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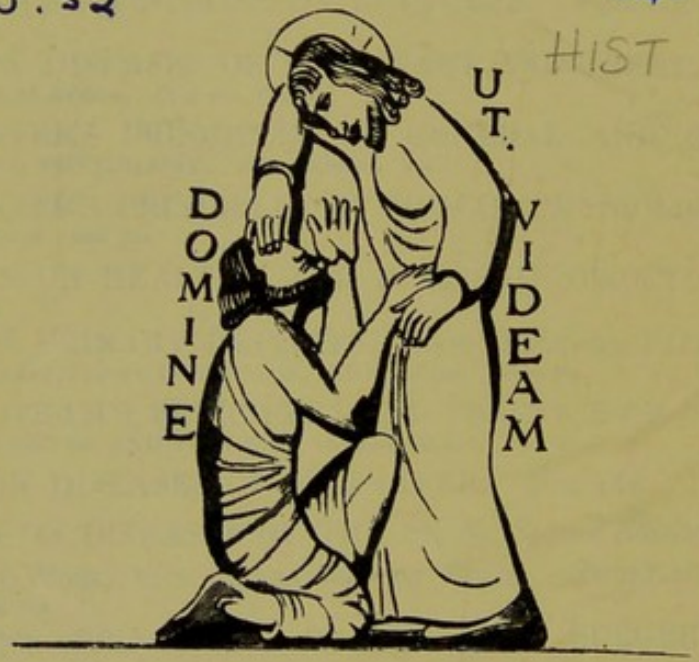

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OF

THE CRYSTALLINE LENS

AND

CATARACT.

BY

BERNARD EDWARD BRODHURST.

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TO

ARCHIBALD BILLING, M.A., M.D., F.R.S.,

&c. &c. &c.

This Essay

IS

INSCRIBED, IN TOKEN OF

ESTEEM AND RESPECT,

BY

THE AUTHOR.

PREFACE.

In considering the subject of cataract, a classification has been adopted through which each variety of disease may be referred to its primary cause. And, although the old form, according to the consistence of the opaque lens, has been departed from, yet, the author has only allowed himself to adopt this change after mature reflection, and with the entire conviction that such a course was not only warranted, but expedient. For, whilst it is customary, at the present day, to be content with such knowledge as the consistence of the cataract may afford, it is possible to arrange each cataract under one of the following heads, namely, inflammation, or malformation, old age, noxious vapours, and wounds. Nor is it alone for the sake of arrangement that such a classification is insisted on, but also for the more perfect con-

sideration of each variety of opacity, and the intimate knowledge, that such consideration affords, of the course pursued by each commencing cataract, as well as for the treatment appropriate to each.

Before entering on the more immediate subject of this essay, the author has felt it incumbent on him to consider the crystalline lens in its natural or healthy state, that, from a knowledge of its structure, the changes to which it is subject might readily be understood: nor has he considered it foreign to his subject to draw attention to the iris, intimately connected as is this membrane with the opaque as with the transparent lens.

Opinions, at variance with those taught in the schools, have here been promulgated, both as regards the iris and the pupillary membrane; this being, however, fairly disputable ground, they have been stated without compunction, and so fully as the present essay would admit of.

These observations, taken as a whole, form the sum of the author's belief on this particular subject. He submits them, with a full sense of their demerits, to maturer judgments. One pleasing duty yet remains to him, to acknowledge, however inadequately, the sense of his obligation to the Professors Jäger and Rosas of Vienna, for their many, and marked kind-

nesses towards him during his prolonged stay in that city; for their instruction and the opportunities of observation they afforded him when prosecuting his studies on the diseases of the eye; and for their kind consideration of a stranger, by whom less favours would ever have been remembered with gratitude.

London, 33, *Finsbury Circus*,
August 1, 1850.

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OF THE

CRYSTALLINE LENS AND CATARACT.

SECTION I.

THE CRYSTALLINE LENS.

General description of the lens.

THE lens is one of the transparent media of the eye. It is enclosed in a capsule, and lodged on the anterior surface of the vitreous humour, at the junction of the anterior with the middle third of the eye, immediately behind the iris, and its axis corresponds with the axis of vision. It is to refract the rays of light which pass to the eye, and to bring them to a focus. The lens is doubly convex, though not perfectly spherical; its posterior surface, which is imbedded in the hyaloid fossa, being more convex than the anterior; it presents an antero-posterior measurement of three lines, and its anterior surface encroaches on the posterior chamber. Its greatest circumference varies from twelve to fourteen lines.

In the fœtus, the lens is soft, having a gelatinous character, reddish and opaque: during infancy, it attains its greatest size, and becomes perfectly transparent, colourless, and nearly spherical; but it loses its rotundity as it gains age and consistency, until in old age, it is shrunken, its centre being dense and yellowish, if, indeed, not opaque. In the human embryo, the lens may be traced at fourteen days; it is gradually developed with the other parts of the fœtus, and in proportion to its development, so does it lose its opacity, until, at length, it is transparent, though not so beautifully clear as it becomes soon after birth. When mature, it is firm as wax slightly softened, its substance becoming gradually looser towards the circumference, when it may be likened to loose jelly. The lens increases in weight during childhood; thus, Petit found that, at three years, it weighed three and a half grains; and, at five years, five and a half. It is specifically heavier than the vitreous humour.

Of the structure of the lens.

In its recent state, the substance of the lens appears almost homogeneous—an unorganized tissue, not unlike a secretion; so that it yet ranks amongst the extra-vascular tissues, as hair and horn: it is necessary to submit it to chemical agents, in order to arrive at a knowledge of its structure. When it has been immersed in hot water, alcohol, or a weak acid, its internal arrangement may be more readily examined and understood. It is then seen to be fibrous in its structure, yet composed of two distinct parts, membrane, and fibre. The fibres are dis-

posed in fasciculi, of four or five fibres each, whilst the fasciculi blend to form laminæ, which are placed concentrically, one without the other. These laminæ, which constitute the mass of the lens, are divided, into three equal parts, by an exceedingly fine membranous substance, and, further, subdivided through the greatest diameter of the body. The divisions of the lens, thus formed, are held together by means of the membranous septa, and the whole crystalline body is supported by processes given off from the septa to enclose each lamella. Further, the serous vessels, which pass from the capsule to supply the lens, ramify throughout this membrane, between the lamellæ. These vessels have been described by Arnold as lymphatics; they have, however, rather the semblance of blood-vessels. In its transparent healthy state, vessels carrying red blood do not pass to the lens; but, in a state of inflammation of this body, a zone of vessels may be descried as belonging especially to the posterior surface. After death has taken place, the lens soon loses its transparency; it becomes muddy, and a certain portion of its watery substance is separated: this is known as aqua Morgagni.

Of the chemical composition of the lens.

The crystalline is insoluble in boiling water, spirit, and acids: it does not even communicate any turbidity to them. By being allowed to macerate in water, however, its substance is slowly removed, the membranous portion remaining alone unaffected. Of its composition, fifty per cent. is water, and the rest a peculiar substance, neither albumen nor osmazome,

though nearly allied to either. With regard to it, Simon writes as follows :—" With respect to the chemical composition of the lens, I find that, in addition to albumen, it contains a substance closely resembling casein, to which I apply the term crystallin. I reduce the lens to a pulpy mass, stir it with water, and then heat the mixture to the boiling point: the albumen coagulates, while the crystallin does not coagulate, but is entangled in the albumen. In order to separate them, I evaporate to dryness, pulverize the white residue, and boil it, first with ether in order to separate fat, and then with spirit of ·915 as long as anything continues to be taken up. The albumen rapidly sinks from the hot, clear, spirituous solution, and the supernatant fluid, which must be decanted from the sediment, soon begins to become turbid from the separation of numerous flocculi of crystallin. I evaporate to a slight residue, and then precipitate the crystallin by strong alcohol, in which it is only slightly soluble. The lactates and chloride of sodium remain dissolved in the alcohol. In this manner I analyzed the crystalline lens of the ox and the horse.

