.
Elder-flower Water,
Distilled Water, of each three ounces.
Mix them.

Specks and Opacities of the Cornea.

The cornea frequently becomes opaque in consequence of inflammation in the vessels covering or surrounding it; the extent of its affection being various, from a slight haze to a perfect opacity, of which there are three species. 1st, A condensed or increased state of the interlamellar secretion, commonly termed nebula. 2dly, The formation of a pseudo membrane, named leucoma. 3dly, That in which the lamellæ unite, called albugo. Nebula usually impedes vision, but seldom destroys it; leucoma and cicatrices, occupying the centre of the cornea, cause total blindness. In leucoma there is a pearly opacity, which, when it occupies the centre of the cornea, so contracts the sphere of vision as to render the patient blind, except by twilight, when the expansion of the pupil admits the rays of light through the diaphanous portion. Cicatrix, or albugo, is either the consequence of a wound or ulcer of the cornea; and when it is situated over the pupil becomes an impediment to distinct vision. It is frequently produced by burns, or the application of corroding substances to the eye. Nebulous opacity is to be removed by stimulating

collyria* or ointments: of the former, the best are the solution of lapis infernalis and oxy-muriate of mercury. Beer recommends the undermentioned.† In obstinate cases, small doses of calcined quicksilver may also be given.

When the plexus of vessels shoot toward the opacity, circular incisions should be made around the cornea. Powders of glass, &c. which are sometimes recommended to be blown into the eyes through a quill, must always be injurious.

Ptergium.

This is another of the sequelæ, or results of inflammation, of which there are two kinds; the membranous, and the fleshy. The first is a thin film, or nebula, of the sclerotic conjunctiva; its figure is pyramidal, with the base towards the

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* ℞ Hydrarg. Muriat. gr. j.
Opii colat. gr. viij.
Solve in Aq. Rosæ, ℥ij. M. ft. collyrium, nocte maneque applicandum.

Take Corrosive Sublimate, one grain.
Strained Opium, eight grains.
Dissolve in two ounces of Rose-water, make a collyrium, and apply it night and morning.

† ℞ Aq. Ammon. puræ, gr. x.
Ol. Amygdal. ℥ss. M.
Pauxillum inter palpebras omni nocte.

Take Pure Water of Ammonia, ten drops.
Oil of Almonds, half an ounce.
Use a little between the eyelids every night.

caruncula lachrymalis: it extends towards the cornea, having a few straight, long, and detached vessels on its surface. The latter is a sarcomatous growth beneath the sclerotica, with a tongue-shaped extremity, which is formed by the deposition of lymph in the interstices of the membrane: it is different from pannus, which is merely a thickening of the conjunctiva.

Pterygium is to be removed by dividing the vessels at the base with a scalpel, and afterwards dissecting off the membrane with a pair of curved scissors. When it does not, however, encroach on the cornea, we may recommend it to be let alone; and when it does, I advise the portion which covers the cornea to be removed by the application of escharotics,* but never to be dissected off.

Staphyloma.

This disease consists, as the name implies, of a tumour projecting from the eye in the form

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* ℞ Potassæ cum Calce, ʒj.

Aq. Distillat. ℥ss.

M. nocte maneque applicand.

Take Potass with Lime, one drachm.

Distilled Water, half an ounce.

Mix them. To be applied night and morning.

of a grape (σταφυλὴ). Total staphyloma of the cornea presents two varieties, very different in their external appearance and in their internal structure. In the *spherical* variety, the tumour of the cornea goes on constantly increasing in size, becoming, at the same time, more and more extenuated. In the *conical* variety, the tumour never increases to any considerable projection, but remains unchanged after it has once formed.

The pathological anatomy of these varieties shews the iris and cornea firmly united by adhesive inflammation in the spherical, so that the anterior chamber is abolished; but in the conical staphyloma both chambers are destroyed; the crystalline capsule, the iris, and the cornea, being all three matted together from the same cause.

The progress of the spherical staphyloma has led Professor Beer to a conclusion, which has been adopted, from other considerations, by some very ingenious physiologists, namely, that the chief seat of the secretion of the aqueous humour is the posterior chamber, and that of its absorption the anterior. In the spherical staphyloma, the anterior chamber being destroyed, while the posterior remains entire, the

secretion of the aqueous tumour evidently overbalances its absorption of that fluid, which before was carried on equally by every part of the parietes of the aqueous chambers.

The principal causes of staphyloma are, small-pox, onyx, hypopium, ulceration of the cornea, and severe ophthalmia.

When complete staphyloma takes place, and the whole cornea is affected, vision cannot be restored. Scarpa has well observed, that infants are often attacked by this disease soon after birth, and mostly in consequence of purulent ophthalmia. It is also produced by small-pox, yet never during its eruption, which is singular, nor during the stage of suppuration; but when the pustules become dry, and even after the detachment of the variolous scabs. In a great number of cases, when the staphyloma has attained a certain elevation above the cornea, it becomes stationary, or only increases in due proportion to the rest of the eye. In other instances, the small tumour of the cornea successively enlarges in its dimensions, and in such a disproportion that it at length protrudes considerably between the eyelids, to the great annoyance and deformity of the patient.

The same celebrated physiologist remarks,

that this disease is justly considered as the most serious to which the eyeball is liable; for, to the total and irremediable loss of sight that it occasions, are added all the evils which necessarily result from the bulk and protuberance of the staphyloma, after the swelling of the cornea has acquired such a size that it can no longer be covered by the eyelids. In such circumstances, the continual exposure of the eyeball to the contact of the air and to the particles of matter suspended in it, the friction of the eyelashes against it, and the incessant flux of tears down the subjacent cheek, are enough to render the eye painful and inflamed: the sound eye is soon affected by sympathy, and the diseased one at length ulcerates, together with the lower eyelid and the cheek upon which it presses.

Scarpa informs us, that surgeons have long thought that, in this disease, the cornea yields to the distension produced by the turgescence of the humours of the eye, nearly in the same manner as the peritonæum yields to the pressure of the abdominal viscera when an intestinal hernia takes place. Richter has opposed this theory, observing, that the staphyloma, for the most part, forms without the swelling of the cornea having been preceded

by any of those morbific dispositions which are generally considered capable of weakening the texture and elasticity of the cornea; that this membrane, when affected with staphyloma, acquires a much greater thickness than it has in its natural state, and consequently that the staphyloma, far from being concave within, is every where compact and solid; though it would be quite the contrary if the tumour had been occasioned by an immoderate distension, operating on the cornea from within outward, with an attenuation of its natural texture.

Hence Scarpa observes, that in the highest stage of this disease, when the staphyloma projects beyond the eyelids, art has, at present, no more effectual means for restraining the progress of the complaint, and removing the deformity, than cutting away the staphyloma, and, when the part has healed, applying an artificial eye. He also recommends, that, on the first appearance of staphyloma, the antiphlogistic plan of treatment should be put in practice, by taking away blood from the infant, either by means of the lancet, or by the application of leeches. Afterwards a blister applied to the neck will be found very useful, especially if the disease have been

preceded by the retropulsion of any eruption upon the head. It will be proper to purge the infant with rhubarb and magnesia; at the same time directing the nurse not to overload its stomach with milk or other food, as is usual, nor to swathe it tightly and dress it in heavy clothes, as is the custom with our ladies even in the hottest weather. And if there be any reason to believe that the disease is in part occasioned by the nurse's milk being bad, she ought to be changed, or the state of her stomach or constitution corrected.

Iritis.

This disease, though, like some of the preceding, it may be said to be internal, is often, if not always, the result of inflammation primarily affecting the external tunics. It has recently attracted so much attention, that it will require careful consideration here. It may be properly divided into idiopathic, syphilitic, and arthritic iritis.

In the idiopathic species, besides the common symptoms of ophthalmia, there are changes occurring at the very commencement which indicate the seat of inflammation. The pupil is seen to be contracted, and loses the bright

black it naturally possesses; the motions of the iris are also less free The colour of the iris is next observed to become changed: this happens first in the lesser circle, which turns of a darker hue; and afterwards in the greater, which grows green if it had been greyish or blue, or reddish if it had been brown or black. As soon as this alteration of colour has taken place to a considerable extent in the greater circle of the iris, it swells and projects towards the cornea; the pupillary margin loses its sharply defined edge, seems now somewhat thickened, and is turned back towards the posterior chamber. The redness accompanying these changes is by no means considerable, and is at first confined to the sclerotic coat, in which a number of very minute rose-red vessels are seen running in straight lines towards the cornea.

The pupil at the same time loses its circular form, becomes somewhat irregular, and presents a greyish appearance. Examined through a magnifying-glass, this appearance is seen to be produced by a substance very like a cobweb, occupying the pupil, and which is soon afterwards distinguished, even without the aid of a magnifying-glass, as a delicate flake of coagulable lymph. Into this, the processes or

dentations of the irregular pupillary margin of the iris seem to shoot; and it is afterwards found that adhesions are apt to be established at these points. It is owing to these adhesions, that the patient, whose vision has been all along indistinct, now complains of being able to see only one side or part of an object.

The effusion of lymph into the pupil continues to increase, is likewise poured into the posterior chamber, and adhesions between the iris and capsule of the lens are formed. The quantity of lymph effused is sometimes so great, as to fall in a curdled form from the pupil to the lower part of the anterior chamber. The size of the pupil is considerably lessened, and it now derives a greyish white colour from that of the lymph by which it is filled; the morbid sensibility to light, prevailing at the commencement of the inflammation, is diminished; the powers of vision become gradually more and more limited, and at length merely the perception of light remains.

By this time the redness of the eye has increased, and partly arises from vessels which are now developed in the conjunctiva. The redness is deepest all around the cornea; and towards the periphery of the eyeball it fades. The cornea loses somewhat of its peculiar bril-

liancy, and striking changes are seen taking place on the surface of the iris. Lymph appears to have been effused into its substance, for while it projects more and more towards the cornea, its fibres get collected into bundles, giving the surface a peculiarly plaited, or rather puckered appearance. A yellowish red tubercle then forms on some part of its surface, but most commonly at that place where the greater and lesser circles of the membrane meet. This tubercle is at first small; it enlarges and projects forward, and is distinctly seen to be an abscess, which finally bursts, and discharges its contents into the anterior chamber. In some individuals, at this time, a small quantity of blood is also extravasated into the same chamber.

This disease frequently succeeds unskilful surgical operations on the eye, particularly those for cataract; it is also very often caused by extraction. This may happen from the wound in the cornea being made too small, which obliges the lens to be forced out with a deal of squeezing, and with considerable prolapsus of the iris; from some pieces of the lens remaining in the posterior chamber, which must be removed; or from the flaps of the cornea having been repeatedly and unnecessarily lifted. Depression is not free from this unpleasant con-

sequence. Schmidt says, it follows extraction oftener than depression. Its frequency is in proportion to the greater or lesser dexterity of the operator.

It more rarely occurs among patients in good circumstances, more frequently among the poorer class, and who from ignorance do not attend to the directions given them. Of the latter, those operated upon in hospitals are more exposed to it than those operated upon at their own houses. The poorer class of cataract patients are more liable to an attack of iritis after the operation, in spring succeeding a severe winter than in the height of summer or beginning of autumn. There is a risk attending those on whom the operation is performed while they are in a state of debility, or are of a bad habit of body. Diseases of the skin; a puffed-up, washy appearance; a yellowish, dirty-coloured countenance; flabby state of the muscles; the skin possessing so little elasticity, that a fold made in it is a long time before it disappears; the eye feeling soft, and reddening on the gentlest touch,—are all ominous signs, indicating an asthenic state of the system.

Iritis is to be treated on the same principles as inflammation in general; but the application

of the particular means must be modified by the seat of inflammation, and by its different nature. General bleeding is necessary only where there is a great degree of symptomatic fever, and when this is inflammatory; hence it is principally in idiopathic iritis that moderate bleeding from the arm is requisite. Six or eight ounces of blood should be taken, and this is to be repeated if necessary; five or six leeches are to be applied to the brow; a smart purgative should then be given. The application of leeches, but fewer in number, ought to be continued every day, or every other day, until a decided abatement of the inflammatory action takes place. In the first stage of the process, blisters to the temples or behind the ears have little effect; but sometimes a large one on the nape of the neck is of service.

The fomentation of the eye with water, made as hot as the patient can bear it, will occasionally procure a mitigation of the violence of the pain. Care, however, must be taken to dry the eye well after this application. Local bleeding, by means of leeches to the forehead, produces the most decided benefit in all the varieties of iritis; and it is a remedy which ought to be employed in almost every

case. Purgatives, given so as to act copiously, are of marked advantage only in the idiopathic iritis. In the other species they should be managed so as to keep the bowels merely more open than natural; and even this is not necessary in the syphilitic variety. Cold local applications are quite useless in iritis.

After the effusion of lymph has taken place, much may be done to promote its absorption. Beer says, when it is observed, at the end of the second stage, that the lymphatic effusion in the posterior chamber—which, though it does not totally prevent, still greatly limits, vision—does not diminish by the treatment pursued, so as to allow us to hope for the complete restoration of sight, but when, on the contrary, there is reason to dread that the lymphatic effusion will remain in the same state after the second stage has terminated; then not only external, but internal alterative medicines must be had recourse to, in conjunction with the other remedies proper in this stage of the disease; such as the preparations of mercury,* which in

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* ℞ Pil. Hydrarg. 3j.
Opii Pulv. gr. iv.
M. ft. pil. no. xij. una omni nocte horâ somni sumend.

Take Mercurial Pill, one drachm.
Powdered Opium, four grains.
Mix, and make twelve pills: one to be taken every night at bed-time.

these circumstances seldom disappoint the practitioner if properly managed. Calomel, united with opium, is to be given internally, in conjunction with tonic medicines,* as the calamus aromaticus, bark, &c. Warm fomentations are often useful; but when they lose their effect, or the eye cannot bear any fluid application, which is sometimes the case, the under-mentioned† ointment may be daily inserted between the eyelids. Frictions, once a day, over the eyebrows, with mercurial ointment, opium being added to it, very much contribute to the absorption of the lymph effused into the posterior chamber.

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* ℞ Decoct. Cascarillæ, ℥v.	Take Decoction of Cascarilla, five ounces.
Sodæ Subcarbon. ʒj.	Subcarbonate of Soda, one drachm.
Tinct. Colomb. ℥ss.	Tincture of Colombo, half an ounce.
Ext. Cinchon. ℈ij.	Extract of Bark, two scruples.
Sy. Aurant. ℥ss.	Syrup of Orange Peel, half an ounce.
M. ft. mist. sumat cochl. iij. bis die.	Mix them. Of this mixture take three table-spoonsful twice a day.
† ℞ Ung. Simpl. ʒij.	Take Simple Ointment, two drachms.
Hydr. Nit. rub. gr. vj.	Red Precipitate, six grains.
Ext. Opii, gr. x.	Extract of Opium, ten grains.
M. ft. ung.	Make an ointment.

Whoever has not witnessed the striking effect of such a method of treatment of this stage of iritis, cannot possibly form any idea of the extraordinary and rapid improvement which, when properly conducted, it often, in a few days, produces. Beer says, I have repeatedly seen a whitish net-work in the pupil, distinguishable even at a distance, disappear in eight or ten days, by the use of the fomentation given below.*

What the peculiar symptoms are under which the poison of syphilis, when introduced into the system, affects the iris, and why it does so, are subjects which are not yet well understood. That it is so, however, is certain, inasmuch as inflammation takes place in this membrane of the eye, which is as characteristic of the presence of the syphilitic poison in the constitution, as are any other of its secondary effects. But of the immediately exciting causes of this inflammation we know nothing. It appears in company with all the other constitutional symp-

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* ℞ Decoct. Cap. Papaveris, ℔j.
Ext. Belladonnæ, 3j.
Solve, sit fotus.

Take Decoction of White Poppy-heads, one pint.
Extract of Deadly Night-shade, one drachm.
Dissolve it, and make a fomentation.

toms of lues, and it also takes place singly, before any of these have appeared.

The earliest symptom perceived in syphilitic iritis is a pale redness all round the cornea. This is at first seated in the sclerotic alone; but the conjunctiva soon shares in it, and afterwards becomes much the redder of the two. However few the vessels may be elsewhere, there is always a broad zone of them all round the cornea—a zone formed at this place not only by the vascular net-work in the conjunctiva, but by the ciliary vessels on the external surface of the sclerotic. The redness has a peculiar tint; for instead of being bright red, it is brownish, something like the colour of cinnamon. From this zone, the vessels have a tendency to be prolongated under the edge of the cornea. The whole cornea now becomes uniformly hazy, losing its clearness without being in any place actually transparent. This appearance of the cornea seems dependent on some affection of its posterior surface, or, more accurately speaking, of the membrane of the aqueous humour, by which it is lined. The pupil becomes contracted, and the iris limited in its motions, as in common iritis; but the pupil does not preserve its natural situation.

It is removed in a direction upwards and inwards, towards the root of the nose, and is irregular. Along with this, the iris loses its natural colour, and projects forwards.

Towards evening there is always an aggravation of the symptoms; the intolerance of light and painful sensibility of the whole eye increasing, and a gush of tears following every change of light and temperature. At length, a regular nocturnal pain sets in, which is extremely severe, and is strictly limited to that part of the cranium immediately above the eyebrow. It usually begins between six and seven in the evening, gradually increases, reaches its utmost height about midnight, and then diminishes till about four or five in the morning, when it ceases.

After every such attack of pain, the pupil is found more contracted, drawn farther upwards and inwards, the iris more altered both in colour and form, the quantity of lymph increased, and consequently vision more impeded.

Then, either on the pupillary or ciliary margin of the iris, or on both, there arise one or more reddish-brown tubercles, which have a spongy look, and when examined with a

magnifying glass seem to have a striking resemblance, in structure, to the condylomata called cristæ gallorum. Their growth is pretty rapid. Sandy-looking ulcers also sometimes appear on the cornea and white of the eye, or on the integuments of the eyelids.

Even when the syphilitic iritis terminates in the most favourable manner, the eye, for a long time afterwards, is peculiarly sensitive of the influence of cold and moisture. On every exposure to these, it becomes morbidly sensible to light, acquires a slight blush of red, and discharges tears. Indeed, frequently for more than a year afterwards, on any sudden change of temperature, a pale violet-coloured zone is seen around the cornea, but which disappears when the eye has remained for some time exposed to the same temperature.

Without removing the constitutional disease, syphilitic iritis cannot be cured; but it by no means follows, that the doing this cures the inflammation of the iris. Were this local affection neglected until it should yield to the constitutional treatment, it would frequently happen that it would have gone too far to be benefited by that treatment, and the vision of the eye would be destroyed by the effusion of coagu-

lable lymph, which might otherwise have been prevented. Wherever, therefore, there is severe pain in the eye, with violent headache, &c. three or four leeches should be applied on the brow, and a purgative* given, the constitutional treatment being pursued at the same time.

But the chief object in view locally, is to prevent those regular nightly attacks of pain which are so invariably followed by an aggravation of all the symptoms. This is effectually done by rubbing well in, over the eyebrow, a small quantity of mercurial ointment, with opium added to it,† a short time before the pain is expected to come on, and then covering the eye with a folded piece of warm linen. Should the pain threaten to appear, this must be repeated towards midnight.

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* ℞ Magnes. Sulphat. ℥vj.	Take Sulphate of Magnesia, six drachms.
Mannæ Opt. ℥ss.	Best Manna, half an ounce.
Inf. Sennæ Tart. ℥iv.	Tartarised Infusion of Senna, four ounces.
Tinct. Sennæ, ℥ss.	Tincture of Senna, half an ounce.
M. ft. mist. sumat cochl. iij. pro re natâ.	Mix them, and take of the mixture three table-spoonsful as occasion requires.
† ℞ Ung. Hydrarg. ℥ss.	Take Mercurial Ointment, half an ounce.
Opii Purif. ℥j.	Purified Opium, one drachm.
M. ft. unguentum.	Mix, and make an ointment.

The species of iritis termed arthritic, or gouty, may originate in two ways. In the one, it is the primary and sole affection of the eye; in the other, a gouty individual having some common ophthalmia, this iritis engrafts itself upon it. The same happens with the syphilitic iritis, though rarely; while in the arthritic this manner of origin is the more common. Before there are any symptoms of this inflammation, a peculiar tingling is felt round the eye, and a sensation as if a single hair was hanging on the face, or as if something was creeping on the skin. The eye and orbit then become the seat of a racking pain, which extends to the temple, shoots through half of the cranium, and into the upper and under jaw. The sclerotic reddens; the flow of tears increases; and, by the frequent opening and shutting of the eyelids, a peculiar white frothy matter is forced out between them, which is quite distinct from the secretion of the Meibomian glands.

It will now be seen, if the eye be examined with a magnifying glass, that the blood-vessels in the sclerotic coat do not, as in the syphilitic iritis, proceed quite to the edge of the cornea, but disappear a short way before they reach it.

Thus a narrow ring of bluish white sclerotic is left all round the cornea, and this ring becomes manifest to the naked eye as soon as a network of red vessels appears in the conjunctiva. These latter vessels, from the first, shew a strong disposition to become varicose, which state is afterwards so remarkable as to be characteristic of arthritic iritis. The colour of them is peculiar, not being red, but purple. The sclerotic loses its pearly white appearance, and becomes of a dirty greyish violet colour.

In individuals of a spare habit, irritable disposition, and tense fibre, the iris becomes expanded, and the pupil contracts, as in the idiopathic iritis; and in such cases, the only characteristic symptom, besides the white ring of sclerotic, is a varicose state of the blood-vessels of the iris, which, however, does not take place till the disease has fully developed itself. The inflammation is always attended with general fever before it arrives at this state; and if the eye is left to itself, without any suppuration taking place, it begins to be absorbed, and at last its volume becomes extremely diminished.

In individuals who, on the contrary, are of

a gross habit of body, possess little sensibility, and have a lax fibre, (in whom gout is most common,) a different set of changes takes place. The iris, instead of being expanded, contracts remarkably, and at the same time loses its motion and colour. The pupil is not uniformly dilated, for the iris contracts more towards the two angles of the eye, and in consequence the pupillary opening assumes an oval shape: indeed the iris sometimes becomes so narrow on the two sides mentioned, particularly on the temporal, as almost to disappear.

There is, with this, no effusion of lymph, and no abscess takes place in the iris; but behind the enlarged pupil there is perceived a greyish green colour, which is deep-seated, and is actually caused by an affection of the vitreous humour. The lens then becomes affected in a similar manner, loses its transparency, acquires a sea-green colour, swells considerably, and projects forward into the pupil and anterior chamber. The iris, which now rests on the enlarged lens, seems quite altered from its natural texture: it looks soft, loose, and disorganised, as if it had been subjected to maceration.

The attacks of pain, during the progress

of these changes, are regular and very severe. The patient is first warned of their approach by a stinging sensation all round the eye, then a copious flow of tears takes place, and after this the pain commences, becoming so violent as to make the sufferer writhe under it. The varicose state of the vessels of the conjunctiva is increased, and those of the choroid coat becoming similarly affected, form bluish knots, which shine through the sclerotic. At the same time, there is seen, beneath the anterior part of this membrane, a dark ring, exactly occupying the situation of the corpus ciliare. Vision is now totally gone. The symptoms of inflammation then begin to decrease, atrophy commences, and absorption takes place, as in the first instance.

This is the most intractable of all the varieties of the disease, and its treatment is still involved in obscurity, owing to our ignorance of the nature and cure of gout itself. In some cases, particularly those arising after the operation of extracting the cataract, a general bleeding is necessary; but the quantity of blood drawn at once should not exceed ten or twelve ounces; since in gouty patients, large general bleedings are always succeeded by great in-

crease of feverish irritation and restlessness. The small bleeding may be repeated in twelve or twenty-four hours, if necessary. In most cases, however, the application of a few leeches to the brow, besides its local effect, produces all the benefit on the general affection which is to be derived from the abstraction of blood. The bowels are to be kept gently open.

Particular attention must be paid in preventing the attacks of pain. This is best done by friction over the eyebrow and forehead with an anodyne liniment.* Along with this, exposure to all those causes which occasion an attack of pain, must be most carefully avoided; such as, a cold draught of air, the heat of a strong fire, violent passions, &c. For removing, in part, the immediate danger to this delicate organ, counter-irritants are of essential service. The best is the tartar emetic

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* ℞ Sp. Ammon. Comp.
Aq. Distillat. āā ℥j.
Tinct. Opii, ℥ss.
M. ft. linimentum, bis die applicandum.

Take Compound Spirit of Ammonia,
Distilled Water, of each one ounce.
Tincture of Opium, half an ounce.
Mix them, and make a liniment, to be applied twice a day.

ointment, rubbed on the nape of the neck, so as to occasion a continued eruption of pustules. If the risk attending the eye is very urgent, the ointment should be rubbed behind the ears. All this is frequently only palliative treatment; for if it is no longer possible to cure the constitutional gout itself, then vision, sooner or later, will be destroyed.

CHAPTER IV.

INTERNAL DISEASES OF THE EYE.

SEVERAL of the preceding diseases are more or less internal; it being impossible to separate them in all cases, without nicer distinction than would be useful or important. I propose, therefore, in this chapter, to describe the diseases which are more decidedly internal than any of those treated of in the foregoing pages, particularly cataract, cancer, and amaurosis or gutta serena.

Cataract.

The crystalline lens, as well as the fluid surrounding it, and the membrane or capsule containing it, is very subject to opacities and cloudiness, all of which are designated by the name of cataract, which varies according to the part affected, and the nature of that affection; for the lens may be hard and cloudy, or the capsule may become opaque and whitish, or the fluid between these may become white and caseous.

Even in infancy, these defects are not of uncommon occurrence, and are found sometimes in infants at birth; but they seem to be the most common in workmen exposed to much heat, as forgemen, glass-blowers, and blacksmiths, and such as drink strong liquors, sour wines, &c. as at Vienna. It has been alleged, that the use of rice in diet tends to produce cataract, because this disease is found to prevail in Turkey, and in some other countries where rice is much used. Others deny this, and impute the effect to climate, or to the use of opium. There must, however, be some foundation for so universal an opinion.

The master of an American vessel has stated, that in a homeward voyage from India, in which rice was much used on board, most of the American seamen were affected with weakness of the eyes; but none of the Lascars, who had been used to it from infancy.

Sometimes cataract has been observed to run in families, without any apparent cause. Professor Walther thinks that cataract is the primitive and natural state of the lens; and that congenital cataract is not, therefore, an altered, but an unaltered condition, in consequence of a check given to the development

of the embryo; and that, like other malformations, it is not owing to the influence of any active or formative cause, but having been originally present in every embryo at certain periods of its existence, does not disappear in its progress to a more perfect state, as it does when this progress is unchecked.

Two of the chief marks of the size of the cataract are derived from the state of the posterior chamber, and the mobility of the iris. If the lens, in an opaque state, still preserve the size which it had when transparent, there is a very evident shadow thrown back upon the surface of the cataract by the iris. If the cataract be less than the natural lens, this shadow is broader than usual; but if the opaque lens be swoln, no shadow is present, as the capsule is pushed forwards into contact with the iris, and the posterior chamber is abolished. The motions, also, of the iris are, in this case, rendered slow, or are altogether impeded. A hard cataract is always small; though every small cataract is not hard. The darker, and at the same time the more uniform the grayish opacity of the cataract, the harder it is; whereas, a cataract which is large, and at the same time cloudy or white, is always soft.

The cystic cataract is always, or almost always, caused by a violent blow in the neighbourhood of the eye, and of its consequent concussion. The lens, enclosed in its capsule, at the time of the accident is loosened from the surrounding parts, from the vitreous humour, from the hyaloid membrane; in a word, from all its vital connexions. The capsule becomes quickly opaque, from the action of the aqueous humour, and at the same time much thickened; the lens also becomes opaque, and then dissolves.

The opacity presented in this disease is white, uniform, and very convex. The iris is pushed forward by the cataract, which is partly forced through the pupil. From the effects of the concussion of the eye upon the retina, amaurosis frequently accompanies this kind of cataract. If extraction be performed in a case of cystic cataract, the lens enclosed in its capsule rolls out as soon as the section of the cornea is completed; but cases of this kind more frequently than any others get well *without an operation.*

The siliquous cataract is the consequence of a wound or rupture of the capsule, through which the aqueous humour is admitted to the

lens. In adults, this kind of cataract is usually the result of a penetrating wound; occasionally of a blow upon the eye. In children, the rupture of the capsule most frequently takes place during the convulsions so frequent in the first days after birth, and in which the muscles of the eyeball are affected with violent spasms. The opacity in children is light gray, and has its seat evidently in the anterior capsule, which is shrivelled and wrinkled. In adults the opacity is chalky, especially where the capsule had been wounded; elsewhere it is dusky or yellowish. The opacity is flat, and the shadow of the iris broad.

Among the most common causes of cataract may be mentioned old age, external injuries, hereditary predisposition, exposure to intense heat, too copious use of wines and spirituous liquors, sudden application of cold to the extremities, and imprudences of various descriptions.

According to Mr. Watson, the worst affection with which cases of cataract can be complicated is amaurosis. When this exists, the pupil is generally dilated, and is of an irregular form. The patient either does not distinguish light from darkness, or does so very

imperfectly; in many cases the degree of opacity does not account for the defect in vision; and he often sees sparks and flashes of fire, black spots, and the like, before him. Very often amaurotic patients complain of frequent and severe headach. The history of the case, too, deserves attention. Eyes that have previously suffered much from inflammation, very often have their delicate internal parts disorganised, which is accompanied in most cases with amaurosis. Cataract seldom takes place suddenly — amaurosis frequently. In amaurosis, too, the blindness in some cases intermits; while in cataract it does not.

Along with amaurosis, inflammation of the eye very often produces disorganisation, or an opaque state of the vitreous humour. This state of the eye frequently accompanies cataract. It is known by the insensibility of the eye to light, — immobility of the iris, — irregularity of the pupil, — and softness of the eyeball.

Some other diseases of the eye are apt to be mistaken for cataract. These are, central opacity of the cornea, chronic inflammation of the retina, and amaurosis.

A spontaneous cure of cataract takes place in those cases where an injury, which has

caused the cataract, has also so ruptured the lens and its capsule, that its solution and absorption take place by the agency of the aqueous humour. In other more rare cases, where the lens has become detached from its connexions, in consequence of disorganisation of the vitreous humour, and fallen from the axis of vision, a spontaneous cure has also happened. M. Boyer mentions an interesting case of a gentleman, who, after twenty-five years' blindness, his eye having been considered unfit for an operation, suddenly had his sight restored when walking along the street; the detachment of the lens above described having taken place at its upper half, by which it waved to and fro in the eye.

The late Mr. Ware communicated an account of the dissipation of cataract to the Medical Society of London, in 1789 and 1790; and in his Chirurgical Observations he states, that since the preceding communications were read to the Society, he had had occasion to attend a considerable number of cases in which an opacity of the crystalline humour was produced by violence done to the eye; and in most of these the opacity was dissipated, and the sight restored, during the external application of æther. Of the cases that proved suc-

cessful under this mode of treatment, he had a written account of eight; and a recollection of several others, the particulars of which he had now forgotten, having unfortunately omitted to take notes of them at the time they were under his care.

He also expressed a hope, in Wenzel's paper, that means might hereafter be discovered for rendering transparent an opaque crystalline lens, without the performance of any operation whatever; and of his own success in the treatment of cataract the cases he has detailed afford satisfactory evidence.

It is necessary thoroughly to examine the eye, and to be satisfied that the disease is actually cataract, as it is often a matter of considerable difficulty to determine whether the cataract be *spurious* or not. In all cases of incipient cataract I should recommend occasionally a moderate abstraction of blood from behind the ears, and the application of a small blister to the nape of the neck, or behind the ears, which should be kept open some weeks with the ointment prescribed below:* care to

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* ℞ Ung. Sabinæ, ℥ss.
Ung. Simpl. ʒij.