	Anal. 158 crystalline lens of ox.	Anal. 159 ditto of horse.
Water . . .	65.762	60.000
Albumen . .	23.250	25.531
Crystallin . . .	10.480	14.200
Fat	0.045	0.142
Extractive matter with chloride of sodium and lactates . . .	0.495	0.426"

"Berzelius has not separated the albumen and crystallin; in other respects his analysis approximates to mine, as far as the amount of the protein compounds is concerned.

He found it composed of—

Water	58.0
Protein-compounds	35.9
Alcohol-extract with salts	2.4
Water-extract with traces of salts	1.3
Cell-membrane	2.4" *

Chevenix found the specific gravity of the human lens to be 1079.

Of the capsule of the lens.

The lens is surrounded by a capsule, composed of a single lamella, though divisible by manipulation. This is a fine, compact, transparent, brittle membrane, capable of a certain degree of extension, and possessing sufficient elasticity to retain its shape when no longer supported by the body which it invests. It is not of equal thickness in all its parts, its anterior surface being thicker and more resisting than the posterior; also, the external lamella or outer surface of the membrane, differs materially from that which may be considered its lining membrane. The latter may be forcibly detached in exceedingly thin shreds, measuring but one-twenty thousandth part of a line in thickness. It is formed of a loose texture, and is perfectly transparent, but it is ren-

* Animal Chemistry, by Dr. J. Franz Simon, Sydenham Society's Edition, vol. ii. p. 419.

dered opaque by maceration in alcohol, and readily putrefies in water. Its microscopical examination shows circular spaces surrounded by meshes of fine vessels arranged like blood-vessels; the whole forming a regular structure, not altogether dissimilar in appearance to the ultimate arrangement of the liver, though a miniature representation. These circular spaces are those from which the secretion passes to lubricate the lens. Between the capsule and the lens, and adhering more firmly to the former than to the latter, are found six-sided cells, which, opening one into the other, establish a communication between the lens and its capsule. This is named cell-texture by Werneck. One of these cells corresponds to four or five of the circular plates of the internal lamella of the capsule; between these the vessels pass, which are distributed to the lens. The external lamella is not only perfectly transparent, but it does not lose this property, though it be macerated for months in alcohol, nor does it even become cloudy: it dries quickly, like a piece of cartilage on exposure to the air, but does not undergo putrefaction, and resumes its original appearance on being moistened. Under the microscope, it does not present any peculiar appearance, but is bloodless, and as though an exceedingly fine layer of cartilage. Its proper vessels do not appear to enter its substance, but rather to lie upon its inner surface.

In its normal condition, the capsule is scarcely capable of a clean cut wound, but splinters like a thin plate of glass, curls up, and becomes opaque.

When opaque, it loses its brittle character, and is rendered tough. A fine halitus constantly arises from the secreting surface of the capsule to bathe the lens, which is most essential to its well-being: it is through this agency that the proper consistence of the lens is maintained: it is not poured out as a fluid through the cells above described, but as a fine vapour, the membrane being in this respect analogous to serous membranes in general, to which, indeed, it may be likened, as a modification.

Of the blood-vessels.

The blood-vessels of the lenticular capsule and vitreous humour may only be injected in the fœtus, or when they are enlarged through inflammation. At birth, they are no longer to be traced, nor can injection be forced even into the mouths of these vessels as into those of the cornea. The vessels passing to the capsule are branches given off to the vitreous humour from arteria centralis retinæ; these run forward and are distributed thickly to the anterior surface of the crystalline capsule, where they anastomose with branches from the ciliary processes. Arteria centralis corporis vitrei, a branch of centralis retinæ, proceeds directly across the vitreous body to the centre of the posterior surface of the capsule, where innumerable branches are given off, in all directions, to supply the capsule, and anastomose freely on its anterior surface with the plexus there formed by the arteries of the vitreous humour and the ciliary vessels. This central artery of the vitreous humour is not accompanied by a vein. Those blood-vessels belonging to the outer layer of

the capsule have as yet alone been injected; the internal or secreting surface presents an intricate net-work of serous vessels, but neither into these nor into those of the lens proper has injection been forced.

Although the capsule be not affected by long maceration in alcohol, at least its external lamella, disease deprives it of some of its properties, such as its elasticity, its transparency, and its peculiar brittle condition, and renders it tough and opaque, an obstacle to vision. The integrity of the capsule is essential to the vitality of the lens: the capsule becoming opaque involves the lens in the same disease; but the longer the membrane is only partially opaque, by so much the longer will the disease cease to implicate the lens, when indeed it be not such, as may affect one and the other almost simultaneously.

The posterior wall of the capsule is closely adherent to the hyaloid membrane, in the whole extent of the hyaloid fossa: further, it is surrounded and firmly grasped by zonula Zinnii. Through pressure, these adhesions cannot be broken through; but, if the attempt be made, the lens will be depressed through its capsule. This splinters and gives way, retaining firmly its adhesions. Professor Hyrtl writes as follows: "Oculists speak of depression of the lens with its capsule, as of an undoubted fact. Also, that the lens has been extracted together with its capsule. Both are anatomical impossibilities. The whole posterior wall of the capsule is closely

adherent (fest verwachsen) to the shallow cavity; and, moreover, the periphery of the capsule is fixed by zonula Zinnii. How can an organ with such adhesions be separated from its connexions in the living eye? How is it, then, that the extracted and depressed lens retains its capsular covering? The answer is easily given, when it is remembered that the lens consists of concentric layers, which, in the hardened lens, may be peeled as the plates of an onion. If the outer layer remain whole, whilst the next to it is softened, so will the rest represent a kernel, which lies in its outermost layer as an entire lens in its capsule. These supposed capsules have only been seen on such lenses as resist absorption; i. e. where the outer layer was so firm that it preserved its coherence, whilst its neighbour was softened. . . . When oculists imagine that, the whole lens, (linsensystem,) i. e. the lens with its capsule, can be depressed, they should remember that, each time pressure is applied forcibly to the lens, the capsule bursts, and when the capsule is not cut through, it is torn, through the pressure applied in depression. All these assertions," adds the professor, " may be verified on the dead body; and it is inconceivable to me that any one should so long have believed such a fable respecting ophthalmic surgery."* With respect to this adventitious capsule, I have nothing to say. I believe that the cases in which the capsule and lens are together extracted, or depressed, are those in which cataract has arisen

* Handbuch der topographischen Anatomie. Band i., p. 158.

through concussion ; where the lens has been deprived of its vitality, its connexions having been forcibly torn asunder, the capsule remaining entire : and this is the only form of cataract in which the capsule and lens can escape together.

Aqua Morgagni.

Under certain conditions of the system, a limpid fluid is found within the crystalline capsule. It is the result of disease or debility, or dependent on the changes consequent on death. The escape of the fluids of the body, after death has taken place, indicates commencing putrefaction ; and this is hastened by the degree of heat to which the body may be exposed, and varies as the state of health at the time of death. In so delicate a structure as the lens, we cannot be surprised to find disorganization already advanced, even before an appreciable amount of transparency is lost to the organ. A drop or two of this fluid escapes on puncturing the capsule a few hours after death ; but its quantity depends on the solidity of the lens, and on the state of health at death. Thus, if death arrive during an attack of typhus fever, or any debilitating disease, this fluid will be found invariably, and so soon as it may be sought : but, if an individual in vigorous health be struck dead, it will not be found, nor for some hours after death. The fluid, thus poured out, is scarcely worthy of a distinct name. In certain states of the system, where the fluids are poured out largely, where the secretion of serum is abnormally abundant, and the excretions not proportionate ; where, from depressing causes, such as inanition,

venery, &c., vital energy is depressed, in such cases, the cause being general, fluid escapes into the capsule of the lens, and it may increase to render the anterior capsule more convex than natural, to project it into the posterior chamber, and thus to alter in some degree the focus in which the rays of light are collected, rendering the subject of it short-sighted. This affection is not unfrequently mistaken for congestion of the choroid. Certain vapours have the property of rendering this fluid opaque.

Of the development of the lens.