M. ft. unguentum.

Take Savine Cerate, half an ounce.
Simple Ointment, two drachms.
Mix into the form of an ointment.

be taken that the blisters are not too large. Alteratives and aperients* may be given, and sedative lotions applied to the eyes;† with now and then warm fomentations of poppies.

Vel,

℞ Cerat. Resinæ, ℥ss.
Cerat. Cantharid. ʒij. M.

* ℞ Hydrarg. Submuriat. gr. vj.
Pulv. Jalapæ, gr. xij.
Ext. Taraxici, ʒss.
Syr. q. s. M. fiant pilul. xij.: capiat ij. horâ decubitûs.

℞ Potassæ Tartrat. ʒvj.
Inf. Sennæ Comp. ℥v.
Tinct. Sennæ, ℥ss.
Tinct. Jalapæ, ʒij.
M. ft. mist. cathartica; sumat cochl. iij. pro dos.; et repetatur post horas tres, si sit necessitas.

† ℞ Ext. Opii, gr. xx.
Solve in aq. puræ tepidæ, ℥vj. Cole et adde Liq. Ammon. Acet. ℥jss. M. ft. collyrium, sæpe utendum.

Or,

Take Resin Cerate, half an ounce.
Cerate of Spanish Fly, two drachms. Mix them.

Take Submuriate of Mercury, six grains.
Powdered Jalap, twelve grains.
Extract of Taraxicum, half a drachm.
Syrup sufficient to make twelve pills: two to be taken at bed-time.

Take Tartrate of Potass, six drachms.
Compound Infusion of Senna, five ounces.
Tincture of Senna, half an ounce.
Tincture of Jalap, two drachms.
Mix, and make a cathartic mixture: three table-spoonsful to be taken for a dose; to be repeated three hours afterwards, if the bowels are not relieved.

Take Extract of Opium, twenty grains.
Dissolve it in six ounces of pure tepid water, and add Acetated Liquor of Ammonia, one ounce and a half. Mix them, and make a wash for the eyes, to be used often.

After the chronic inflammation is subdued by these remedies, the cataract is to be touched every morning with a solution of the potassa cum calce, beginning with a weak solution, and increasing it gradually. It should be applied with a camel-hair pencil: and I beg to observe, that the dissipation of cataract depends much on the way in which the solution is applied. The eyelids must be kept open during its application, and the centre of the cataract alone be touched, otherwise part of the caustic will adhere to the eyelids, and occasion unnecessary pain, besides defeating the object in view. Great care should also be taken to use only one brush for each patient; much mischief having

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Vel,

℞ Liq. Ammon. Acet. ℥j.

Vin. Opii, ℥ij.
Aq. Rosæ,
Aq. Distillat. āā ℥iij.

M. ft. collyrium, sæpe utendum.

Vel,

℞ Acet. Distillat. ℥ss.

Vin. Opii, ℥ij.
Mist. Camph. ℥iv. M.

Or,

Take Acetated Liquor of Ammonia, one ounce.
Wine of Opium, two drachms.
Rose Water,
Distilled Water, of each three ounces.
Mix them, and make a wash for the eyes, to be used often.

Or,

Take Distilled Vinegar, half an ounce.
Wine of Opium, two drachms.
Camphor Mixture, four ounces.
Mix them.

arisen from practitioners not being particular in this respect, but using the same brush for all patients indiscriminately. In the incipient stage of cataract, I am convinced much good may be done, and a cure effected; but when the disease is become confirmed, and the patient is old and feeble, there is little to be expected, and the risk of an operation had better always be avoided. For should inflammation take place after an operation, which in many instances it does, and cannot be subdued, it is sure to prove fatal.

Mr. M'Kenzie judiciously observes that, with regard to the ultimate prognosis, practitioners are too much in the habit of raising sanguine hopes in the minds of patients affected with cataract, that by surgical operations on the eyes their sight may be almost perfectly restored, not weighing with sufficient consideration, the frequency with which other morbid changes in the organ of vision come to be associated with this disease, especially in advanced life, such as dissolution of the vitreous humour, absorption of the pigmentum nigrum, and imperfect sensibility of the retina. Many a patient, who, before the operation, can perceive the hand passing before the eye, sees very little

more after the opaque lens is removed, on account of the dulness of the retina, or the deficiency of the choroid secretion. The dangers attending operations for cataract, are also much too lightly estimated, in pronouncing an ultimate prognosis in this disease.

Some practitioners recommend, that when a cataract is newly formed, we should wait until it is fit to be operated upon. On the contrary, I think we should use every means in our power to dissipate it as speedily as possible after it has made its appearance.

There are three modes of treating cataract without operation, namely, the antiphlogistic, the stimulant, and the counter-irritant; each of which ought to be fairly tried; and it is only when unsuccessful that an operation should be attempted. There are also three modes of performing the operation. One is, to pass an instrument through the white of the eye, which is insensible till it reaches the clouded lens, and then to push the lens aside into the glassy humour. This operation is known by the name of *couching*, and is very easily performed. Another way is to cut into the cornea, and, by an instrument fitted for the purpose, to bring the lens through the opening, taking

it entirely out of the eye. A third way is, to let the lens remain in its place, and either to break it into pieces with an instrument, or merely to prick it in several places. In this last case the lens disappears in a short time after the operation; being dissolved, as is supposed, by the watery humour. When the cloudy speck in the lens is small, producing dimness of sight, as it usually does at the commencement of the complaint, the extract of belladonna, by keeping the pupil wide, has been beneficially employed; but it requires great caution in its application.

Cancer of the Eye.

There can be no question that this is a very alarming and formidable disorder when happening in any part of the body; but still more so in the eye, in which it is greatly aggravated by the extreme sensibility of the organ. Unlike other causes of cancer, which seldom occur till middle age, cancer of the eye, or at least a disease very like it, is most frequent under the age of twelve. The causes of it can seldom be assigned. The pain is intolerable; and the bursting of the eye sooner or later takes place.

As in all cases of cancer, the only cure is to cut away the whole of the diseased portion; and death has been repeatedly arrested by extirpating the eyeball, together with the lachrymal gland, where, indeed, the malady often originates.

There is a disease similar to this, and, till lately, not distinguished from it, in which a mass of soft livid substance forms and shoots out from the eye. It prevails chiefly in infancy, as true cancer does in old age. No cure has yet been found for this dreadful malady.

According to Mr. Mackenzie, the disease vulgarly called eating cancer of the face is not an unfrequent one. It often begins on the lower eyelid. It slowly consumes the skin and the muscles, till it destroys not merely the lid, but a great part of the cheek, enters the orbit, attacks the eye, and at length proves fatal. Dr. Jacob, in some excellent observations which he has published on this disease, remarks, that its characteristic features are, the extraordinary slowness of its progress; the peculiar condition of the edges and surface of the ulcer; the comparatively inconsiderable suffering produced by it; its being incurable unless by extirpation; and its not affecting the neighbouring lymphatic glands.

We sometimes meet with this disease while yet confined to the lower lid. We find it thickened, and more or less of its edge ulcerated. In some instances, the outer angle of the lids is the seat of the disease. It appears not unfrequently to commence in the form of a wart, which, being picked off with the finger, leaves a raw surface, exposed to the irritation of the tears, and apt to spread by ulceration. In other cases, the origin of this disease appears to be an encysted tumour, which, allowed to burst on the inside, or, it may be, on the outside of the eyelid, becomes irritated, and is thus induced to assume the ulcerous or cancerous action. An encysted tumour, immediately under the skin, picked with the finger, sometimes a mere scratch of the edge of the eyelid, a blow, or the irritation of an old cicatrice, such as that which results from small-pox, may give rise to cancer of the eyelids. This disease produces the most shocking deformity, sometimes leaving the face half destroyed.

Amaurosis.

When, in consequence of an unusual quantity of blood in the brain, the optic nerves are compressed, the sight is either impaired

or destroyed. In slight cases, dark specks are seen flitting before the eyes during the day, and luminous spots, or flashes of light, are perceived in the dark. This sometimes arises from a disordered stomach; but often from causes which we cannot immediately trace.

Among the most frequent known causes of amaurosis, are—the pressure of exostosis or other tumours; over-exertion of the sight, and exposure of it to a bright light, as is often the case with sea-officers and astronomers in looking through their glasses; violent contusions of the head; apoplectic fits; long-continued occupations by candle-light; insolation; strong passions, as terror, rage, &c.; forced exertions of the body; errors in diet, especially the abuse of wine and spirituous liquors; suppressed discharges; action of poisonous substances; gastric and intestinal irritation; the too free use of tobacco; excessive venery; grief; long-continued suckling, producing debility and emaciation; intestinal worms; chronic disorders of the digestive organs; suppressed eruptions; and all other causes which predispose to nervous and paralytic affections, the same as in nervous deafness.

In this disease, it is by no means an unfre-

quent occurrence for the nerves to become quite insensible, and total blindness to ensue. The eye in this case does not appear to be diseased, except by its vacant stare, or constant rolling and large pupil, which, in confirmed cases, undergoes no variation in size from being exposed to, or screened from, the light. The severe pain in the head also, so distressing at first, at length goes off. This is the disease that afflicted Milton, and which he calls the "drop serene," literally translating the Latin words *gutta serena*. It is best known to medical men by the name of *amaurosis*, is a much more common complaint than is generally imagined, and is by many considered incurable.

Two of the most frequent species of amaurosis are the rheumatic and the plethoric. Rheumatic amaurosis manifests itself by the following symptoms:—the pupil is perfectly clear; the iris almost immovable, and not greatly dilated, but evidently displaced inwards and upwards, being nearer the nose and eyebrow than naturally; there is a flow of tears on the slightest occasion; always more or less intolerance of light; together with a frequent aching pain in the ball, and about the region of the eye. The motions of the eye-

ball are impeded, especially in one direction: it is generally turned outwards; and when the disease is fully developed, cannot, by any exertion of the patient, be made to revolve inwards. A considerable weakness of the levator palpebræ superioris, or even a complete palsy of that muscle, is also experienced.

This species of amaurosis rarely goes the length of total blindness; and Professor Beer has succeeded in curing the greater number of such cases. The treatment consists chiefly of diaphoretics. Guaiacum and camphor, the former in the dose of two grains, the latter in that of half a grain, are given twice or thrice a-day in powder, and Dover's powder at bed-time. Amongst external remedies, vesicatories hold the chief place. They are to be applied alternately behind the ear or to the temple, and over the eyebrow; so that a succession of counter-irritations may be kept up.

Plethoric amaurosis is an exceedingly well-marked disease, and one which, in its early stages, is within the power of depletory treatment. That species of amaurosis which results from chronic disorders of the digestive organs, is also well marked, but is much less under the influence of medicine. Both these diseases

are frequently hurried on to their complete development, and to a total insensibility of the retina, by stimulants, especially by belladonna.

But, either in the organic or functional amaurosis, the vision is not always wholly obstructed, the patient being enabled to distinguish large objects. He first notices his sight to be interrupted by small bodies floating before the eye, called muscæ volitantes; or when reading, by the letters of the book appearing transposed. There is also an oscillation of objects, or double vision. Light affects amaurotic persons differently; some being unable to bear the stimulus, others seeking it. It may be sudden or progressive in its attack, according to the nature of the exciting cause. The morbid characteristics, in either case, are, the pupil no longer obeying the stimulus of light, its circular form being somewhat changed, and a coloured spot appearing in the fundus of the eye, as in the horse or sheep. Severe pain in the orbit and temples is usually an attendant symptom. When any of the other senses are affected, there is little prospect of recovery. It most frequently occurs in middle-aged persons having dark eyes.

This disease, in some rarer instances, is not

constant, but the patient sees well at one period, and is nearly blind at another. The intermission in some cases comes on as regularly as a paroxysm of ague, the patient being able to see well, or tolerably, during the day, and none at all after sunset: in other instances these symptoms are exactly reversed.

Many patients have observed dark motes floating before their eyes; and when this is frequent, it is an unpromising circumstance for the sight. The phenomenon is described as resembling flakes of soot or flue, insects' wings, flies, &c. which are sometimes bright, like a chain formed of globules of quicksilver. A cloud of these is often the precursor of a severe attack of headach. In another species of the disorder, a dark screen appears to shade the field of vision; sometimes wholly, at other times only in part. These symptoms, however, may occur with more or less aggravation, when there is no plausible reason to be apprehensive of amaurosis, of which several very marked instances might, if there was room in this place, be recorded. The most unfavourable cases are those in which the attack has been sudden; and if one eye be first affected, the other generally soon follows.

In the treatment of amaurosis we must take into account the causes from which the disease has originated, because our applications must necessarily vary according to these causes. The prognosis is generally unfavourable. If the disease attack the aged and infirm, a cure cannot be expected. If it originate from irritating matter in the stomach, from plethora, or from suppressed evacuations, the disease is generally curable, and always admits of alleviation. If plethora exist, venesection, especially from the jugular vein, will be proper; repeated according to the age, former mode of living of the patient, and the degree of plethora which exists. Cupping-glasses should be applied between the shoulders. Leeches may also be employed on the forehead, or under the eye itself. Blisters behind the ears, to the nape of the neck, and to the head, are serviceable. Laxatives or cathartics should be recommended, as below.* If the disease pro-

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* ℞ Mist. Amygdalæ, ℥ij.

Sodæ Tartar. ʒjss.

Mannæ, ʒij.

M. fiat haustus, 4tis horis repetend.

Take Almond Emulsion, two ounces.

Tartarised Soda, one drachm and a half.

Manna, two drachms.

A draught, to be taken every four hours.

ceed from obstructed perspiration, the nitrate of potass should be combined with diaphoretics, as under.* Diuretics may be prescribed

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Vel,

℞ Hydrarg. Submuriat. gr. iij.

Pulv. Antimonialis,
Scammon. āā gr. v.
Confect. q. s. ut fiant pilulæ ij. horâ decubitûs sumendæ; et posterâ aurorâ propinet æger haustum sequentem:

℞ Infus. Sennæ, ℥jss.

Potassæ Tartrat. 3ij.

Antimon. Tartar. gr. ¼.

Tinct. Jalapii, 3j.

Pulv. Radicis Jalap. ℈j.
M. fiat haustus catharticus, cras mane sumend.

* ℞ Aquæ Cinnamomi, 3iij.

Aquæ Puræ, 3v.
Pulv. Ipecac. gr. j.

Liq. Ammon. Acet. 3ij.

Nitratis Potassæ, gr. x.
M. fiat haustus, 6tis horis repetend.

Or,

Take Submuriate of Mercury, three grains.
Antimonial Powder,
Scammony, of each five grains.
Confection sufficient to make two pills, to be taken at bed-time.
The next morning let the following draught be taken:

Take Infusion of Senna, one ounce and a half.
Tartrate of Potass, two drachms.
Tartarised Antimony, one-fourth of a grain.
Tincture of Jalap, one drachm.
Powder of Jalap, one scruple.
A cathartic, to be taken the next morning.

Take Cinnamon Water, three drachms.
Pure Water, five drachms.
Powder of Ipecacuanha, one grain.
Liquor of Acetated Ammonia, two drachms.
Nitrate of Potass, ten grains.
A draught, to be taken every six hours.

alone, or combined with cathartics.* If the disorder proceed, as it often does, from foulness of the stomach, indicated by nausea and an effort to vomit, an emetic should be given.† If periodical evacuations be suppressed, their return must be promoted; and if these fail, some artificial discharge must be substituted, as issues and setons. Sometimes sternutatories have been beneficial, from the discharges of serum which they occasion: a few grains of asarum, or of the resin of guaiacum, may be snuffed up the nose. The fumes of alkaline spirits, properly diluted, may be passed through a funnel to the eye. When rheumatism is the cause, or when a paralysis of the retina is sus-

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* ℞ Pulv. Jalap. ℈j.
Potassæ Supertart. ʒss.

Capsici contrit. gr. j.
M. fiat pulvis, singulis vel alternis auroris repetendus.

Take Powdered Jalap, one scruple.
Supertartrate of Potash, half a drachm.
Capsicum, one grain.
A powder, to be taken every morning, or every other morning.

† ℞ Zinci Sulphatis, ℈j.
Pulv. Ipecac. gr. xij.

Aquæ Puræ, ℥ij.
M. fiat haustus emeticus, quamprimum sumendus, et repetatur si urgeat nausea.

Take Sulphate of Zinc, one scruple.
Powder of Ipecacuanha, twelve grains.
Pure Water, two ounces.
Make an emetic draught, to be taken immediately, and repeated if necessary.

pected, valerian, or guaiacum, combined with bark, has been useful.*

If a scrofulous diathesis produce the disease, bark or steel may be prescribed, with carbonate of soda. If it arise from a venereal taint, mezereum, sassafras, sarsaparilla, and the preparations of mercury. A salivation is said to have often succeeded in curing amaurosis when all other remedies have failed.

Dr. Richter, professor of medicine in the University of Göttingen, states that he has lately restored to sight several patients who laboured under gutta serena. In all those

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* ℞ Decoc. Cinchon. ℥v.

Pulv. Valerian. ʒij.

Tinct. Valerian. ʒvj.

M. capiat cochlear. tria ampla sextâ quâque horâ.

Vel,

℞ Valerian. Radicis contus. ℥ss.

Aquæ Ferventis, ℥viij.

Macera in vase operto per horas duas, et liquori colato adde

Tinct. Cinchonæ, ℥j.

M. capiat cochlear. tria ampla 4ter indies.

Take Decoction of Bark, five ounces.

Powder of Valerian, two drachms.

Tincture of Valerian, six drachms.

Three table-spoonsful to be taken every six hours.

Or,

Take Bruised Valerian, half an ounce.

Hot Water, eight ounces.

Macerate in a covered vessel for two hours, and add to the strained liquor

Tincture of Bark, one ounce.

Take three large spoonsful every six hours.

cases, he thinks the cause of the disease was seated in the abdominal viscera; for he cured them by means of medicines which remove obstruction in these viscera, and evacuate the bowels. He affirms, that in this way he has not unfrequently performed a complete cure, in cases where he hardly expected it, and in some where the disease had actually continued for several years. After vomiting, he recommends the pills mentioned below;* adding, that it is often necessary to persevere in the use of these remedies six or eight weeks before any amendment is perceived. A gradual increase of the dose is also requisite. A disappearance of the fiery sparks from before the eyes, and of the sensation of tension in their balls, are the first symptoms, he observes, of amendment, which

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* ℞ Gum Ammon.
Gum Assafœtid.
Pulv. Rad. Valerian.
Pulv. Summitat. Arnic.
Sapon. Venet. āā 3ij.

Antimon. Tart. gr. xviij.

Syrup q. s. M. ft. pilul. pond. gran. v.; quarum iij. sumat ter in die.

Take Gum Ammoniac,
Gum Assafœtida,
Powder of Valerian,
Tops of Leopard's Bane,
Venetian Soap, of each two drachms.
Tartarised Antimony, eighteen grains.

Syrup a sufficiency to form the mass, out of which let pills of five grains each be made, and of these three are to be taken thrice a day.

give reason to hope for success in the cure of gutta serena.

My friend Dr. Tattersall, Fellow of the Royal College of Physicians, has communicated to me the case of a young lady who became blind from amaurosis, in consequence of having caught cold at a ball, which yielded completely to brisk cathartics and diaphoretics.

According to Dr. Copland, various volatile substances, spirituous, saline, and oleaginous, have been recommended to be applied to the eyes, either in a state of vapour or of solution, and dropped into them, by Warner, Sagar, Manardus, Dunckler, Chomel, St. Yves, and Schmucker; but these require to be cautiously resorted to. The application of cold and slightly stimulating washes and baths to the eye, and bathing the whole head, or eyes, in cold water, have been approved by Richter and Beer. Moxas, applied in the course of the facial nerves, have been used by Larrey; and the actual cautery behind the ears by Khlodovitch.

The treatment of amaurosis which I have here detailed very closely resembles that recommended for nervous deafness in my Treatise on the Ear; in both diseases much depend-

ing on the patient himself. In addition to the various medicines prescribed, he should attend to his general health, breathe a pure air, take much out-door exercise, live on plain but nutritious food, give rest to the affected organ, and enjoy a little cheerful society. Above all things, he should be careful of the state of his bowels, as constipation ought always to be avoided.

CHAPTER V.

LIGHT.*

"LIGHT," said the wisest of men, "is sweet; and a pleasant thing it is for the eyes to behold the sun." The truth of this few will dispute, though perhaps only those who have at some period of their life been deprived of the blessing, can feel the full force of the sentiment. Sight is, indeed, of all our senses, the most delightful, the most perfect, the most diversified in its powers, and the most accurate in the information it conveys. Whence, then, it is natural to inquire, and by what mechanism, do we derive so much of the purest enjoyment? The philosophic Bacon asserts that "knowledge is power," an assertion the truth of which every day's experience verifies; and applying this

* In various parts of my Treatise on the Physiology and Pathology of the Ear, the reader will find much information on the subject of this chapter, which the intimate connexion between the organs of hearing and sight rendered necessary to the more perfect elucidation of the topic.

axiom to the subject before us, we shall find that an attentive consideration of the phenomena of vision has led to the invention of artificial aids by which the sight may be wonderfully strengthened and preserved, and man endowed at once with the perspicacity of the eagle and the minute scrutiny of the insect. Nay, more: by such discoveries the failure of this faculty in old age has been retarded, or, if lost, restored; and thus, in the latter case, those who had been perhaps for years doomed to perpetual gloom, have again been gladdened with the beams of day.

From the peculiar properties manifested by light in different degrees of polarisation, the scientific mind derives a fund of information relative to the intimate constitution of bodies, and to the nature of the material universe, which varies wholly from the general impressions of form, colour, and distance, made on mankind at large by daily observation.

The opinions of the ancients respecting vision were in many points erroneous: they thought that the faculty of sight consisted in a sort of emanation from the eye towards the object beheld. But that such is not the case is manifest from the fact that we cannot see

in the dark, which proves that the vicinity of an object is not of itself sufficient to constitute sight; as it would be, did light emanate from the eye. The object must therefore be in what we call a *luminous* state. Some natural bodies are themselves capable of exciting in the eye the sensation of brightness or light; as, for instance, the sun, stars, a candle, red-hot iron, &c.; and these are said to be self-luminous; though it is hardly necessary to add, that very few possess this quality, and that those which have it not are invisible in the dark, even when the eye is directed towards them: they are in consequence called *non-luminous*. Even such, however, become luminous when near self-luminous bodies. If a lighted candle be brought into an apartment previously in darkness, we immediately see not only the self-luminous body, the candle, but whatever else comes within the range of its rays. The non-luminous bodies are thus made luminous for the time, and are in a condition to illumine others. In this manner a sunbeam entering a darkened chamber, and falling on any white body, say a sheet of paper, renders it luminous, and consequently visible; the paper in turn illuminates the entire chamber,

making visible all the objects it contains, until the sunbeam ceases to irradiate the sheet, when darkness again prevails.

The moon and planets are opaque or non-luminous bodies, yet when the sun shines on any part of them, such part becomes luminous, and acts as a self-luminous body. Many substances possess the property of intercepting this peculiar intercourse between luminous bodies and the eye, or other bodies. A plate of metal put between our eyes and the sun, hinders us from perceiving that luminary; and if the metallic plate be interposed between the sun and a sheet of white paper, or other object, it casts a shadow on such object; in other words, renders it non-luminous. This power of bodies to intercept light proves that the communication constituting light is made in straight lines.

Light emanates from luminous bodies in every direction, since in all positions of the eye we perceive them, so long as there is nothing to obstruct the light. And herein consists the essential difference between luminous bodies and optical images, from which light emanates only in some directions. It is obvious, also, that light radiates from every

point of a luminous body, as those points of it from which light is not emitted are non-luminous.

In a darkened room, if a card having a small hole in it be placed between a candle and a piece of white paper, a perfect resemblance of the flame, in an inverted position, will be seen on the paper, increasing in size as the paper recedes from the perforation. In this manner the hole becomes the vertex of a conoidal solid, lengthened both ways, which has for its base the object at one end, and the screen at the other. The section of this solid by the screen is the picture seen projected upon it, which must resemble the object, being inverted geometrically.

White light, if passed through a prism, and thereby subjected to oblique refraction, is seen to be composed of many degrees of excitement. These different excitements are divided into an oblong figure, the base of which is red shading to orange, and, in succession, to yellow, green, blue, indigo, and lastly to violet or negation.

In the prismatic spectrum, violet rays denote heat to be as 1, green as 4, yellow as 8, and red as 16, beyond which there is no peculiar action.

Colours have been, by certain philosophers, referred to these various degrees of intensity; and, in like manner, painters speak of blue as cold, green as soft, yellow as rich, and red as warm. Musicians have adopted similar modes of thought and expression.

It is well known that the colours of bodies are regulated by the dimensions of their atoms, as well as by the chemical character of the local atmospheres of their atoms and interstices. The atoms of black being small, it absorbs light; white having large atoms, reflects light. According to Ellis, green is of a nitrogen, violet of a hydrogen, and red of an oxygen character. The minute particles of these decompose incident light — absorbing some, and reflecting others: thus, an oxygen body unites with hydrogen, and reflects red, and the reverse with others. A hydrogen absorbs red, &c. and reflects blue, indigo, &c.; a nitrogen absorbs red and violet, and reflects green or white, orange or blue.

Various other excitements, besides combustion, produce light, among which are friction and phosphori. Snow, diamonds, and the Bologna stone, apparently absorb and radiate it; some combinations evolve it, and several

plants scintillate. Every one is aware, that if the eyes be rubbed in the dark, flashes of light will be produced. Slaking lime gives out light and intense heat.

The breadth of waves of light, according to Fraünhofer, are, in parts of an inch, as follow:

Red	·00002582
Orange	·00002319
Green	·00002073
Blue	·00001912
Indigo	·00001692
Violet	·00001572

The interstices are black, except when the waves mingle, in which case they are white.

The opinion of the late learned and scientific Dr. Young concerning light, was, that it is an affection of a continuous medium, so rare and elastic that it suffers bodies to permeate it without resistance.

Having made these general remarks on the nature and properties of light, I shall now briefly notice some of the peculiar sensations experienced, on the recovery of sight, by those who had been once destitute of that inestimable boon.

It is related of a blind youth, couched by Chesselden, that he thought scarlet the most

beautiful of colours, and that the sight of black was unpleasant. He imagined every object touched him; and being unable to discriminate by the eye, things with which he was well acquainted through the medium of touch, he had to be told the names of whatever he saw. Pictures appeared to him to be merely particoloured surfaces, from his having no idea of light and shade. A miniature painting greatly astonished him: he said it seemed as if a bushel measure had been put into one of the dimensions of a pint. He was quite unable to conceive why a house should look larger than a room. After his other eye had also been couched by the same eminent surgeon, he thought objects appeared smaller to it than they had done to the first eye that was operated upon; and when he viewed an object with both eyes, it seemed twice as large as when he looked at it with one eye only.

Sir William Adams couched several young persons, with results, in the main, closely resembling those in the above case.

I may here remark, however, that the want of vision is partially compensated in blind persons by their possessing an accuracy and sensibility of touch, and habits of association

connected with that faculty, with memory, and with judgment, unknown to those who see. Many interesting examples of this fact might readily be adduced; but I shall content myself with stating a few particulars relative to some of the more striking cases.

Blind musicians have always been celebrated. Stanley, the organist, was one of the first players of his day on that magnificent instrument; and, indeed, not a few of the best musicians the world has ever heard, have been either born blind, or at some period of life have become so. This circumstance will not so much surprise us, when we remember that the blind distinguish sounds, both near and distant, with far greater precision than can those who are not constrained to trust solely to their ear.

A remarkable proof that the blind hear more acutely than others, occurs in the case of a Miss Chambers, a blind schoolmistress, who could tell that two boys were playing in a far corner of the room instead of minding their books, though their movements were so noiseless, that a spectator could not have known they were even present, but for the use of his eyes. Professor Sanderson, also, possessed the power of discovering, in a few minutes, the

number of persons contained in any room into which he entered, and could even find out what were the proportions of the sexes by the sound of their clothes.

I might further add to these, many curious instances of the perfection of other senses in the absence of sight,—such as a blind man playing at cards by slightly pricking them, ladies dancing figure-dances, sewing tambours, threading a needle, &c.; but having already occupied as much space as this part of the subject seems to demand in a work of this nature, I proceed to select some portions from "Experiments and Observations on the Inflection, Reflection, and Colours of Light," by Henry Brougham, jun. Esq., communicated to the Royal Society through its Secretary, Sir Charles Blagden, Knt.; and inserted in the Philosophical Transactions for 1796.*

* When this paper was written, Mr. Brougham, now Lord Brougham and Vaux, and Lord High Chancellor of England, was only sixteen years of age; and although the extreme youth of the writer was unknown, the merit of these experiments caused them to excite considerable interest in the learned world. He is also said, at this period to have carried on a scientific correspondence in Latin with some of the most distinguished continental philosophers.

I have always thought it wonderful, (says the writer), since Nature seems to delight in those close analogies which enable her to preserve simplicity and even uniformity in variety, that there should be no dispositions in the parts of light, with respect to inflection and reflection, analogous or similar to their different refrangibility. In order to ascertain the existence of such properties, I began a course of experiments and observations, a short account of which forms the substance of this paper. For the sake of perspicuity I shall begin with the analytical branch of the subject, comprehending my observations under two parts : *flection*, or the bending of the rays in their passage by bodies, and *reflection*. And I shall conclude by applying the principles there established to the explanation of phenomena, in the way of synthesis.

As in every experimental inquiry much depends on the attention paid to the minutest circumstances, in justice to myself I ought to mention, that each experiment was set down as particularly as possible immediately after it was made ; that they were all repeated every favourable day for nearly a year, and before various persons ; and as any thing like a preconceived opinion, with respect to matter

of theory that is in dispute, will, it is more than probable, influence us in the manner of drawing our conclusions, and even in the manner of recording the experiments that lead to these, I have endeavoured as much as possible to keep in view the saying of the Brahmin, "That he who obstinately adheres to any set of opinions, may bring himself at last to believe that the fresh *sandal-wood* is a flame of fire."*

Of Flection.

In order to fix our ideas on a subject which has never been treated of with mathematical precision, we shall suppose, for the present, that all the parts of light are equally acted upon in their passage by bodies; and deduce several of the most important propositions which occur, without mentioning the demonstrations.

Definition 1. If a ray passes within a certain distance of any body, it is bent inwards; this we shall call inflection. 2. If it passes at a still greater distance, it is turned away; this may be termed deflection. 3. The angle of

* Asiatic Researches, vol i. p. 224.

inflection is that which the inflected ray makes with the line drawn parallel to the edge of the inflecting body, and the angle of incidence is that made by the ray before inflection, at the point where it meets the parallel, and so of the angle of deflection.

Proposition I. The force by which bodies inflect and deflect the rays acts in lines perpendicular to their surfaces.

Prop. II. The sines of inflection and deflection are each of them to the sine of incidence in a given ratio; (and what this ratio is, we shall afterwards shew).

Prop. III. The bending force is to the propelling force of light as the sine of the difference between the angles of inflection (or deflection) and incidence, to the cosine of the angle of inflection (or deflection).

Prop. IV. The rays of light may be made to revolve round a centre in a spiral orbit.

Prop. V. If the inflecting surface be of considerable extent, and a plane, then the curve described may be found by help of prop. 41, book 1, *Principia;* provided only, the proportion of the force to the distance be given. Thus, if the bending force be inversely as the distance, the curve cannot be found;

for in order to obtain its equation, a curvilinear area must be squared, which in this case is a conic hyperbola; the relation, however, between its ordinates and abscissæ may be obtained in fluxions, thus; $y\dot{y} + by = a^2\dot{x}^2$.