In the chick, the lens is to be seen at the end of the second day, as a round elementary corpuscle ; and during the following day the capsule may be distinguished as a round vesicle. In cattle, sheep, swine, and man, the lens is divided into six parts ; in the rabbit, hare, and rodentia generally, but four divisions obtain, a transverse line being found on the anterior surface, and a vertical line on the posterior. In amphibia and birds, there is no appearance of lobes and segments : in these, the lens is formed, not in parts which are afterwards to be joined, but as a whole, with a membranous structure in the centre, where the fasciculi meet. In the human embryo, the lens is found at fourteen days perfectly opaque and homogeneous ; as it is developed, it becomes transparent, for the passage of light, reddish, and gelatinous in consistence : after birth, its development proceeds, and it becomes pellucid during the first months of life ; but it is not yet fully developed, nor does it attain to complete deve-

lopment until puberty has been gained: then its nucleus is firmly formed. As it becomes transparent, it loses its reddish colour and gelatinous character, and becomes paler and firmer. In the adult, it is perfectly pellucid, and its nucleus is firm; as age advances, it becomes more solid, its watery parts are diminished, it shrinks and is rendered smaller, whilst it increases in colour and consistence, until, in old age, its nucleus is hard, and not unfrequently opaque. In the fœtus, it is found, as all other parts, soft; and gradually gains consistence in a relative proportion with the other tissues of the body, being subject to the changes produced by old age, changes referrible to deficient nutrition alone: it is amongst the first to bear witness to the hand of time—to usher in old age.

By reason of its low organization, the lens is unable to recover from an injury inflicted; so that, the touch with the point of the finest needle is sufficient to produce opacity. The displacement of a particle will thus disturb the whole mass; it originates a peculiar action, not inflammation, through which opacity is propagated to affect the whole; and since it may not be restored, a part being affected, to its original condition, it rapidly becomes opaque on the receipt of an injury, and, at the same time, absorption commences and proceeds to its total removal. For, since it is a necessary consequence that opacity should be distributed to the whole, having affected a part, and since it is essential that it should be deprived of its vitality prior to its removal; so, that it

may not remain an obstacle to vision, it rapidly dies or becomes opaque, and is scarcely less speedily removed.

Of the nutrition of the lens.

Whether the lens be nourished by the halitus arising from its capsule, is immaterial to determine. Doubtless, this is most essential to the consistence of the lens that it be preserved; but that its nutrition is referable to this alone, not considering its proper vessels, appears highly improbable. That its nourishment should be performed by bathing the lens in a fluid foreign to its substance, or that nutrition, other than that necessary to the lowest organized life, is essential to its well-being, is disproved by the circumstance of this body not being affected, at any time of life, whilst the vitreous humour and bones are coloured by feeding with madder. That the lens is ever removed during its transparent state, or that its substance is renewed, we have no evidence to determine affirmatively; but, on the contrary, that which might have served as an argument, if not for its regeneration, at least for its nourishment, fails to establish either point. Through life, it undergoes no sensible change, but that only referable to the diminution of its watery parts, which are removed in proportion as nutrition is diminished, as old age is established. It has been supposed by some that not only the lens might be removed through the agency of its capsule, but that, through the same means, it might be regenerated. Valentin, Sœmmerring, and others, are advocates of this opinion. The former says, that the regenerated

Is the lens regenerated?

lens is smaller and softer than in its normal condition, and that, when examined microscopically, its vessels are seen to be interrupted by irregularly formed cells. Leroy d'Etiolles has recorded instances of the reproduction of the lens in the rabbit, cat, and dog, in which he affirms that, after extraction had been performed, in a space of six months crystalline lenses were regenerated, and, so perfect were they, that they differed in nothing from those that had been extracted ; that they presented the same form, size, and consistence, and that no cicatrix was to be observed in the capsule, but that this membrane was perfectly transparent.* I may not doubt this statement, but I may be allowed to observe that the reproductive power of animals appears to differ. M. Leroy d'Etiolles found, that the lens was reproduced in the course of six weeks, and, that its formation was complete at the expiration of six months. When the lens has been extracted without wounding the vitreous humour, and the space that it occupied, examined, within a period of two years from the date of the operation, the hyaloid fossa will be found, at least, concave, empty, (being filled alone by the aqueous humour,) and the hyaloid membrane transparent. The anterior capsule will have disappeared, more or less, and its remains alone will be seen, as a white, opacous, shrivelled membrane attached to zonula Zinnii ; but there will not be present a trace of new formation, not to mention a reproduced lens. Mr. Guthrie has gone further, and has recorded, in

* Journal de Physiologie, tome vii.

an essay, entitled, "On the certainty and safety with which the operation for the extraction of a cataract from the human eye may be performed," an instance of regeneration of the lens in man. The case is written at length ;* I can only refer to it. Nature is not peculiar in her actions, but repeats them for the many as for the most favoured ; so that, were the reproduction possible, it might often be seen. Nor is it for want of observation that these instances of new lenses are so rare, for the strictest inquiry leads to the establishment of the fact, that the record of such cases is supererogatory.

Of the nature of the lens.

Because the muscles of certain water insects are soft and destructible as is the lens, and because they have an appearance not altogether dissimilar, therefore it has been concluded, that the lens is muscular. The lens is fibrous, but fibre is no distinctive mark of muscle. Again, it has been thought to be a secretion. Now, it is not homogeneous, but possesses a lamellated structure, membranous septa, and vessels. The brain has been held to be a secretion, and with equal probability. Inasmuch as the lens has a peculiar function to perform, and its structure no less peculiar, why suppose it to be muscular, or indeed analogous to anything else in the body, whilst its appearance and composition are so different ? To limit nature is but to own man's inability to follow her in her works. It has been deemed necessary to perfect sight that the shape of the lens be capable of alteration, that, so, the focus might be adjusted to

* Page 43.

the distance of the object to be viewed. This duty the lens has been charged with, as though there were not a very beautiful apparatus specially for this purpose; an apparatus which man has closely imitated in the construction of his telescope, where the lenses have to be approximated or removed one from the other, by drawing out or closing slides, as is the distance at which is situated the object to be viewed. So in the eye. The muscles of the eye, although individually they possess the power of rotating the organ, of drawing it upwards, downwards, and laterally, have a collective power, quite as important, of retracting, or protruding the eye, thus, somewhat to alter its shape, and, consequently, the focus. It cannot be supposed that they influence the lens directly, that by their pressure the shape of this body is altered: nothing further would be required to produce coloured light. But, by elongating, or otherwise, the eye, they produce the required effect, by approximating or removing the lens from the retina. If we consider the eyes of such animals, who are so constituted as to live either on the land or in the water, we shall see this apparatus in its most extended form. In the seal, the walrus, &c., it is necessary for perfect sight that the refractive medium be altered with the animal's change from the water to the land; for the rays of light passing to the retina demand a stronger refractive power when they pass through the water than is necessary when the air forms the external medium. Thus we find, in these amphibious animals, a contrivance to alter the

position of the lens, and to increase the convexity of the cornea. This is obtained by the various thickness of the sclerotica : the anterior segment being thick and firm, whilst the posterior is still thicker and almost cartilaginous, and the intermediate portion thin and pliable : the whole being surrounded by strong muscles, which are attached to the anterior segment. Consequently, when the eye is retracted into the orbit, the convexity of the cornea is increased, whilst the lens is drawn nearer to the retina. Through this simple apparatus, to increase the size of the anterior chamber, these creatures are at once provided with the eye of the fish and that of a terrestrial animal. When we look at the distant landscape, it requires an instant to fix the eye to the distance, accurately to distinguish objects. This is only required, until, by habit, so to say, the distance is gained, and the muscles are so regulated as to produce the desired effect. The eye having been fixed on the object, so as to ascertain accurately its position, may be withdrawn, and again directed to it will seize it instantly. On looking at an unvaried surface, as the sea, the expanse of colour is, at first, alone remarked, and such objects on its surface, as boats, are passed over without observation. The same may be remarked of the heavens, when the stars are but faintly visible. The eye must be directed steadily upon an object readily to compass it. I would illustrate this compression of the globe by the muscles of the eye, by a case that occurred to Professor Jäger. Having had occasion to operate on

a young person for staphyloma, the professor removed the cornea, but omitted to rupture the crystalline capsule. Cicatrization, however, proceeded, and the capsule played the part of the cornea, so that a very fair degree of sight was enjoyed. All parties were pleased, for the case advanced favourably, and with a probable issue totally opposed to that usually observed, for cicatrization appeared to be now almost complete. However, the capsule of the lens was but a poor substitute for the cornea, and little able to resist pressure. Having dropped her needle on to the floor, the girl immediately stooped to search for it, and straining her eye, to compass so small an object, out flew the lens. From the manner in which the muscles of the eye arise and are inserted, closely binding the organ, it is impossible that they should act collectively, without producing considerable pressure upon the globe of the eye. It is the spasm of these muscles that the operator for cataract has to dread, when he has divided the cornea. When compression is thus produced, the straight muscles are assisted in their action by corrugator supercilii, tensor tarsi, and orbicularis palpebrarum. The protrusion of the eye, on the contrary, as is seen in violent gusts of passion, is effected by the combined action of the oblique muscles, and the tense state of levator palpebræ, thrusting the eye forward, and wide raising the lid ; the other muscles being in a passive state.*

* Simonoff maintains, and that by calculation, that it is not necessary, to perfect vision, that the eye should change its form.