If the force (which is most probable) be inversely as the square of the distance, the curve to be squared is the cubic hyperbola; species 65, genus 3, of Newton's enumeration; and this being quadrable, the curve described by the light will be the *parabola camponiformis pura;* species 69 of Newton.

If the force be inversely as the cube of the distance, the curve is a circular arch, and that of deflection is a conic hyperbola.* If the inflecting body be a globe or cylinder, and the force be inversely as the square of the distance from the surface, then by prop. 71, book 1, *Principia,* the attraction to the centre is inversely as the square of the distance from that centre; and, therefore, by propp. 11 and 13 of the same book, the ray moves in an ellipse by the inflecting, and an hyperbola by the deflecting force, each having one focus in the centre of the body. The truth of these things mathematicians will easily determine.

* Principia, lib. i. prop. 8.

Prop. VI. If a ray fall on a specular surface, it will be bent before incidence into a curve, having two points of contrary flexure, and then will be bent back the contrary way into an equal and similar curve.

Corollary to these propositions. If a pencil of rays fall *converging* on an interposed body, the shadow will be less than the body by twice the sine of inflection.

And if a pencil fall diverging on the body, the shadow will be greater than the body by twice the sine of inflection; but less than it should be if the rays had passed without bending, by twice the sine of the difference between the angles of inflection and incidence. The sine or angle of incidence is greater than the sine or angle of inflection, when the incident rays make an acute angle with the body; but when they make an obtuse or right angle, then the sine or angle of inflection is less than that of incidence. The sine of incidence is greater than that of deflection, if the angle made by the incident ray with the body is obtuse, but less if that angle be acute or right. If a globe or circle be held in a beam of light, the rays may be made to converge to a focus.

Hitherto it has been supposed that the

parts of which light consists have all the same disposition to be acted upon by bodies which inflect and deflect them, but we shall now see that this is by no means the case.

Observation I. Into my darkened chamber I let a beam of the sun's light, through a hole in a metal plate (fixed in the window-shut) of $\frac{1}{40}$th of an inch diameter; and all other light being absorbed by black cloth hung before the window, and in the room, at the hole I placed a prism of glass, whose refracting angle was 45°, and which was covered all over with black paper, except a small part on each side, which was free from impurities, and through which the light was refracted, so as to form a distinct and tolerable homogeneous spectrum on a chart at six feet from the window. In the rays, at two feet from the prism, I placed a black unpolished pin, (whose diameter was every where $\frac{1}{10}$th of an inch,) parallel to the chart, and in a vertical position. Its shadow was formed in the spectrum on the chart, and had a considerable penumbra, especially in the brightest red, for it was by no means of the same thickness in all its parts; that in violet was broadest and most distinct; that in the red narrowest and most confused; and that in

the intermediate colours was of an intermediate thickness and degree of distinctness. It was not bounded by straight, but by curvilinear sides, convex towards the axis, to which they approached as to an asymptote, and that nearest in the least refrangible rays. Nor could this be owing to any irregularity in the pin, for the same thing happened in all sorts of bodies that were used; and also, if the prism was moved on its axis, so that the colours might ascend and descend on these bodies, still, wherever the red fell, it made the least, and the violet the greatest shadow.

Of Reflection.

That bodies reflect light by a repulsive power, extending to some distance from their surfaces, has never been denied since the time of Sir Isaac Newton.* Now this power extends to a distance much greater than that of apparent contact, at which an attraction again begins, still at a distance, though less than that at which before there was a repulsion; as will appear by the following demonstration, which occurs to me, and which is general with respect

* Optics, book ii. part 3, prop. 8.

to the theory of Boscovith.* Let the body A have for P an attraction, which, at the distance of AP, is proportional to PM; then let P move towards A, so as to come to the situation P′, and let the attraction here be P′M′; as it is continual during the motion of P to P′, MM′ is a curve line. Now, in the case of the attraction of bodies for light, and for one another, PM is less than P′M′, and consequently MM′ does not ever return into itself, and therefore it must go *ad infinitum*, having its arc between AB and AC, to which it approaches as a symptotes; the abscissa always representing the distance, and the ordinate the attraction at that distance: let P′ now continue its motion to P″, and M′ will move to M″, and if P″ meets A, or the bodies come into perfect contact, P″M″ will be infinite; so that the attraction being changed into cohesion, will be infinite, and the bodies inseparable, contrary to universal experience; so that P can never come nearer to A than a given distance. In the case of gravity, PM is inversely as the square of AP, so that the curve NMM‴ is the cubic hyperbola; but the demonstration holds, what-

* Nova Theoria Philosophiæ Naturalis.

ever be the proportion of the force to the distance. It appears, then, that flection, refraction, and reflection, are performed by a force acting at a definite distance; and it is reasonable to think, even *à priori*, that as this same force, in other circumstances, is exerted to a different degree on the different parts of light, in refracting, inflecting, and deflecting them, it should also be exercised with the like variations in reflecting them. Let us attend to the proof, which enables us to change conjecture into conviction.

Observation I. The sun shining into my darkened chamber through a small hole $\frac{1}{40}$th of an inch in diameter, I placed a pin of $\frac{1}{30}$th of an inch diameter in the cone of light, (one half inch from the hole) inclined to the rays at an angle of about 45°, and its shadow was received on a chart parallel to it, at the distance of two feet. The shadow was surrounded by the three fringes on each side, discovered by Grimaldo; beyond these there were two streaks of white light diverging from the shadow, and mottled with bright colours, very irregularly scattered up and down; but on using another pin, whose surface was well polished, and placing it nearer the hole than before, the

colours in the streaks became much brighter (and the streaks themselves narrower), being extended from one side to the other; so that, except in a very few points here and there, no white was now to be seen; and on moving the pin, the colours moved also. But they disappeared if the pin was deprived of its polish by being held in the flame of a candle, or if a roll of paper was used instead of the pin; also, they were much brighter in direct than in reflected light, and in the light of the sun at the focus of a lens, than in his direct unfracted light. Placing a piece of paper round the hole in the window-shut, I observed the colours continued there; and, inclining the chart to the point where they left off, I saw them continued on it, and then proceed as before to the shadow. If the pin was held horizontally, or nearly so, they were seen of a great size on the floor, the walls, and roof of the room, forming a large circle; and if the chart was laid horizontally, and the pin held between the hole and it, in a vertical position, the circle was seen on the chart, and became an oval, by inclining the pin a little to the horizon.

Observation II. Having produced a clear set of colours, as in the last observation, I

viewed them as attentively as possible, and found that they were divided into sets, sometimes separated by a gleam of white light, sometimes by a line of shadow, and sometimes contiguous, or even running a little into one another. They were spectra or images of the sun, for they varied with the luminous body by whose rays they were formed, and with the size of the beam in which the pin was held; and when, by placing it between my eye and the candle, a little to one side, I let the colours fall on my retina, I plainly saw that they resembled the candle in shape and size (though a little distended), and also in motion, since if the flame was blown upon, they had the like agitation. The colours, therefore, which fell on the chart were images of the sun; they had parallel sides pretty distinctly defined, but the ends were confused and semicircular, like those of the prismatic spectrum. Like it, too, they were oblong, and in some the length exceeded the breadth six, even eight times: the breadth was, as I found by measurement, exactly equal to that of the sun's image received on a chart, as far from the sun as the image was, and the length was always to the breadth, at all distances, in the same ratio, but not in all positions

of the pin: for if it was moved on its axis, the images moved towards the shadow on one side, and from it on the other, becoming longer and longer (the breadth remaining the same), the nearer they came to the shadow on the one side, and shorter in the same proportion, the farther they went from it on the other.

Having devoted so much space to these interesting, and, when we remember the age of the writer, wonderful experiments of the embryo Lord Chancellor, I must be more brief in my citations from Sir John Herschel than I had intended; but for the information of those who desire to prosecute the subject further, I can with confidence recommend that gentleman's excellent dissertation on Light in the "Encyclopædia Metropolitana."

After asserting that reflection of light is more copious at great obliquities, Sir John goes on to say:—"Hence we see that the proportion of the molecules of a ray falling on the surface of a medium in every possible state or phase of their fits, which undergo reflection, will depend, first, on the nature of the medium on whose surface they fall, or if it be the common surface of two, then on both; secondly,

on the angle of incidence. At great obliquities the reflection will be more copious; but even at the greatest, when the incident ray just grazes the surface, it by no means follows that every molecule, or even the greater part, must be reflected. Those which arrive in the most favourable phases of their fits of transmission, will obey the influence of small attractive forces, in preference to strong repulsive ones; but it will depend entirely on the nature of the media whether the former or the latter shall prevail; the fits in the Newtonian doctrine being conceived only to dispose the luminous molecules, other circumstances being favourable, to reflection or transmission, to exalt the forces which tend to produce the one, and to depress those which act in favour of the other, but not to determine, absolutely, its reflection or transmission under all circumstances.

"These conclusions are verified by experience. It is observed, that the reflection from the surfaces of transparent (or indeed any) media, becomes sensibly more copious as the angle of incidence increases; but at the external surface of a single medium is never total, or nearly total. In glass, for instance, even at extreme obliquities, a very large portion of the

light still enters the glass, and undergoes refraction. In opaque media, such as polished metals, the same holds good; the reflection increases in vividness as the incidence increases, but never becomes total, or nearly so. The only difference is, that here the portion which penetrates the surface is instantly absorbed and stifled.

"The phenomena which take place when light is reflected at the common surface of two media, are such as, from the above theory, we might be led to expect; with the addition, however, of some circumstances which lead us to limit the generality of our assumptions, and tend to establish a relation between the attractive and repulsive forces, to which the refraction and reflection of light are supposed to be owing. For it is found, that when two media are placed in perfect contact, (such as that of a fluid with a solid, or of two fluids with one another,) the intensity of reflection at their common surface is always less, the nearer the refractive indices of the media approach to equality; and when they are exactly equal, reflection ceases altogether, and the ray pursues its course in the second medium, unchanged either in direction, velocity, or intensity. It is

evident, from this fact, which is general, that the reflective or refractive forces, in all media of equal refractive densities, follow exactly the same laws, and are similarly related to one another; and that in media unequally refractive, the relation between the reflecting and refracting forces is not arbitrary, but that the one is dependent on the other, and increases and diminishes with it. This remarkable circumstance renders the supposition of the identity of form of the function Y, or φ (y) expressing the law of action of the molecules of all bodies on light indifferently, less improbable.

"To shew experimentally the phenomena in question, take a glass prism, or thin wedge, of very small refracting angle, (half a degree, for instance: almost any fragment of plate glass, indeed, will do, as it is seldom the two sides are parallel,) and placing it conveniently with the eye close to it, view the image of a candle reflected from the exterior of the face next the eye. This will be seen accompanied, at a little distance, by another image, reflected internally from the other face, and the two images will be nearly of equal brightness, if the incidence be not very great. Now, apply a

little water, or a wet finger, or, still better, any black substance wetted, to the posterior face, at the spot where the internal reflection takes place, and the second image will immediately lose great part of its brightness. If olive-oil be applied instead of water, the defalcation of light will be much greater; and if the substance applied be pitch, softened by heat, so as to make it adhere, the second image will be totally obliterated. On the other hand, if we apply substances of a higher refractive power than glass, the second image again appears. Thus, with oil of cassia it is considerably bright; with sulphur, it cannot be distinguished from that reflected at the first surface; and if we apply mercury, or amalgam (as in a silvered looking-glass), the reflection at the common surface of the glass and metal is much more vivid than that reflected from the glass alone."

I close these remarks and experiments on light by another interesting passage on the velocity of light, by the same celebrated philosopher and astronomer.

"Light requires time for its propagation. Two spectators at different distances from a luminous object suddenly disclosed, will not begin to see it at the same mathematical instant

of time. The nearer will see it sooner than the more remote; in the same way as two persons at unequal distances from a gun hear the report at different moments. In like manner, if a luminous object be suddenly extinguished, a spectator will continue to see it for a certain time afterwards, as if it still continued luminous, and this time will be greater the farther he is from it. The interval in question is, however, so excessively small in such distances as occur on the earth's surface, as to be absolutely insensible; but in the immense expanse of the celestial regions the case is different. The eclipses and emersions of Jupiter's satellites become visible much sooner (nearly a quarter of an hour) when the earth is at its least distance from Jupiter than when at its greatest. Light, then, takes time to travel over space. It has a finite though immense velocity, viz. 192,500 miles per second; and this important conclusion, deduced, by calculation, from the phenomenon just mentioned, and which, if it stood unsupported, might startle us with its vastness, and incline us to look out for some other mode of explanation, receives full confirmation from another astronomical phenomenon, viz. the aberration of light."

CHAPTER VI.

ON THE PRESERVATION OF SIGHT; AND ON THE USE, ABUSE, AND CHOICE OF SPECTACLES, &c.

My design in this chapter is to give in plain and easily understood language, some advice on the care necessary to be taken of the eyes, on the means of restoring their healthy action when impaired by over-exertion, and to offer some remarks on the use, abuse, and choice of spectacles.

In proportion to the expansion of the pupil of the eye, is the sensibility of the organ: the mean diameter of the pupil, though varying from one to two tenths of an inch in proportion to the brightness of objects, is reckoned to be commonly about one tenth of an inch.

When the light is too strong, or the object too bright, the pupil contracts, that it may intercept the excess of light, by which the eye

would otherwise be distressed: on the contrary, when the light is faint, the pupil expands, in order that a larger portion of it may be admitted by the eye, and thus a more powerful impression be made upon it.

Sudden changes from comparative darkness to strong light, and *vice versâ*, are highly improper: hence the eyes should be carefully guarded from the full effect of the morning sun on first awaking in summer; and the custom of breakfasting in the lightest room in the house, as is generally practised, is certainly weakening to the eyes, which ought to be accustomed by gentle transitions from one degree of light to another, till they can bear the effulgence of the sun's meridian splendour.

Rubbing the eyes on waking is a destructive habit which many people have contracted; for though healthy persons, whose sight is moderately used through the day, may not be sensible of receiving any injury from this custom; yet those whose occupations demand close application of their visual organs for any continued space of time, will soon be convinced by painful experience of the truth of this remark. Besides the daily injury thus done to the eyes, it sometimes also happens that hairs and other

foreign matters are forced into them by their being violently rubbed, which may occasion inflammation, and are frequently very troublesome to dislodge. The inflamed and weak eyes of many persons are likewise in a great measure to be attributed primarily to this most imprudent habit. Should, however, the eyelids be so fixed that a difficulty in opening them is felt, let them be moistened with a little warm milk and water for a few minutes, which, in all cases where the organ is healthy, will be found to answer the purpose in a manner such as they can have no idea of who have never tried this simple remedy.

The use of shades and bandages, on every trifling affection of the eye, is an evil that cannot be too strongly reprobated; for the action of light and air being thus excluded, and the organ rigidly compressed, ophthalmia, and even total blindness, is not infrequently the consequence of what, being perhaps merely a slight flow of humour, or a little extravasated blood, would have subsided in a few days, if judiciously treated, or even if left to itself.

Bathing the eyes occasionally during the day as well as on rising, is of much importance to their preservation: where the organ is

healthy, cool spring water should be preferred; but where there is reason to suspect any disease, people cannot be too careful, considering what a very delicate organ the eye is, in having professional advice before they adopt any remedial means. When the roads are dusty and the weather windy, bathing the eyes is so pleasant, and felt to be so necessary to comfort, that I need say nothing as to its salubrity, to induce its employment by those who have experienced the annoyance arising from dust in walking our streets in summer; but I have to remark, that care must be taken to be perfectly cool before bathing the eyes, because if the face be covered with perspiration, the application of cold water may be very dangerous.

The most frequent situation of counting-houses, and other places where business is carried on, in close and dark situations, is equally injurious to the sight and to the general health; for the latter is not more affected by confined and ill-ventilated rooms, than the former by dim and obscure ones, into which the light of day can hardly ever be said fairly to penetrate. It is therefore essential to the preservation of the sight in any degree of vi-

gour, that the apartments in which the greatest portion of our time is spent, and in which are carried on those occupations requiring a continued exertion of our eyes, be in a light and cheerful situation; for whoever neglects this advice will assuredly sooner or later feel the baneful effects of his temerity. Care should also be taken to avoid rooms whose windows face whitewashed walls, which reflect the rays of the sun so powerfully as in a short time sensibly to weaken the strongest sight, causing inflammations, and a train of other evils.