The lens a refractor.

The crystalline is an unequally double convex lens, refracting the rays of light in a less degree than the cornea, and more powerfully than the vitreous humour.* It is the most perfect form of lens, being so composed, its nucleus being firm, whilst the circumference approaches the consistence of the

(Journal de Phys. vol. iv.) Each near-sighted person, however, can practically solve his problem, showing the fallacy of his conclusions.

* Magendie, in his "Précis Elémentaire de Physiologie," has recorded some interesting experiments, made by himself and M. Biot, to ascertain the relative importance of the humours of the eye, as well as the membranous media, in refracting the rays of light. His report tends to prove all the humours necessary to a perfect image; the discharge of a portion of the aqueous, or of of the vitreous, increasing the size of the image, and, consequently, lessening its intensity. Further, that the removal of the cornea does not alter the image, but diminishes the intensity of the light only. These experiments would contribute, therefore, to the idea, that the cornea was useless to the refraction of light. This is indeed not the case; it being more instrumental—a more powerful refractor than the lens itself. Indeed, M. Magendie's experiments prove the cornea at least a refractor, although the circumstance is explicitly denied: for, says he, "if the aqueous humour, the crystalline lens, and the cornea be removed; and only the crystalline capsule and vitreous humour left for media, the image ceases to be formed on the retina." Now, we know, that the crystalline lens and aqueous humour may be taken away, leaving the cornea and vitreous alone for media, (this is the operation of extraction,) and that a perfect image may be transmitted to the retina; therefore, as there is no image formed, the cornea being removed, but, by its addition, an image more or less perfect is produced, it does not require very close reasoning to understand that the cornea does play a most essential part in the refraction of light.

aqueous and vitreous humours, as to be sufficiently achromatic for perfect vision, whilst spherical aberration is prevented by its form ; the anterior surface being elliptic, whilst the posterior presents a parabolic curve. That it is not perfectly achromatic is shown by approaching minute objects to the eye, when the spectral colours are produced.

Not all the light that strikes upon the cornea arrives at the crystalline ; some is reflected from that membrane ; other, traversing it, is reflected or absorbed by the iris ; whilst some few rays alone, passing through the pupil, impinge on the lens and pass to the retina. The lens refracts alone the rays of light, neither absorbing nor reflecting any ; but allows all that impinge upon it to pass to the retina, their course only altered, nothing of their power being lost. The refractive power of the lens increases, as age advances; the organ requiring, for its perfection, a more solid nucleus than is found in infancy ; but its density is not maintained at that point to which the mature lens may be considered to have attained, for, gradually losing its watery parts, the body shrinks and becomes harder, and thus the power of refraction is increased in a ratio with the density of the medium. For the same reason the refractive power of the centre of the lens is greater than that of its circumference. It has been found in the adult to be as 1.3990 to 1.3767 ; the difference being necessarily increased by age, whilst it is less during infancy, when the nucleus differs but slightly from the circumference of the lens. Sir David

Brewster gives the following as the refractive indices of the lens, light being incident upon it from the air, the aqueous, and vitreous humours.

Refractive index of light passing from air to lens,	1.3839
" " " from aqueous to lens,	1.0353
" " " from vitreous to lens,	1.0332

Of the rays of light passing to the retina, some are incident perpendicular to the cornea ; these traverse the membranes and humours without refraction ; others, falling obliquely, suffer refraction at the point of immersion, towards the perpendicular.

The refractive power of the lens increases with age ; so, in proportion with its density is the angle of refraction ; the sine of the angle of incidence being to that formed by the traversing ray at the point of emergence and a line perpendicular to the emerging ray, as is the density of the lens to the surrounding media. The rays of light decussate, in traversing the lens, to produce the image painted on the retina, inverted : they are refracted by all the transparent media, but chiefly by the cornea and the lens : they are refracted towards the perpendicular, on entering a denser medium from one rarer ; and, away from the perpendicular, on entering a rarer from one denser. Having entered the medium, be it rare or dense, they proceed in a straight course, and are not turned away from it so long as they continue in that medium ; but, on passing to another, they are turned away from, or towards, the perpendicular, as the medium is rarer or denser, and in proportion to its rarity or density. So, in passing through the different media that constitute the

transparent eye, they are made to converge towards a focus upon the retina, on which the object viewed is painted : thence the impression is transmitted to the sensorium.

The amount of light admitted to the eye depends on the mobility of the iris, but its estimation upon the sensibility of the retina ; the pupil being open, proportionably with the effect produced by the measure of light. That vision may be perfect, it is necessary, that the rays of light be collected on the retina in the optic axis : should they be scattered, or collected before they reach the membrane, the image produced will be more or less imperfect as is the distance of the focus from the seat of sensibility. The image is produced on the posterior surface of the retina, the rays of light being reflected by the choroidea and sclerotica. The appreciation of light belongs properly to the retina ; and it is necessary to the image painted upon this membrane that it be appreciated, that the sense of light be fully developed ; for, in proportion as amaurosis is established, so does the image cease to affect the sensorium : the image may be painted perfectly upon the retina, but will not be estimated, the sense of light being wanting. The sense of light may be said to be proper to the retina, and that in an extended sense. It may be removed, and recalled, to a great extent, at pleasure : let a hard cataract be depressed to rest upon the retina, its pressure shall extinguish the sense of light ; amaurosis is said to be produced : the image is formed on the retina, whilst it is still transparent, but it is not appreciated, the sense of light being

wanting; notwithstanding that there be a healthy brain and humours of the eye: raise the cataract, and the sense is restored.

Of the inverted image.

The image is inverted by the humours of the eye, and so painted on the retina; not through any peculiar vital action, but by laws equally applicable to inanimate substances. How, then, is the object estimated as erect, its image being inverted? This question has long been a stumbling-stone, and yet remains to be answered. Buffon and others have stated broadly, that objects are at first seen inverted, and that impressions are corrected by touch and observation. There is no evidence, however, to substantiate such a proposition, but, on the contrary, we have direct proof that such a position is untenable. Dr. Golding Bird says, "Much unnecessary argument has been used to explain why objects appear erect, whilst their images painted upon the retina are inverted, although a little reflection on this circumstance would have shown that such must necessarily have occurred, from the law that all objects appear to be placed in the direction pursued by the rays which eventually reach the eye."* For Dr. Golding Bird's explanation, I must refer my reader to the section in question. It does not appear to me to solve the question, but being altogether voluntary and wanting in proof, Q. E. D., is not. But not only is Dr. Bird's explanation wanting in proof, but also in likelihood. If the image were painted on the extremity of the optic nerve, and the sensation

* Elements of Natural Philosophy, sect. 580.