An excess of gilding, or indeed of any shining or white articles, in rooms, ought to be carefully avoided. Dress also, it cannot be doubted, exercises much influence on the visual organs; and many naturally good eyes have been permanently weakened by the apparently innocent custom of wearing a veil, the constant shifting of which affects the sight so prejudicially, in its ceaseless endeavours to adjust itself to the veil's vibrations, that I have known not a few young ladies who have brought on great visual debility by this means alone. Again, tight clothing is manifestly hurtful to the sight; too copious a flow of humours being thereby induced to the head; for it needs not

to be demonstated, that the effective state of the eyes, like every other part of the body, depends on a free circulation of blood, which cannot take place when the body is too straitly laced or buttoned.

Rigid cleanliness is a point of much importance as regards the sight of children especially; for it is well known, that though one powerful cause of inflammatory ophthalmia among the children of the poor consists in improper and innutritious diet, yet it cannot be denied that the putrid exhalations of the places in which many of them are doomed to live have a greater effect in producing diseases of the eyes, than even the deleterious and insufficient food which is the lot of but too many of our miserable fellow-creatures in this great and densely populated metropolis.

Costiveness, and whatever causes much straining at stool, is very injurious to the sight; as in such cases, the pressure on the intestines impels the blood with an unnatural rapidity to the head.

A due portion of sleep is as essential to enable the eyes to perform their office comfortably and effectively, as a due portion of rest is to enable the limbs wearied with toil,

or the mind with reasoning or other kind of exertion, to resume with alacrity their wonted offices. But sleep too long protracted, on the other hand, is perhaps hardly less destructive of accurate and healthy vision than when taken too sparingly; for as in the one case the organ is enfeebled by unremitting activity, without a proper degree of repose, so in the other case the eye, from unfrequent or insufficient exercise, becomes torpid and dull, and if inaction be persisted in, is at length unfitted for its functions.

Consequently, however strong and good our sight may be, it ought always to be moderately and carefully used; and to make it plain, what I consider the symptoms of its having been immoderately and carelessly used, I shall throw together a few remarks by which each may judge for himself of the nature of his own case.

If, in order to perceive objects distinctly, we are compelled to place them nearer to the eye than we have been accustomed, *i. e.* if the focus of sight or point of view begins closer to the eye than usual. If one desires, while employed or otherwise, to fix the eyes steadfastly on some distant object, and they begin involuntarily to emit aqueous humours. If

during labour or occupation, a painful contraction through the entire orbit of the eye be experienced, but which invariably disappears after a few minutes' rest, or shutting the eyelids now and then. If the employment be protracted, or require close mental application added to considerable visual tension, and the contraction just noticed is followed by heat in the eyelids, heaviness, difficulty of opening them, &c. If in young persons who are fair and sanguine, the borders of the eyelids become red, or thicker than when in health, and the blood-vessels turgid. If, in fine, we perceive motes floating before the eyes (called *muscæ volitantes*), and objects become so indistinct and ill defined as to oblige us to shut our eyes for a while;—then, in any of these cases, we may be certain that the sight has been overworked, and that relaxation is absolutely necessary to its recovery of a healthy tone. It is of the utmost consequence that these premonitory symptoms be carefully attended to, otherwise the eyes are in danger of being materially weakened ever after.

If, however, these symptoms are neglected, others of a more formidable character will not be long in making their appearance; the first

of which will be, that objects will seem as if encircled by a faint cloud or mist, the extremities of it being tinged with every variety of colour: after which, objects will begin to dance before the eyes, which are suddenly enveloped in great obscurity, and the objects themselves, at times seemingly raised, at others lowered, not unfrequently topsy-turvy, look as if they were floating at random. Now, though even this stage can hardly be called an actual disorder, being rather perhaps a kind of oscillation, as it were, between disease and health, yet if still unattended to, it may altogether ruin the sight for the rest of life.

A few simple remedies are, indeed, all that are required to restore the healthy functions of the organ in such cases; and these I shall briefly explain.

The first thing to be attended to, is a careful regulation of the use of the eyes in regard to length of time, as far as this is practicable: entire disuse of them suddenly would be almost as injurious as a continued straining of them beyond their capabilities. They should, therefore, be variously employed as much as this can be done, not applying them too long or too intently to the same object, but relieving

them by change of scene and diversity of occupation.

Another means that will be found to be beneficial, and to help the eyes where much relaxation cannot be obtained, consists in shuting them now and then while at work, going into the air, looking out at an open window, especially if there be any trees or verdure within sight: this interval of rest, though only of a few minutes' continuance, will be found greatly to relieve the eyes, and enable them to resume their employment with comparative pleasure.

A third caution is, that those who are conscious from experience that their sight has been weakened by its severe and protracted exercise, or arising from any other cause, should carefully avoid all attention to minute objects, or such business or study as requires close application of the visual faculty, immediately on rising; and the less it is taxed for a while after eating, or by candle-light, the better.

The fourth means I have already recommended, viz. bathing the eyes frequently through the day with cold water. Though the effect of this simple remedy may for a time be hardly perceptible, yet if duly persevered in,

I can vouch for its producing the happiest results. So long as there is no actual disease of the eyes, only cold water should be used; and this, applied in the gentlest manner, will soon become sufficiently tepid for all the ends of utility and comfort.

These several methods are of course referrible only to cases of weakness, &c. brought on by fatigue and over-exertion. But where no such causes can be assigned for imperfection of sight and pain in the organ, advice ought to be immediately sought; and on no account should any remedies be applied but under the direction of an experienced oculist.

The kind and degree of light in which an occupation is carried on, deserves some notice.

Whatever be the nature of the occupation, an equal degree of light should, if possible, be attained, and a happy medium observed—there should neither be too much nor too little, both being very destructive to the eyes. Some, however, seem to think that nothing can affect their sight; hence we find such persons, as a matter of choice, working opposite a wall white enough to reflect powerfully the sun's rays; never considering that this foolish conduct cannot fail to weaken their vision. I have, indeed,

frequently known this to be the cause of obstinate and dangerous inflammations, which, even after cured, left the eyes still so weak as to unfit them ever after for their accustomed duties.

A good and equal light being procured, the next remark I have to make is, that it is highly conducive to the comfort and durability of the eye, to vary frequently the position in which any employment is carried on; this being a very effectual way of preventing too great an influx of humours to the head. For example, the student and man of letters should be furnished with a high desk, at which he should stand to read or write, alternately with sitting. This, simple as it seems, if once fairly tried, would, I am confident, so strongly commend itself by its benefical influence not only on the sight, but on the general health, that they would not easily be induced to abandon the custom. To their constant habit of sitting, and seldom changing their position, there can be no reasonable doubt that very many of the complaints peculiar to literary men are owing.

That the colour of the eyes should affect their strength may seem strange; yet that such is the case need not at this time of day be

proved; and those whose eyes are brown or dark-coloured should be informed that they are weaker and more susceptible of injury from various causes than grey or blue eyes. Light-blue eyes are, *cæteris paribus*, generally the most powerful; and next to these are grey. The lighter the pupil, the greater and longer continued is the degree of tension the eye can sustain.

Within these few years past, screens and shades against the light have come very much into vogue for weak eyes; but I may observe that such artificial defences are only serviceable and proper for those whose eyes are very prominent, and who have very sparing eyelashes and eyebrows. To such as, from this cause, need some protection for their eyes, a green silk shade is the simplest as well as the best contrivance that can be used.

Reading by moonlight, or gazing steadfastly on the moon for any considerable length of time, is a common practice with many young people, but one which cannot be too strongly censured. Even total loss of sight has sometimes been the consequence of astronomers pursuing their observations of the moon for too long continued a period, without sufficient

intervals of repose; and in all cases the sight is more or less dimmed and weakened by exposure to such influence.

Some remarks on the care and use of the sight from infancy to age may with propriety be made here.

The eyes of infants should be gradually accustomed to exercise themselves in scrutinising distant objects; but this should be done in the most careful manner, without inducing them to strain their tender sight on such things as are too remote or dazzling for them to see without causing too forcible a contraction of their immature organs, which may lay the foundation of permanent and irremediable debility throughout life.

If these precautions are duly taken in infancy, and a proper regard be had in the use of the vision during youth, by not over-straining it, either by excessive reading at night, or any other practice likely to be detrimental, then even to old age the eyes will sustain a great deal of active labour without suffering from fatigue, and thus one of the most annoying of decaying nature's infirmities be kept at bay perhaps even till the hour of dissolution.

To eyes of all ages, and of whatever degree

of strength or weakness, there are of course certain periods in which they are more capable of undergoing exertion than at others; and of such periods doubtless the chief is the morning, when the body being refreshed and invigorated by sufficient repose is prepared for exertion; but excess of sleep is as injurious to the visual as to the mental faculties, and *est modus in rebus* is just as true of sleep as of food, drink, or any other of the bodily appetites. Yet, as I have before intimated, I by no means recommend close application of the sight in a glare of light immediately on rising, the contrast being too great; and it may be laid down as an axiom, that all violent and sudden contrasts are baneful to the eyes. Hence, when carried to the extreme, complete deprivation of sight has not unfrequently ensued, of which classical history furnishes numerous instances. To notice only one or two: Dionysius of Sicily, deservedly called the Tyrant, taxed his own ingenuity and that of those about him, to devise continually some new method of tormenting his victims; and among those which gave the greatest satisfaction to this monster in human shape was that of confining his wretched captives in dungeons of the deepest darkness till their sight was

almost lost from being unused, and then suddenly having them brought forth into the broad light of the meridian sun; the consequence of which, as may readily be supposed, was excruciating agony, followed by total blindness.

Equally barbarous, though perhaps admitting of some palliation, when it is considered how formidable an enemy to Africa their prisoner had been, was the treatment of Regulus by the Carthaginians: having cut off his eyelids, they exposed him in this deplorable condition to the direct rays of a tropical sun, by which he was very soon blinded.

But to return to my directions as to the best time for demanding unusual activity from the eyes, I remark, in the next place, that it will be well, whenever it can be accomplished, to give them rest for a while after eating, especially if our occupation oblige us to sit. The bad effects of an opposite line of conduct may be daily seen in the red faces, livid lips, and bloodshot eyes of those who either think intensely, or strain the sight soon after meals.

Again, after all employments that tend to inflame the passions, as pleading, preaching, lecturing, debating, &c. rest to the sight is

absolutely essential to its preservation in old age; for the blood being more heated than usual, and flowing to the head in excess, unfits the eyes for a time for exertion; and will, if persevered in, produce the most painful consequences, of which I might cite many cases, in every profession exposed to such influences.

The practice of turning the back towards the light for the purpose of seeing better to read or work, though frequently adopted by many persons, is extremely pernicious — the rays of light being too directly reflected; and in proportion as the paper or other object is whiter, the greater will be the injury.

I would here advise a plan which I have myself found to be of signal benefit both to the mind and the body, namely, that where it is necessary to employ the faculties in the evening in reading or writing, the latter should always be preferred, as being less exertion to the eyes, and more likely to be done effectually than reading at night.

Although what follows may perhaps be considered as belonging more strictly to the chapter on the treatment of diseases of the eye, yet as these remarks refer only to cases in which, for the most part, professional assistance is not

essential, they may, without impropriety, be introduced at this place.

Foreign bodies are often forced into the eye by various causes, such as a gust of wind, mending a pen, &c. &c. and here the method taken to remove such is generally wholly unsuited to that end. The eyelids are first rubbed with the hand, which always produces unpleasant sensations, and not unfrequently inflammation, the offending substance being in danger of being forced into the coats of the eye, whence it cannot, without considerable difficulty, be removed. On the contrary, let the head be leant forward, and the upper eyelid raised by the person suffering, who will be more gentle than another can be; and by this means he will commonly succeed in expelling it. The natural consequence of raising the eyelid, and retaining it in that position, is a flow of tears, which bring with them the intruding body, or carry it towards the canthus of the eye next the nose, whence it may be easily removed. Should this, however, be found ineffectual, the finger may be gently passed over the eyelid, towards the nose, a few times, which seldom fails to cause the substance to descend to the lachrymal glands, and thus be dislodged.

But should he still be unsuccessful, then it will be advisable to let another person introduce, between the eyelid and the ball, a small hair-pencil dipped in cream, beginning at the outer corner and proceeding towards the nose, which usually effects the desired intention. Further than this I would warn any unprofessional individual from going; as a serious lasting injury may be done to so delicate an organ before we are aware of it, and cause much painful reflection on ourselves afterwards.

As connected with the care of the eyes, what I am about to mention may perhaps properly be introduced here. It has lately become much the practice in this country, to *hire* both single and double opera-glasses at the theatres; and in doing so, it behoves persons to be particularly careful. Few organs are more sensitive than the eye, or more readily take on infection; and should the smallest particle of purulent matter from the eye of an individual afflicted with ophthalmia adhere to a borrowed glass, and come in contact with a healthy eye, the disease will almost invariably be communicated: in the same manner as a foul comb, used after a person having tinea capitis, induces the disease; and as many other diseases are communicated by touching the vestments,

&c. of those affected with them. I therefore earnestly caution my readers, either to have a glass of their own, or to be extremely particular in using one after another person.

I now come to the second part of this chapter, in which I purpose briefly to give some general advice on the use and choice of spectacles.

Most persons begin to feel the necessity for some assistance to their eyes in reading and working after the age of 30 or 35; though even the commencement and progress of the deterioration of the eyes vary according to the degree of health the individual has enjoyed, their original formation, the use that has been made of them, &c.; so that some persons have as much occasion for spectacles at 25 as others have at 50; and others, on the contrary, have as good sight at 50 as they had at 25. Still, the average time at which glasses are needed for reading, may be said to be from 35 to 45.*

* I extract, from Dr. Smith's valuable work on Optics, the following reasons why old persons cannot see to read or work without glasses; what is the cause of the indistinctness of their sight; and how convex glasses remedy the defect:—

"If the humours of the eye decay by old age, so as, by

After this latter period of life, the power of adjustment possessed by the eye in youth fails; and those who continue to perceive distant objects clearly, are unable to see plainly those which are near; and the man who can read the smallest print unfatigued without glasses, cannot distinguish any thing distinctly at the distance of ten yards.

shrinking, to make the cornea and coat of the crystalline humour grow flatter than before, the light will not be refracted enough, and for want of a sufficient refraction will not converge to the bottom of the eye, but to some place beyond it, and, by consequence, will paint in the bottom of the eye a confused picture; and according to the indistinctness of the picture, the object will appear confused. This is the reason of the decay of sight in old men, and shews why it is mended by spectacles; for the convex glasses supply the defect of plumpness in the eye, and, by increasing the refractions, make the rays converge sooner, so as to convene distinctly at the bottom of the eye, if the glass has a due degree of convexity.

"The contrary happens in short-sighted men, whose eyes are too plump; for the refraction being now too great, the rays converge and convene in these eyes before they come to the bottom, and therefore the picture made in the bottom, and the vision caused thereby, will not be distinct, unless the object be brought so near the eye, as that the place where the converging rays convene may be removed to the bottom, or that the plumpness of the eye be taken off, and the refraction diminished by a concave glass till it come to a due figure."

His late Majesty George the Fourth was always particularly careful of his eyes; and it is by no means improbable that the afflictive blindness of his revered father, during several of the closing years of his life, was often present to his mind, and was the main cause of his care in this respect. The spectacles he used for viewing distant objects were No. 6; for nearer objects No. 2; but it is very singular that for reading he wore only preservers of 36 inches focus.

Among the many vulgar errors that are daily injuring those who cherish them, few have done more injury to eyes than the notion that all persons of the same age require glasses of the same focus. Nothing can be more absurd; as well might the same remedies be applied indiscriminately for all diseases, provided the ages of the sufferers but tally!*

* "The proper selection of glasses for imperfect vision is a point of much deeper importance than is generally believed. An oculist who is acquainted only with the diseases of the human eye, without possessing any knowledge of it as an optical instrument, is often led professionally to recommend glasses when they ought not to be used, and to fix on focal lengths entirely unfit for the purpose to which they are applied; and the mere vender of lenses and spectacles is still more frequently in the habit of proffering his deleterious counsel."—BREWSTER *on Spectacles*.

The most general, and probably the best, direction which can be given to those who feel that glasses are necessary to enable them to use their eyes with comfort to themselves and advantage to their occupation, whatever that may be, is to make choice of such as represent objects nearest to their natural state; for to be exactly suitable to the eye, spectacles ought neither to magnify nor minify, but should enable us to read or work without creating any straining or unnatural exercise of the pupil.

The great design of spectacles is to give the eyes of the wearer ease; and although this is also attended by increased power of application, yet no glasses can be said to be properly accommodated to the sight of the individual which do not, with additional capability, also procure rest and comfort for the eyes. If they weary them, we may conclude, either that we have no occasion for any, or that those we have are improper for us, or defectively made.

Glasses are of two kinds—*convex* and *concave:* convex glasses are for the use of those who have what is commonly called an old, or long, sight, and are unable to read or see small objects near them; concave glasses are for the use of those who are short-sighted, to enable

them to see distinctly objects at the same distance at which they were able to perceive them before they became short-sighted.*

By the aid of convex glasses of 36 or 30 inches focus, persons whose sight is beginning to be unequal to read small print, or to work, without fatiguing and paining their eyes, will be enabled to do either; and, if properly chosen, by the ease and comfort they afford, will tend materially to preserve the sight: hence their name of *preservers*, which, however, is a term as applicable to all the various gradations of

* "When the eye (says Dr. Young) is possessed of too great refractive power for the distinct perception of distant objects, the pupil is generally large, so that the confusion of the image is somewhat lessened by partially closing the eyelids; and from this habit an eye so formed is called myopic. In such cases, by the help of a concave lens, the divergence of the rays of light may be increased, and a virtual image may be formed, at a distance, so much smaller than that of the object as to afford perfect vision. For a long-sighted or presbyopic eye, on the contrary, a convex lens is required, in order to obtain a virtual image at a greater distance than the object; and it often happens that the rays must be made not only to diverge less than before, but even to converge towards a focus behind such an eye, in order to make its vision distinct. Presbyopic persons have in general a small pupil, and, therefore, seldom acquire the habit of covering any part of it with their eyelids."

glasses. The length of time that will elapse before it may be necessary to change these first spectacles, must depend upon the same circumstances which I have mentioned as creating the necessity for using them at all. However, it may be said that they will commonly serve for reading, in the day-time, about six or seven years.

As soon as the eye begins to do little better with the glasses used than without them, it is time to change them for more powerful magnifiers, and the second sight, or 30 inches focus, are necessary; though these should not be too hastily adopted by those who wish to preserve their sight unimpaired to old age; but they should be content to use them as sparingly as possible—only when unavoidable. Many have worn out their sight prematurely by using spectacles of too great a magnifying power, or of improper materials and faulty workmanship, to which their eyes have soon become accustomed; but they speedily exhausted the resources of art, and before death have become totally blind.

Those who are about to commence wearing glasses, as they cannot know what will suit their eyes, will do well to borrow a set of glasses, consisting of spectacles of regular gra-

dations of power, and try at home for a few days which best suits them: they should make the experiment by daylight and candle-light, in that posture of the body in which they will be most used.

Almost all persons, on first wearing spectacles, if they keep them on for a few hours, complain of fatigue and uneasy sensations in their eyes; and this, even though they have been judiciously chosen, and when they were needful. Such weariness will be most felt by candle-light; and is caused, no doubt, by the eyes for some time before resorting to glasses having been tasked beyond their ability; and not, as is commonly supposed, by the artificial light, though that probably contributes to it.

Those whose avocations or amusements render the assistance of magnifiers necessary, ought to bear in mind, that the lower the degree of magnifying power possessed by their glasses, the less the eye will be fatigued by them, the less constrained the position of the body in using them, and the larger as well as more uniformly distinct the field of view embraced by them. Where only a moderate magnifying power is required, I would recommend, instead of a single magnifier, the use of spec-

tacles of nine inches focus, which will enable the eye to be directed to minute objects without weariness for a longer time than if an eye-glass only be used, as well as being of material benefit in preserving one of the eyes from becoming injured by being constantly unemployed.

The glasses called *compound magnifiers*, consisting of two plano-convexes with their plane sides outwards, as they have a large and distinct field of vision, are very agreeable and useful to some persons. I believe it is known only to very few how long ago this peculiar construction of an eye-glass has been invented; but I find it stated in the Philosophical Transactions for 1668 (vol. iii. p. 842), that one Eustachio Divini made a microscope with two plano-convex glasses so placed that they touch in the middle of their convex surface; and the writer says that the instrument has the peculiarity of shewing objects flat, not crooked; although, he adds, "it takes in much, yet magnifieth extraordinarily."

Short-sighted people, as I have mentioned above, require *concave* glasses. The late Mr. Jesse Ramsden used to make the first number of his concaves equivalent to a convex of twenty-four inches focus, (that is, he joined a

convex of this focal length to a No. 1 concave); the combination of which forms a plane, through which objects appear neither magnified nor diminished, but just the natural size. This is now the common practice of opticians.*

The use of spectacles is every way preferable for short-sighted persons to single eye-glasses; a strong confirmation of the truth of which may be found in the fact that Mr. George Adams, a late highly-celebrated optician, asserted that he did not recollect an instance of a short-sighted person who had occasion to increase the depth of his glasses, if he began with spectacles: but, on the other hand, he knew many cases where only one eye had been used, in which the individuals had been obliged repeatedly to change their glasses for concaves of higher power. Indeed, the advan-

* "A new kind of spectacles, called *periscopic*, were introduced some years ago by Dr. Wollaston, who secured the privilege of the invention by a patent. Their principal object, as their name denotes" (*περὶ around, σκοπέω to view*) "is to give a wider field of vision than those of the common kind; and they derive their property from always having the surface next the eye *concave*, whether the glasses are intended for short- or long-sighted persons, the convexity of the outer surface being less deep than the concavity of the inner one for short-sighted persons, and more deep for long-sighted persons."—BREWSTER.

tage of a pair of spectacles over an eyeglass is very evident, from the circumstance that all objects are much brighter when seen with both eyes than when looked at with one only.

Little can be said in the way of advice as to the choice of spectacles for those who are shortsighted; the defect being totally unconnected with age, and making no regular progress, by which an optician might be guided in his recommendation of one focus rather than another. It rests entirely with the persons who feel their need of assistance; but I would strenuously advise all such to be satisfied with glasses as slightly concave as possible: by which I mean, that they should employ no higher power than is necessary to enable them to see distinctly objects at from forty to fifty feet distance. This will be found amply sufficient for all ordinary purposes; and when it is desirable on any extraordinary occasion to increase for a time this power, it may be done with pleasure and without injury.

Near-sightedness remains nearly the same through life; and few who have chosen their first concaves judiciously have occasion to change them even in old age, the same glass continuing to give the very same degree of help which it did in early manhood.

To see very distant objects, many persons are in the habit of looking through a concave eyeglass placed obliquely; but a small opera-glass, from its having an adjustable focus, though it magnify only twice, will be far better than a single concave, in consequence of the facility with which it can be adapted to various distances.

It is perhaps hardly worth while to notice a commonly received vulgar error in respect to short-sighted persons, viz. that their sight is stronger and better to advanced age than the common sight: nothing can be more erroneous than such an idea.

Much has been written respecting the superiority of pebbles over glasses; but their actual superiority consists only in this, that they are much less liable to be broken or scratched, and so may be carried in the pocket without a case; for which convenience they cost above four times as much as glasses. It is, indeed, impossible to point out any difference between good pebbles and good glasses.

It will probably be expected that I should here say what opinion I entertain of the amber spectacles. These have been recommended by several oculists, and my patronage has been

solicited for them. But surely those gentlemen who have given them their sanction cannot have remembered that amber is comparatively a soft substance, consequently very liable to become scratched, and that the polish is easily worn off. They are also much more expensive than even pebbles, and, as it appears to me, possess no one advantage corresponding with their cost. For these reasons I entirely differ from those who have thought them preferable to glass.*

I have not thought it necessary to notice *squinting* among diseases of the eye, the cure for it being of a purely mechanical nature. The best contrivances of this kind with which I am acquainted, are spectacle-frames fitted with convex horn, having a small aperture only large enough to admit light to the centre of the pupil, by which means the squinter, if he wishes to see at all, is obliged to accustom himself to look straight forward.

To persons of weak eyes, and to those who

* Mr. Dollond, Optician to his Majesty, and Fellow of the Royal Society, informs me that he considers amber a very improper material for spectacles, on account of its colour, its not being homogeneous, its liability to scratch, and its being also impossible to form it into a perfect lens.

have been in the habit of using goggles for riding, driving, or walking, I would recommend the gauze spectacles, on account of their being much cooler; and as a protection against the wind, dust, and sun, they will be found very serviceable and agreeable.

To enlarge more on the subject of optics would be unsuited to the main object of this work; and therefore, for the information of those who are desirous of further pursuing it, I have much pleasure in giving a short list of some of the works I have found most useful in the course of my own study of the theory of vision as connected with spectacles, opera-glasses, telescopes, &c. &c.

Fabricius ab Aquapendente de Visione; De Dominis de Radiis Visûs et Lucis; Traver Nervus Opticus; Berkeley's Theory of Vision; Dr. Smith's Complete System of Optics; Dr. Herschel and Sir John Herschel on Light, &c.; Porterfield on the Eye and on Vision; Dr. Young's Lectures on Vision; Dr. Kitchiner's Economy of the Eyes; Sir Isaac Newton on Optics; Dr. Brewster on Spectacles; Adams on Vision; the Philosophical Transactions of the Royal Society; &c. &c.

CONCLUSION.

HAVING accomplished the objects I had in view in undertaking this work, viz. given a systematic description of the physiology of the eye, detailed the symptoms and mode of cure of its principal diseases, devoted a chapter to light and experiments relating to it, and also one to the care of the eyes and on spectacles,—all that remains is to add here some remarks which either could not have been appropriately introduced elsewhere, or such as have been inadvertently omitted.

And first of the ganglia. The great sympathetic nerve, and its various ganglia, exert an influence over all the organs of the body, but more particularly over those of sight and hearing; and as these ganglia are affected in disorders of the digestive functions, I have endeavoured to trace diseases of the eye and ear to this source. I have not yet given a description

of the semi-lunar ganglion and solar plexus, not having had an opportunity of again examining them till after the physiology was put to press. I have since, however, been enabled to do so, in the dissecting-room of the King's College, where, in the presence of Mr. Partridge, the excellent Demonstrator of Anatomy, I carefully examined these important ganglia, dividing with a scalpel the semi-lunar ganglion and the solar and cœliac plexuses: and as a right understanding of the structure and functions of these ganglia is essential to a knowledge of their influence upon the eye and ear, and on nervous disorders generally, I shall here give a more particular account of them.

The semi-lunar ganglion and solar plexus are placed on the base of the pillars of the diaphragm, one on each side; the right being generally larger than the left. Nothing is more variable than the form of these ganglia: however, notwithstanding their irregularities of form, at least a part of the enlargement, if not the whole, is always seen to receive a bend, the convexity of which is inferior and external. It is generally by this side that it receives the great splanchnic nerve. Sometimes this last nerve is united to the ganglion by its posterior face. The two semi-lunar ganglia communicate

together in front of the aorta, either immediately by their internal extremity, or by means of some large branches, upon which are often seen intermediate principal enlargements. Anteriorly, these ganglia are in relation on the right with the vena cava inferior, the lobe of Spigelius, the superior part of the supra-renal capsule, and the great gastro-hepatic epiploon; on the left, with the same capsule, the great end of the stomach, and the extremity of the pancreas. From the periphery of the two semi-lunar ganglia spring a multitude of branches, which frequently anastomose with each other, to constitute the solar plexus; the latter is placed before the aorta, the origin of the cœliac and superior mesenteric arteries, and the correspondent part of the pillars of the diaphragm; in front it is covered by the stomach and the gastro-hepatic epiploon. The branches composing this plexus often present enlargements, which are so many small ganglia, some of which occasionally attain a considerable size. From the great solar plexus spring as many secondary plexuses as the abdominal aorta gives off branches from its anterior and lateral sides. There is consequently a cœliac, a superior mesenteric, a diaphragmatic, a capsular, a renal, a spermatic, and an inferior mesenteric

plexus, which accompany the mesenteric and cœliac arteries, &c.

And next of more miscellaneous matters. Although I have before mentioned the necessity of attending to diseases in their incipient stages, yet I would here again press on my readers the importance of this fact; since the majority of diseases, if treated in time, that is, before change of structure has supervened, can be either cured or materially relieved; while if neglected, even trifling maladies often become formidable, and not unfrequently prove fatal.

In treating of diseases of the eye, I have remarked that staphyloma, arthritic iritis, and cancer, when confirmed, do not, at least with the means we at present possess, admit of cure; but that ophthalmia, cataract, amaurosis, and many other diseases of the eye, are within our reach. Some practitioners, however, contend that there is no cure for a *true* cataract except by an operation; at the same time admitting that the *spurious* may be cured. Now I humbly conceive it can be a matter of very little importance to the sufferer (provided he is cured without the pain and danger of an operation) to be told, when he is quite well,

that his disease was only spurious. With regard to amaurosis, it has also by some been considered as incurable, though much light has lately been thrown on it by our own and by continental practitioners; and when we remember the numerous causes which give rise to this disease, and the pain and inconvenience it produces, it obviously deserves particular attention.

The science of optics seems to have gained ground in this country, in proportion as acoustics has been neglected; for, perhaps, in no country in Europe have spectacles, reading-glasses, &c. been more correctly and better made: a proof of which is, that most foreigners who require glasses are said to procure them when in England. On the other hand, truth compels me to add, that while we make the best glasses, we also make many of the very worst; so that spectacles formed of common window-glass, polished only on one side, are hawked about at low prices, by which the eyes of the poorer classes are frequently more injured than in any other way.

To the subject of acoustics I have paid much attention, and have contrived many artificial means for the assistance of the deaf. Among these, the chief is my Acoustic Chair, constructed on the principle of the Invisible

Girl; and a person while sitting in it perfectly at ease, by means of pipes branching from the chair into the apartment or apartments whence it is desired to collect the conversation, &c. can hear distinctly whatever transpires. In fact, the principle is susceptible of being so much extended, that sound can in this way be conveyed for the distance of two or three miles, if the necessary length of pipe be connected with the barrel of sound, which possesses amazing capabilities.* A model of this chair may be seen at the National Gallery of Practical Science in Adelaide Street.

Many old practitioners were fond of using herbs in the treatment of diseases of the eye: indeed, my own father, who was a physician, and my uncle the late Mr. William Curtis, the celebrated botanist,† who instituted the herbarizing at Apothecaries' Hall, as well as their grandfather, John Curtis, formerly a surgeon at Alton in Hampshire, all held plants in great estimation as external applications in diseases of the eye; the best of them are —

* For an account of this chair, see my Treatise on the Ear; and for evidences of its value and merits, see the Literary Gazette, Mechanics' Magazine, &c.

† Author of the Botanical Magazine, Flora Londinensis, &c.

garden angelica, betony, land caltrop, centaury, charlock, eyebright, garden fennel, scented flag, garden flax, germander, goutwort, wild barley, hemlock, and herb frankincense. For myself, I cannot speak as to their efficacy, never having tried them; but as they are all easily to be procured, they deserve attention. It appears that they were once fashionable, our forefathers considering the eye as a more delicate organ than their descendants appear to do; for, having abandoned herbs, we took to minerals, and now nothing is in vogue but the knife. Hence it is not improbable, that herbs may again, at some future day, be extensively employed in curing diseases of the eye.