transmitted along the course of its fibres to the sentient seat in the brain, in the same manner as the rays of light course through the humours of the eye, then Dr. Bird's theory could be sustained: but, inasmuch as the image is painted in the visual axis, and that not the position of the optic nerve; and inasmuch as the extremity of the optic nerve is insensible to the action of light, and we yet ignorant of the particular manner in which impressions are transmitted by a nervous cord to the centre, it yet remains to be shown the precise manner in which the inverted image is transmitted that it shall not appear inverted. The object viewed being painted upon the retina with a certain amount of light, the impression is, so to say, collected by the nervous expansion, the retina, and transmitted by the optic nerve, in the same manner as the knowledge of the consistence and shape of bodies is acquired through the tips of the fingers. I am not ashamed to avow myself ignorant of, perhaps, the simpler phenomenon of the estimation of bodies by touch—how sensation should be so transmitted as to produce an exact image to the mind's eye, as may be through the acquired touch of one accustomed to judge of objects through this sense; consequently, and for the same reason, I shall not attempt an explanation of the manner in which the inverted image is transmitted, through the long and sinuous course of the optic nerve, to produce the effect of an erect object. All must agree, however, in one point, namely, that the image, although painted inverted, is always esti-

mated as erect; and this independent of the will, knowledge, or experience; for, if it were not so, but a non-natural process, instances would not be rare, where it might be found impossible to acquire this power, as it is to acquire a correct touch; or, forgetful of the complicated turning process to which each object would have to be submitted, it would be left as painted, topsy-turvy. Although this, then, be a natural process, vision has to be acquired. Sight may be given to a child born cataractous; but it shall make no use of it, until it be deprived of that sense through which it previously judged of surrounding objects; it shall see, but it shall not understand. The same is observed, sight being first enjoyed after years of discretion have been reached; objects are seen confusedly, and without producing effect. In the babe, objects are first learned, and then connected to form a picture, impressions being corrected by the touch; just as words are first acquired and then sentences. It is quite clear that the retina at birth is not fit for vision; light produces a certain effect, but a strong light is required, as that of a fire. The child, however, soon becomes cognizant of surrounding objects. At first, all appear equally distant, and it grasps at those far off as at those near to it. The sense of sight is present at birth, but objects are not noticed until about the sixth week. The progress of this sense advances in equal step with the other faculties, and neither precedes nor lags behind: surrounding objects are unheeded whilst unknown, and glittering objects alone

Of vision.

attract attention : all others fatigue and only gain a cursory notice. Form is first acquired by the child, for the knowledge of form depends upon the memory, whilst size and distance are learnt later, the knowledge of size and distance being inseparable, each affecting the other, the knowledge of one being essential to that of the other ; both demand intelligence, and consequently cannot be attained to by the young child ; but form is acquired without the exercise of the reasoning powers; near objects become familiar as they are constantly seen, so that each is known for itself, and becomes planted in the memory : nor is comparison necessary to the estimation of form. Thus, although vision is very imperfect in the child, the idea of "men as trees walking" is never produced.

The size of the pupil necessarily commands the figure painted upon the retina; for, in proportion to its dilatation, so is, *cæteris paribus*, the increase of the rays of light admitted to the posterior eye. It must not be forgotten, that the same degree of light may produce, and generally does produce, varied effects upon any two individuals. Light only sufficient to produce an agreeable effect on one, may be painful to another, or not sufficient to produce a clear and ample vision in a third: and although the pupil exercise a direct influence in the mechanism of vision, in appointing the size of the image thrown upon the retina, the size of the pupil is no evidence of the estimation of that figure. In experimenting with dead eyes, it is found that an image is pro-

duced of a certain size, as is the pupillary opening, and is distinct, as the light is vivid. In the living eye, it is not necessarily so. Two irides may be equally expanded, both in apparently healthy eyes; the size of the image is consequently the same, but it shall be differently appreciated; in one it shall produce a faint vision, whilst it is agreeable to the other. The effect that light may produce upon the retina is referable, not so much to the retina itself, neither to the humours of the healthy eye, as to the tone of the general system : the action of the retina being no less impaired, or its sensibility morbidly increased, through gastric, mesenteric, or other irritation, or morbific influence, than is the sense of smell or that of the palate. Therefore, although the iris may regulate the size of the figure upon the retina, it is in no degree constant in its changes, producing a concentrated and perfect sight with its expansion, and, on the contrary, a feeble image with a dilated pupil. It determines only the size of the figure, but is no evidence of the estimation of that figure. Through constant use in one direction, the iris loses much of its power. The watchmaker, who, constantly viewing minute objects, requires a contracted pupil, is unable to view a distant landscape : the irides having become permanently expanded, no longer yield in the same degree, or to the same influence that is sufficient to produce contraction, or dilatation, in another. In the same manner, the sailor, always on the look out for distant objects, acquires a dilated pupil:

nor is it possible to produce at will, a pupil sufficiently contracted to view minute objects; as any one may prove by endeavouring to examine these under the microscope, when unaccustomed to its use or to the examination of minute objects. Whatever be on the object-glass will necessarily be painted on the retina, but it will not be perceived, unless the pupil contract to concentrate the light admitted to the eye. In one case and the other, the condition of the iris is abnormal, and is no more evidence of tonicity or debility than is the large biceps of the boatman's arm, or the gastrocnemii muscles of the ballet-dancer, or, on the other hand, the dwindled condition of the tailor's shanks.

The education necessary to the eye, for form, distance, and size, is easily acquired, for the most part, and an accurate estimation, of one and the other, gained, at least sufficient for general purposes, as a matter of habit. For natural objects, this knowledge is not difficult and is attained to by most. Far otherwise is it, however, with some artificial objects, as paintings. Here, not only have size and distance to be considered, but colour. A right knowledge of perspective is no less difficult to acquire than to express; and the estimation of colour is one of the most difficult and intricate arts to attain, and is indeed unattainable in a high degree, without there be a peculiar talent for the estimation and arrangement of colour. Of this we have evidence in the limited number of painters who have rightly understood the amalgamation of colours.

The generality of artists, and especially the masters, being distinguished by the appropriation and constant use of certain colours, or by the judicious distribution of light and shade. Titian, perhaps, alone being remarkable for his brilliancy and majestic colouring; and Raphael, in his last years, in his celebrated Transfiguration, showed himself indeed a master in the art of colouring. This is, perhaps, more wonderful for its variety of colour, yet chaste style and perfect harmony, than for the admirable manner in which the great artist has treated his subject. It is, by reason of its colouring alone, the most beautiful painting to be found. I remember well, when a boy, being in the frequent habit of seeing what was intended to represent a tiger's head: it was admitted, on all hands, to be an admirable specimen of burning figures on wood, for it was drawn with a hot iron. Consequently, the colours were only those natural to the wood, and the different degrees of burning to which the artist had submitted it: but, though I examined this painting with the best intention of seeing its meaning, I never could discover even that it represented a head; and still, for my years, I rather excelled in the use of my pencil. It is the same with the ear; how readily, how immediately does the infant know its mother's voice; but how difficult to appreciate music, to have a just sense of harmony.

Cheselden's case, as showing the effect produced on an intelligent being by the gift of sight, is interesting. It is recorded, that this young man,

" when he saw light for the first time, knew so little how to judge of distances, that he believed the objects which he saw touched his eyes, (this was his expression,) as the things he felt touched his skin. The objects which were most pleasant to him were those whose form was regular and smooth, though he had no idea of their form : nor could he tell why they pleased him better than the others. During the time of his blindness he had received such an imperfect idea of the colours, which by a very strong light he was then able to distinguish, that a sufficient impression had not been left by which he could again recognize them. Indeed, when he saw them, he said that the colours he then saw were not the same as those he had seen formerly ; he did not know the form of any object, nor could he distinguish one object from another, however different their figure or size might be : when objects were shown to him which he had known formerly by the touch, he looked attentively and observed them carefully, in order to know them again ; but as he had too many objects to retain at once, he forgot the greater part of them, and when he first learned, as he said, to see and know objects, he forgot a thousand, for one that he recollected. It was two months before he discovered that pictures represented solid bodies ; until that time he had considered them as planes, and surfaces differently coloured, and diversified by a variety of shades ; but when he began to conceive that these pictures represented solid bodies, in touching the canvass of a picture with his hand,

he expected to find in reality something solid upon it, and he was much astonished when upon touching those parts that seemed round and unequal, he found them flat and smooth like the rest ; he asked which was the sense that deceived him, the sight or the touch ? There was shown to him a little portrait of his father, which was in the case of his mother's watch ; he said, that he knew very well it was the resemblance of his father ; but he asked with great astonishment, how it was possible for so large a visage to be kept in so small a space, as that appeared to him as impossible as that a bushel should be contained in a pint, and every object seemed very large to him ; but after he had seen larger things, he considered the first smaller : he thought there was nothing beyond the limit of his sight. The same operation was performed on the other eye about a year after the first, and it succeeded equally well. At first he saw objects with his second eye much larger than with the other, but not so large, however, as he had seen them with the first eye ; and when he looked at the same object with both eyes at once, he said that it appeared twice as large as with the first eye ; but he did not see double, at least it could not be ascertained that he saw objects double after he had got the sight of the second eye."

The sense of light resides in the retiña, while that of colour and form is resolved in the brain. The amount of light admitted is determined by the sen-

sibility of the retina,* and the adjustment of the pupil is in accordance with the effect produced upon the brain.

THE IRIS.

Is the iris muscular, vascular, or nervous?

Sir Everard Home delineated the muscular structure of the iris, and was one of the most strenuous supporters of this theory: his drawings were not

* What a singular train of reasoning is that which induced Magendie to express himself as he has done with regard to the retina. "Physiologists," he writes, "formerly agreed in considering the retina the most sensitive part of the nervous system, its sensibility being so exquisite, that the contact of so subtle a fluid as light produces a strong impression. I have ascertained by experiments," continues M. Magendie, "that the sensibility of the retina is, on the contrary, extremely obscure, if even it exist. A cataract needle passed into the posterior eye may tear or puncture the retina, and yet produce scarcely any, if indeed any effect upon the senses. A piece of down passed over the conjunctiva produces a sensation much more lively; therefore, far from the retina being the prototype of sensitive organs, its sensibility may fairly be questioned." (Précis élémentaire de Physiologie.) Such a sentiment from Magendie must call forth surprise. He might have added, with equal truth, that the auditory nerve is insensible, because a rose held to the ear produces no effect upon it. It was a saying with Mr. Abernethy, that one fact was worth a hatful of theory. I think Magendie's fact, however, can scarcely be held to have so copious a bearing.

deficient in ingenuity ; but, as they were the produce of the imagination, more ingenuity might have been displayed. Sir Everard limited himself to the description of a sphincter muscle ; and for want of a better solution of the question, many followed in his track.

The researches of Arnold are sufficient answer to this part of the question. There is no trace of muscular fibre to be found in the iris.

Others, again, have supposed it to be erectile through injection. To erection or injection, increase of substance is necessary : the organ would be thickened as it was displayed, whereas the contrary obtains. Without adhesions to the capsule, it would contract impartially, the vessels in a part having been closed through inflammation ; as in that state known as chordee. When divided, blood would flow ; and in proportion to its division so would be its decrease. Permanent contraction of the pupil would be produced by extravasation into the organ without rupture ; contraction which could not be followed by dilatation. The pupils of people drowned or hanged are widely dilated ; if expansion of the iris took place through accumulation of blood, then, in these instances, the pupils should be contracted, for congestion of the head and eye is produced by one means and the other. It may, therefore, be asserted that its vascularity is not directly subservient to its contraction.

The iris is composed of a loose cellular tissue, and a pigment deposit, to which it owes its colour. The

pigment deposit or uvea, is not a part of the membrane, but may be separated from it, to leave the membrane of the iris slightly coloured by it. The uvea differs in quantity with the individual, increasing, for the most part, in a direct ratio to the colour of the hair; thus, in the negro, although the iris may not be said to be black, it demands careful inspection to distinguish it from the pupil. The Ethiopian, Turk, Italian, with other southern nations, have the darkest irides, according with the colour of their hair; and light hair and blue, or grey, irides are generally found together. The complexion is an indifferent indication of the colour of the iris; it is not uncommon to meet with the fairest complexion and dark hair and dark irides. As a general law, however, the iris is dark according to the power of the sun's rays; for in proportion to the amount of pigment, whether of the choroid or of the iris, so is the power to bear the glare of light. Thus, we find that the pigment increases with the temperature of the country. It is well known that, by cutting down the forests of Italy, and central Europe, their climates have been rendered milder. In Italy, snow and frost are comparatively rare, nor is the Tiber now ever found to be frozen; nor is Soracte ever covered with snow, as two thousand years ago, and later, we know to have been customary.

"Vides ut alta stet nive candidum
Soracte, nec jam sustineant onus
Silvæ laborantes, geluque
Flumina constiterint acuto."

In like manner have the inhabitants changed. The dark-eyed maidens of Italy do not differ less from their fair-haired sisters of Porsenna's time, than does the climate of the present day from that when Horace sang. So in Germany, the cold is infinitely more severe in those districts surrounded by forests, than where they have been cleared away. It is doubtless through the temperature of the country having been raised, that the traveller may now look in vain to realize the description of Tacitus when speaking of this people: "rutilæ comæ, cærulei oculi," than which, in Germany, nothing is rarer. The inhabitants are dark, dark brown, or with muddy light brown hair, dirty complexions, and grey eyes. Auburn hair and blue eyes, and flaxen and blue, are rare, though occasionally met with in the north: light hair, with dark irides, eyebrows and lashes, is more common in Italy, however, and dark hair and blue irides in Ireland. The same is to be observed in India as a general rule, the iris and hair bearing a proportion to the sun's heat that the person may be exposed to. Mr. Fraser assures us that, in the Himalaya, the Hindoos are very fair, that they are often to be found with blue eyes and auburn, or red hair, and curly beards.* In albinos, the pigment is wanting, both of the choroid and of the iris; one and the other appearing pink, as in the white rabbit.

Of the arteries of the iris.

The arteries of the iris are exceedingly numerous: derived from the long and anterior ciliary arteries, they are distributed to cover the membrane so thickly

* J. Baillie Fraser. Travels in the Himálaya.

that, when injected, the iris is scarcely visible through its mass of blood-vessels. The long ciliary arteries, two in number, perforate the sclerotica near the optic nerve, and passing between this membrane and the choroidea, and along the greatest circumference of the eye, one on the inside, the other on the outside, they arrive at ligamentum ciliare, where each divides into two branches to encircle the iris. This zone is joined by the anterior ciliary arteries, which pierce the sclerotica at one line from its junction with the cornea. From this zone or greater arterial circle of the iris, innumerable vessels pass, in a zig-zag manner, towards the pupillary margin, inosculating in their course to produce a delicate network of vessels ; the whole being linked together to form, as a chain, the lesser arterial circle immediately in front of the pupillary opening.

In their uninflamed, natural state, these vessels of the iris do not carry red blood : the pink colour of the iris of the albino is derived from the choroid membrane, and seen through the delicate iris, now deprived of its uvea. When torn, blood does not flow from the iris ; but, if it be detached from the ciliary ligament, considerable hæmorrhage will occur, even to fill the chambers of the anterior eye. The viscid secretion, the uvea, is retained by the fine membrane of the posterior chamber, which, separating it from the aqueous humour, prevents it being washed by this fluid. The pupillary margin of the iris is formed by this deposit. During early fœtal life, the lesser arterial circle is not formed

in the iris, but the vessels are continued forward into membrana pupillaris.

Membrana pupillaris.

Membrana pupillaris is a cellular membrane to close the pupil during fœtal life. The ciliary vessels pass into it from the iris, forming a system of loops around a free centre. These are covered by the fine serous membrane of the aqueous humour, which, constituting the outermost layer of the pupillary membrane, is continued over the iris to form a closed sac. The membrane, at first opaque, becomes perfectly pellucid, and at the sixth month of fœtal life has already attained its full development. It decreases as the iris is perfected, and with its decrease, retraction of the vessels of the iris takes place, to form the lesser arterial circle of this membrane. Towards the eighth month, a few vessels only are to be seen, near the margin of the pupillary membrane; but, notwithstanding that its vessels are thus withdrawn, its vitality is not affected, it remains perfectly transparent; or rather, to its perfection, it requires that its vessels be withdrawn. It is found, at birth, more or less perfect; not unfrequently without the smallest rent: but it is also found ragged, or with but a few shreds remaining, or wanting. Dr. Jacob says, "When I have examined it in subjects who have lived for a week, or a fortnight, after birth, as proved by the umbilicus being healed, I have uniformly found a few shreds still remaining. Thus," concludes Dr. Jacob, "it is obvious that the membrane does not disappear by a rent taking place in the centre, and retraction of the vessels of the iris, as supposed

by Blumenbach; but that it first loses its vascularity, then becomes exceedingly thin and delicate, and is finally absorbed."* This membrane is not absorbed, as supposed by Dr. Jacob; but it is ruptured at birth, by the action of light upon it. It is detached from the iris, either wholly or in part, to fall down upon and become adherent to the anterior capsule of the lens: there it remains and is never removed. That it is so ruptured may be seen by opening the eyes of a young kitten under water, when the membrane may be viewed and ruptured at pleasure; whereas, if the eyes be opened without this precaution being taken, it will be ruptured before the observation is complete. This membrane is particularly obnoxious to inflammation, and is very frequently affected, especially through blenorrhœal ophthalmia, when it becomes opaque, and is seen as a central spot on the anterior capsule. The membrane may equally be ruptured through inflammation, in utero. It speedily becomes opaque, even before the surrounding structures are apparently affected, and the opacity is never lost, though it never increases from the lymph-like film as at first observed. See Central Cataract.