By modern surgeons, however, the idea of the eye being so very tender an organ, is little regarded; they say it is wonderful what it can bear; and indeed, to see some of them operate upon it, one might fancy they were cutting a cork!

I shall now give a few of the cases which have come under my own observation, as illustrative of the mode of treatment I have recommended; and that they may be the more easily understood, I have made them as plain and at the same time as concise as possible.

CASES.

CASE I.

Miss N. a young lady of delicate frame, in consequence of the sudden death of her mother was seized with an apoplectic fit: after her recovery, it was perceived that her vision was nearly extinct. As she complained of much pain in the head, I took some blood from behind the ears, and applied a blister to the nape of the neck, which was kept open for three weeks; the bowels were evacuated, and she made use of the pediluvium. It is a singular fact, that before this attack she was frequently so deaf as to be obliged to use a trumpet. She has now quite recovered her health, with the assistance of the cascarilla bark joined with calumba: her sight and hearing are also perfectly restored.

CASE II.

Mr. D. applied to me, being troubled with extreme deafness, which he had had for upwards of four years; his sight was also much affected. He complained of violent pains in his head, especially at night, attended with tinnitus aurium; his digestive functions at the same time being deranged. I commenced my treatment by ordering eight ounces of blood to be taken from between the shoulders, and small blisters to be applied behind the ears, which were kept open for a fortnight; some aperient medicines were also taken, and afterwards the compound galbanum pill joined with the aloetic pill and myrrh. He completely recovered both his sight and hearing.

CASE III.

Lord H. accompanied by his physician, called on me, and stated that he had been suffering for some time from violent pains in his head; was very deaf, and exceedingly nervous; his eyesight being also much affected. By pursuing the same treatment as in the

former case, his lordship perfectly recovered his health, as well as his sight and hearing.

CASE IV.

Mr. A. had likewise suffered much for nearly ten years, at different times: he was very deaf, and laboured under a puriform discharge from both ears; he was also troubled with epiphora. Blisters were applied behind the ears, and kept open a short time. I ordered him a solution of the sulphate of zinc, in the proportion of a scruple to six ounces of water, which suppressed the discharge. Unknown to me, however, he applied the lotion to his eyes; the result of which was, that the diseases of both organs were cured.

CASE V.

The Rev. T. G. was attacked with a violent ophthalmia of both eyes, attended with defective vision. A purulent discharge came on rapidly, conjoined with a redness in the corners of the eyelids. The evening before the discharge took place, the palpebræ were closed and tumid. The humour was very fœtid.

After giving him some aperients, joined with small doses of the hydrarg. submuriat. I ordered a fomentation of poppy-heads, the parts being greatly swollen. As he did not experience much relief, I scarified the conjunctiva of the eyelids with a broad-pointed lancet, which reduced the tumefaction. But my patient not getting well, I was induced to apply blisters behind the ears, which were kept open for three weeks, when the discharge was suppressed, and the inflammation considerably diminished. By attending to his diet, being rather a free liver, as well as to the state of his bowels, and by the use of a collyrium, with the wine of opium, (one of the best applications in this complaint,) he completely recovered his health and eyesight.

CASE VI.

George Williams, servant to a gentleman, in travelling from Edinburgh outside a coach caught a severe cold, attended with a violent ophthalmia, which lasted three months. When I first saw him he was quite blind. He had taken aperients and large doses of calomel, besides being leeched and cupped on the temples;

but without obtaining any relief. I ordered him a blister behind each ear, which was kept open a fortnight; the eyes to be washed with a sedative lotion; and gave him small doses of antimonials. The blisters behind the ears had not been applied three days before he was able to see the articles in the room; and in less than a month he completely recovered his sight, and was quite well.

CASE VII.

Mr. L. laboured under acute inflammation of the left eye. The pupil was contracted, and rendered opaque by a deposition of lymph. Blisters were applied behind the ears, and the antiphlogistic plan adopted, joined with gentle aperients. In the course of a fortnight the pupil was considerably enlarged and oval, and the lymph occupying the aperture was nearly absorbed. The iris, however, remained fixed by adhesions, and the pupil did not vary. By the means above prescribed, and using a sedative lotion, with aq. ammon. acet. and wine of opium, he recovered his sight perfectly.

CASE VIII.

Miss D. a young lady from Dublin, whose sister I had formerly attended for an affection of the ear, consulted me on account of an acute inflammation of the iris. The pupil being much contracted from the deposition of lymph, the eye was incapable of sight. Being of a plethoric habit, some blood was taken from behind the ears by leeches, which was repeated three or four times in the course of ten days; as I find repeated small bleedings answer much better, especially with women, than a larger quantity taken away at one time. After the inflammation had subsided, I applied the solution of the lapis infernalis to the part for a few days, when she completely recovered her sight.

CASE IX.

Mr. W. gradually, and without any pain or apparent disease, lost the sight of his left eye. About a year after, he was attacked with excruciating pains in that eye, and on the same side of the head. From this time he became subject to occasional ophthalmia, for which he had consulted several of the profession. He had

been blistered on the temples, had the temporal artery opened, and had, at various times, been copiously bled from the arm. He had also taken large doses of calomel, and had the belladonna repeatedly applied to his eye; but without obtaining any relief. As the other eye became affected, he was desirous of my advice. I began by applying a seton to the nape of the neck, administering mild cathartics, and occasionally touching the cornea, as there appeared a small unsightly speck on it, with a weak solution of potass with lime. In the course of a few weeks the speck disappeared; and in little more than a month his sight was perfectly restored.

CASE X.

Mr. E. a barrister in the Temple, consulted me, in consequence of becoming blind of one eye. In this instance a purulent ophthalmia, which had been very severe, terminated some time before I saw him. The pupil was contracted, irregular, and opaque. A blister was applied behind the ear, and kept open for a few weeks with the savine cerate; a brisk cathartic

was also given occasionally. The solution was applied as in the former case; and in the course of ten days the pupil became less irregular, having assumed an oval form, and being become tolerably clear. By continuing the use of the solution, and at the same time increasing its strength, for three weeks, he can now see to read with this eye, and is not troubled with any pain or inconvenience, which before he was not unfrequently subjected to.

Much irremediable injury is often done to the eyes by the use of strong collyriums. In many instances I have found that a little milk and water, or a few drops of vinegar or brandy in a glass of spring water, has been all the external application necessary in cases of ophthalmia; but I beg to observe, that great care should be taken to have them fresh mixed every time they are used.

CASE XI.

Mrs. P. having caught cold one evening after leaving the Opera last summer, was seized with a violent ophthalmia, which lasted

three months, at the expiration of which time opacity of the cornea ensued in the right eye, which not only made her completely blind, but what annoyed her still more was its being very unsightly. On examination, I found that it was a true cataract, although it had much the appearance of amaurosis. She had taken the advice of one or two oculists before coming to me; but it seemed they were not agreed about the removal of the cataract, as, from the pain and anxiety she had suffered, and her dread of an operation, her health was considerably impaired. When I saw her, I made her mind easy, by telling her I would endeavour to dissipate the cataract without an operation, by means of the solution of potassa cum calce, to which she readily submitted. By occasionally touching it with the solution, and by the hope and confidence I had inspired, her spirits improved, and she is now quite well.

CASE XII.

Mr. G. having received a blow from a cricket-ball last summer, when in the neighbourhood of Bristol, which caused a cataract

in his left eye, came to town for the purpose of having advice; but as he was very averse to an operation, (his uncle having died in consequence of an unsuccessful one, performed on him some years since), he felt anxious to try remedial means. When I first saw him, I did not give him much hope of cure; at the same time, as it was only in one eye, and as he saw remarkably well with the other, I declined performing the operation, although he was willing that I should attempt it, if I thought it advisable. I began by ordering blisters to be applied behind the ear, and kept gently open for a few weeks, occasionally giving him a mild alterative and aperient: as he had no pain in any part of the eye, no lotions were applied. I touched the centre of the cataract every morning for a short time with a camel-hair brush dipped in a solution of potassa cum calce; and in the space of a few weeks he was quite well.

CASE XIII.

Miss L., a child four years of age, was the subject of cataract. Her mother, who brought

her to me, said she had had the measles when only two years old, since which time her sight had been very imperfect; though it was not until lately she observed that the child was quite blind. As she was a robust and healthy girl, I gave her a cathartic medicine, composed of rhubarb joined with the sulphate of kali, which appeared to abate the inflammation about the vessels of the eyes; the cataracts were touched with the potassa cum calce twice a week for some time, which dissipated them; and she is now able to see well.

CASE XIV.

Master C., aged nine years, was observed when an infant to labour under imperfection of sight; but it was not until he attained his seventh year, that his father suspected any positive disease to exist in his eyes. On examining him thoroughly, by means of a magnifying glass, I discovered that he had two true cataracts; and as he was a healthy boy, and just from the country, I considered him a fit subject for my new discovery. I therefore, without delay, (as his father gave me the entire

management of him), begun with the solution of potassa cum calce, with the view of dissipating them. I have so far succeeded during fourteen days, that after leaving my house he is able to see any articles exposed for sale at the Bazaar, and by the use of cataract glasses can play at marbles, &c. This youth is still under my care, and I have little doubt of effecting a complete cure.

CASE XV.

Mr. T. applied to me with a cataract of many years' standing. Only one eye was affected; with the other he saw remarkably well. I therefore, in consequence of the disease being confirmed, and as his sight in the other eye was good, dissuaded him from undergoing an operation, the result of which would have been doubtful, and might probably have injured the sound eye. But as the cataract was very unsightly, I touched it with a solution of the lapis infernalis, to remove the protruding portion of the speck; and advised him, while in company, to endeavour to sit with his back to the light, when his defect could not be noticed.

I insert this case in confirmation of the plan I always pursue in such instances: namely, never to attempt an operation on one eye where the other is perfectly sound, as the danger is that both may be lost by so doing.

CASE XVI.

Sir G. L. applied to me, affected with amaurosis. His sight was not only very much impaired, but his general health was greatly out of order. He complained of severe pain and noise in his head, was very restless at night, had great depression of spirits, together with flatulency of stomach and bowels, acid eructations, costiveness, great nervous debility, and emaciation. After his bowels had been well operated upon by cathartics, and he had taken a gentle emetic of ipecacuanha joined with a grain of tartar emetic, I was induced, as he had had much professional advice, to try the pills recommended by Richter. (See page 134 of this Treatise.) I am happy to say that I was not disappointed in their effect; for Sir George, after continuing the pills regularly for a month, perfectly recovered his sight, together with health and spirits.

A short time since, an old general officer similarly affected, only that he was deaf, instead of blind, applied to me, having previously consulted several practitioners without avail. I was induced to try the same remedies, which I did with the happiest results, his health and hearing being quite restored. In both cases no external application was made use of, either to the eye or ear.

I introduce these two cases to confirm what I have already stated respecting the connexion of the nerves of the organs of sight and hearing; and to shew in how remarkable a manner the same medicines removed the maladies of both organs.

CASE XVII.

Captain N., who from insolation in the East Indies became amaurotic, and could see very little, was obliged to return home on leave of absence. He applied to me, as I had attended him some years before for a nervous deafness, of which I completely relieved him. I treated his blindness precisely as I had formerly done his deafness, namely, by applying blisters behind the ears, and keeping them gently open

for a short time: he also took twice a day some pills composed of the compound galbanum pill joined with a small portion of aloes and myrrh. The only application to the eyes was lukewarm water. He completely recovered his sight in six weeks.

CASE XVIII.

Lady R. having caught cold, in consequence of going out too soon after her confinement with her first child, was seized with amaurosis, attended with muscæ volitantes: both eyes were affected. Leeches and blisters were applied with some success; the pediluvium, and compound galbanum pills joined with aloes and myrrh, were likewise had recourse to; but her ladyship did not recover until after some weeks, when she took the decoction of cinchona combined with quinine. Country air and gentle exercise were also recommended with very beneficial effects; and her ladyship's health and sight are now perfectly restored.

CASE XIX.

Mrs. D. the wife of a major in the army, a healthy young woman, of a good constitution, was brought to bed with a fine child, which she undertook to suckle herself: this she did for six weeks without experiencing any inconvenience, at the end of which time she was seized with amaurosis, attended with debility. When I first saw her, I recommended her to have a wet-nurse for the child. This she was very reluctant to do, saying, that her mother having suckled all her own children, she wished to do the same; but as she appeared to get worse instead of better, she was induced, by the advice of her physician as well as myself, to obtain a nurse for the child; when by the treatment before detailed, she completely recovered.

I ought to observe, that when I first saw this lady, I could hardly distinguish her case from cataract, of which it had every appearance: her brother had also had a cataract. In general, the blindness produced by amaurosis is preceded by imaginary appearances of numerous insects, or substances like pieces of cobweb, interposing themselves betwixt objects

and the eye: the origin of a cataract, on the other hand, is usually attended merely with a cloudiness of vision.

CASE XX.

Mr. R. applied to me with ophthalmia, attended with the secondary symptoms of syphilis, which he had had for some time. His eyes were exceedingly red and painful, and very troublesome at night, disturbing his rest. He had taken advice, but had not followed it. When I last saw him, he was very uneasy; but I told him, unless he would conform to my instructions, I must decline attending him, as he had before consulted me, and neglected to comply with my advice. He promised to do as I wished; and I therefore ordered him the compound decoction of sarsaparilla joined with nitrous acid, and at night a small dose of calcined mercury with opium; occasionally using a collyrium with the aqua ammon. acet. combined with the wine of opium and rose-water. By pursuing these means for a short time, he completely recovered.

CASE XXI.

Mr. N. a principal clerk in a banking-house in the city, in consequence of great application to the balancing of the accounts at Christmas, which engaged his whole attention, was suddenly seized with vertigo and headach, together with great dimness of sight, and a sense of fulness in the abdomen. By the advice of one of the firm, he was cupped between the shoulders, losing about twelve ounces of blood. On his return home, his medical attendant advised some aperient medicine, repeated the bleeding by cupping, and opened the temporal artery. He did not, however, experience any change of symptoms that evening; but on the following morning the pupils were considerably dilated, and almost immovable to the strongest light, his sight being nearly gone. His wife, whom I had formerly attended, came to me in great distress, wishing me to go and see him, which I did as soon as I conveniently could. I found him exceedingly low, in consequence of the great loss of blood; and as his bowels had been well acted on, I gave him a little warm wine and water; ordering him a saline mixture, with small doses of tartarised

antimony in it. The next day he was better. The pupil of the right eye appeared a little movable to a bright light, but the left remained as before. The headach was considerably relieved, as well as the sense of weight in the region of the stomach. In a few days he was much better, the pupils of both eyes having contracted a little; and to his great delight, he was able to discern large objects. As he was still very weak, I ordered him a nourishing diet. In the course of ten days I discontinued the saline mixture, and prescribed a decoction of bark with valerian, which he took for a fortnight, when he appeared so much better that he was desirous of returning to the banking-house. However, I considered it more prudent, (although I had much difficulty in persuading him,) to go to the sea-side for a short time, which he did, and returned quite well.

I insert this case to shew, that under no circumstances should very large quantities of blood be taken away at one time. Indeed, I have never seen any good result from it, but often irremediable mischief. In amaurosis, as in nervous deafness, the best plan is to abstain from every thing that has a tendency to weaken the nervous system, and consequently the hearing and eyesight.

Before parting with the reader, I would observe, that my object in pursuing this line of practice, and publishing this work, is to prove, that in diseases of the eye the best results may be expected from mild means, if employed in time; and to shew that a very large portion of the operations now performed on this organ are not only unnecessary, but are in fact injurious and destructive of the end for which they are undergone. Indeed, Professor Thomson of Edinburgh, and the late Mr. Abernethy, have both affirmed, that the triumph of surgery is to cure *without* an operation. Let us therefore hope that a milder system will ere long obtain; and that the constitutional mode of treatment—a trial of which I so earnestly recommend—will be more successful than the severe and dangerous one of operations has hitherto been, or, in the nature of things, seems ever likely to be.

THE END.

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