Of the nerves.

The iris is not less well supplied by nervous influence than by arterial. Its nerves are derived from the lenticular ganglion, in number from fifteen to twenty branches, and from the nasal branch of the ophthalmic division of the fifth pair of nerves. From this, two minute twigs are given off, which

* Medico-Chirurgical Transactions, vol. xii.

pierce the sclerotica, and accompany the other ciliary nerves as far as the ciliary ligament, lying, in their course, between the sclerotica and the choroidea. These nerves reach the ciliary ligament, without interlacement: they enter and traverse the ligament, and minutely subdivide, to pass down, together with the arteries, into the iris, following a tortuous course. In the iris, they again divide, and then course along to reach the membranous edge, not the free edge, the free edge being formed by the uvea.

The lenticular ganglion receives a filament from the inferior oblique branch of the inferior division of the third or motor nerve of the eye. Thus, it may be said, that the ciliary nerves are motor, sensitive, and vegetative. But, though these nerves are derived from three sources, they combine to produce a single effect; there being no special nerves of motion, sensation, and secretion, but each nerve accommodates itself to the organ over which it passes, to produce motion, though a sentient nerve, or secretion. Whenever the vascular system is largely developed, and the nervous influence is, at the same time, important, the former being the ruder, the latter the more powerful agent, it claims a superiority; it disposes of function, the arterial distribution being accessory only to its accomplishment. Although there are organs in the body whose structure presents no like, some analogy may still be claimed, whereby functions are assimilated or design furthered. The iris is unlike any other structure in the body; without sensation, or power of increase, further than the

gathering of so slender a membrane. In death, the membrane assumes a median state, neither contracted nor dilated. In health, it is contracted; during sleep, it is contracted, and never more dilated than when waking.

Of the motions of the iris.

The motions of the iris are twofold—associated and independent: the associated movements depend on the contraction of the other iris; the independent, are those produced wholly irrespective of the other. The associated movements have been well explained by Arnold as depending on the junction of the third pair of nerves in substantia perforata media. These are prevented, and the iris is rendered motionless by the division of one of these nerves. In paralysis, also, of the muscles supplied by the third nerve, the pupil is dilated and the iris motionless. The independent motions of the iris are those which are the most important to attend to: they may even be found with complete amaurosis. Mr. Lucas bears testimony to five very painful cases which occurred in the family of a clergyman near Beverley. These five children were all born blind, and were unable to distinguish light from darkness. Respecting them, Mr. Lucas says, "Although the pupil is, in common, neither too much dilated nor contracted, and has motions, yet these do not seem to depend upon the usual causes, but are irregular." Dr. Watson esteems it evidence of disease within the cranium, the independent movements of the iris being preserved together with amaurosis; and to support this opinion, Dr. Watson

declares his views as follows: "We know that, in the healthy condition of the parts, the brightness of the light admitted to the retina determines the size of the pupil; but the motions of the iris do not depend solely or directly upon the retina. It has been ascertained by experiments made upon animals, that the pupil may be made to contract either by mechanical irritation of the *optic* nerve within the cranium, or by irritation of the *third* nerve; a motor nerve which sends filaments to the ophthalmic ganglion, whence the ciliary nerves, passing to the iris, are derived. Now the optic and the third nerves have some link of connexion within the brain; and if the morbid condition upon which the amaurosis depends is situate deeper than that point of connexion, we may understand, I think, how disease so placed may destroy the power of vision, and yet leave the connexion between the retina and the third pair unaffected: and then the influence of light falling on the retina, though it fails to create a perception in the mind, will be reflected back upon the third pair of nerves, and so continue to govern the motions of the pupil." * It would be important to establish this connexion, referred to in the foregoing sentence, if, really, it exist; and that Dr. Watson's statement may not carry with it, through his authority, more weight than it deserves, I will briefly refer to the anatomy of these two nerves. The optic nerve is attached to corpus geniculatum externum, and to

* Lectures on the Practice of Physic, vol. i. p. 338.

corpora quadrigemina through medullary fibres: thence, it passes to the orbit, without giving off, or receiving, branches: lying in its cranial course upon crus cerebri, and between this and the middle lobe of the brain, in the optic tract. It unites with the nerve of the opposite side to form the optic commissure: then, diverging, each traverses foramen opticum to enter the orbit. In the first part of its course, after its exit from the brain, it lies in contact with crus cerebri; sometimes unattached; at others connected by cellular tissue; but, although Spurzheim described this connexion as through cerebral substance, anatomists are for the most part agreed that such does not exist. In this part of its course, however, it is not surrounded, but merely covered by pia mater: when the nerve becomes round and firm, it is invested by a neurilema, which is finally lost on the globe of the eye. Thus these nerves connect the eye with the brain, their fibres dividing alone at the chiasma, one part passing to the right, another to the left, through a regular and constantly observed decussation of their fibres. The third nerve issues from the brain at crus cerebri, immediately in front of pons Varolii: it is invested by its neurilema, and passes to the eye through the sphenoidal fissure, where it receives a minute twig from the ophthalmic division of the fifth pair, as well as one from the cavernous plexus. Then, dividing into two branches, it enters the orbit. If the nerve be traced into the substance of the brain, its filaments may be followed into locus niger, and into the medullary substance

above and below this point. It is in consequence of the proximity of the optic nerve to these ultimate fibres of the third pair, that the supposition of union exists. That such union ever takes place is in the highest degree problematical; that no such connexion can for the most part be formed, is without doubt; there being frequently no union, or if union, only cellular, but never nervous. To allude to other union than this, would be to enter into a matter far too hypothetical; nor is this the place to trace the fibres of the medulla oblongata above locus niger in crus cerebri, into thalamus opticus; nor could it lead to a useful result, thus to connect the ultimate fibrils of the second and third pair of nerves. It may then, I think, be said, that the independent movements of the iris are not, in any case, the result of the transmission of sensation from the second nerve to the third. The iris is paralyzed by the section of the fifth nerve, equally with that of the second or third pair; consequently, it is not under the control of any one of these nerves, although the division of one destroys its power. The same result is produced by the division of a motor nerve, a sentient nerve, and the peculiar nerve of vision. It must not be forgotten, however, that the injury done, by the division of these nerves, is so great, that the result can scarcely be considered satisfactory evidence to establish one point or another.

It has been said, that the iris is under the influence of the will, because it may be made to contract

at pleasure. To prove this, a person with a very moveable iris has been selected ; a sheet of paper has been held at a certain distance from the eyes, and the size of the pupil remarked ; then, without any movement of the person, the individual has been desired to read characters traced upon the paper, and immediately the pupil has been found to contract. But this is no proof of the iris being under the influence of the will ; for it is essential, that the object be discerned, that the pupillary opening be diminished in proportion to the *intensity of vision* employed, if I may use the expression, that the light be concentrated upon the retina. Therefore, the iris is not immediately under the influence of the third pair, neither is it under that of the fifth, whilst it is void of sensation, neither the touch affecting it nor yet light directed upon it. Nor is it under the direct influence of the brain, though the pupil be found contracted in encephalitis. I am not in a position to make the assertion, though I doubt not, that the irides of an acephalous monster would act. With hydrocephalus, tabes mesenterica, worms in the alimentary canal, and other occasions of irritation of the splanchnic system of nerves, the iris yields uniformly to this irritation, and the pupil is dilated. In excesses, of whatever kind, in general debility of the system, the pupil is, as it were, the barometer, to show the power of the basic system of the animal economy. In strumous ophthalmia, where there is the greatest intolerance of light, so that the child is not content to close the eyes merely, but would bury

them in its pillow, the pupil may be found dilated. Now, although this photophobia does not depend upon the retina, but rather upon the fifth pair of nerves, through which it may be relieved, it might have been supposed that the pupil should be reduced to a pin-hole aperture, obeying the direct nervous power to which it usually submits ; but no, it obeys that system upon which it primarily depends. Photophobia may be relieved by direct means, but it shall recur and recur, until the tone of the general system has been so much altered and increased, that power shall be given to resist the morbid irritation, occasioned by the removal of the healthy influence of the basic or vegetative system of nerves. The pupil is more dilated in light-haired than in dark people. In the former, the power of life is less, the passions less strong, and the organism more feeble ; but they are more susceptible and sensitive, in every sense of the word, than are the dark-haired. Sight is equally powerful in the light and in the dark-haired. If contraction of the pupil depended alone on cerebral influence, then it should be greater in the light-haired than in the dark, for as sensibility is increased so should the pupil be contracted : but no, the iris is found to keep pace with the sphanchnic system, and in proportion as the nourishment of the body is performed, and the vigour of the system is great, so is the tone of the iris. The iris is kept in a state of constant tension, tension being its active condition, and common to this membrane with all other structures under the influence of the sphanchnic sys-

tem of nerves; even during sleep, this influence is not removed, for organs under this system never sleep; and its motions never tire, for they are involuntary; they are motions closely allied to those of the cilia of infusoria, or to those of the antennæ of insects. In its action, the iris is not unlike the fimbriated extremity of the Fallopian tube; which, being passive, floats loosely; but, during excitement, raises itself as a crest, to fall down upon and grasp the ovary with violence at the moment of seminal emission. This contraction is only in degree allied to muscular contraction, but partakes in nothing of the peculiarities of those contractions that are known to be muscular. In the Fallopian tube, as in the iris, no abatement of that force, which is maintained during the waking hours, is found to accompany the state of sleep, but when all other organs under the influence of cerebral or spinal influence are reduced to a passive state, to be again fitted by the general sleep of the body for renewed exertions on waking, these organs are still active, nor is their vigour diminished, but their state is similar to that observed during the waking hours.

The iris, then, may be said to be an irritable membrane, without sensation, and, its sole function, involuntary motion. It is highly vascular, whilst this condition is necessary to its activity.

The cataract knife carried across the anterior chamber induces expansion of the narcotized iris; the foreign body entering, overcoming, and removing the torpid state induced by the nar-

cotic, causes the membrane to reassume its natural or tense state, to recover its irritable condition,—that condition being analogous to the irritability possessed by the plant, where perception is expressed by motion alone,—motion without design.

It is evident that the iris yields to the retina during health, and contracts as this is affected, causing the image to be painted upon the retina in proportion to its contraction; but it yields to the influence of light upon the retina, as its immediate stimulus, being governed primarily by the great basic system of vegetative life.

SECTION II.

OF CATARACT.

General characters.

THE lens being the portal, as it were, through which the rays of light must pass to produce the sense of sight, it is necessary that it should be transparent for their passage; or that, having lost this property, it be not allowed to remain an obstacle to vision, but that means be adopted to remove it from its central position.

As the watery parts of the lens are absorbed, it is rendered firmer and smaller, and, in old age, the centre may be almost impermeable to the rays of light, if indeed not already opaque. When the crystalline loses its transparency, it is named a cataract, let the opacity be in whatever degree, or however produced; whether of the lens proper, its capsule, or aqua Morgagni: it may be complete, or partial; it may be temporary, or lasting.

The term cataract in itself implies nothing by which may be recognized that it at present signifies:

ὑπόχευμα was formerly used to designate the disease in question; but this word is no better than that from which ours is derived, καταράκτης,* ἀ κατα-ῤῥάσσω.

* This word was sometimes used to signify vectis, a bolt or bar; porta a gate: hence, a water-gate, as the lock of a dam or canal. Thus, cataracta is used by Livy, and others, to signify portcullis, as in the following passage, Lib. xxvii. cap. xxviii.

"Vigiles, velut ad vocem eorum excitati, tumultuari, trepidare, moliri portam, cataracta dejecta clausa erat, eam partim vectibus levant: partim funibus subducunt in tantum altudinis, ut subire recti possent. Vixdum satis patebat iter, quum perfugæ certatim ruunt per portam: et quum sexcenti ferme intrassent, remisso fune, quo suspensa erat, cataracta magno sonitu cecidit."

Vegetius, also, uses the word cataracta in the same sense.

"*De cataractis, et portis, ne exurantur ab ignibus.*"

"Sed amplius prodest, quod invenit antiquitas, ut ante portam addatur propugnaculum, in cujus ingressu ponitur cataracta, quæ annulis ferreis, ac funibus pendet, ut si hostes intraverint, demissa eadem extinguantur inclusi."—*De Re Militari,* Lib. iv. cap. iv.

Thus is derived the English word cataract, to signify obstruction.

Hippocrates described cataract as disease of the crystalline, terming it γλαύκωμα: thus γλαύκωψ, qui cæsios habet oculos. This more correct opinion of the nature of the disease was thrown into obscurity by the false doctrine of Galen and his disciples, who held the lens to be the immediate organ of sight: and this opinion gained ground and was generally received, until Lasnier, in the middle of the seventeenth century, endeavoured to revive the old teaching of Hippocrates. To say the most, however, doubt was raised as to the seat of cataract, and it remained for Mâitre Jean, in the commencement of the last century, to correct opinion by re-establishing the truth, as taught by Hippocrates, that the lens was the seat of cataract. See Traité des Maladies de l'Œil.

Cataract may be lenticular, capsular, or capsulo-lenticular; it may be hard, soft, or fluid; it may be complete or partial. Further, there are spurious cataracts, of which there are several varieties; but it is proposed, at present, to confine the attention to disease of the lens and its investing membrane, spurious cataracts implicating other structures in the eye, and having no direct connexion with the lens.

There are numerous kinds of cataract: therefore, a common definition, any more than a common operation, will not suffice; but each requires to be distinguished, according to its position; according to its consistence; according to the amount of inflammation by which it has been produced; according to its development, or its production. The ordinary nomenclature has, here, slightly been departed from, and some terms, as *fluid-hard*, a conjunction of antagonists not readily comprehensible; *dry-hulled*, both inconsequent and discordant; with some others, not more euphonious, have been omitted.

Every cataract is, in some sort, peculiar, according to its production; consequently, the productive cause being known, a classification according to causes is both convenient and natural; and for the just and proper treatment of cataract, it is indispensable that the productive cause be recognized: without this, an accurate diagnosis cannot be formed; much less an accurate prognosis. Frequently, the causes of disease cannot be accurately defined; either our knowledge of the structure of parts, or of

their pathological changes being too limited ; or, the seat of disease being hidden from view, we are unable to trace each symptom to its source, but are compelled to speak of them *en masse*, as known effects produced by certain changes. In the eye, however, it is not so : at least in those structures with which we are now concerned : each morbid change may be seen; so that, not only what is present may be defined, but a knowledge of that is present allows occurrences to be foretold with the greatest certainty : events following in certain succession, their progress alone varying. For the sake of information respecting the operation for cataract, it were much to be desired, that statistics were framed on some intelligible and fixed principle, that those who consult them might be able to glean information, although they should be ignorant of the operator's views of disease, or of his manual ability. In looking over tables of operations for cataract, we perhaps learn, that a dozen sections of the cornea have been made, and as many cataracts extracted. We, perhaps, find, that eight of these have succeeded, and that four have failed : here, however, we are left ignorant why extraction was preferred to discission, or reclination, and why the four failed. And so it must ever be, if the operator's views be not known, and no fixed classification adopted, after the production of the cataract. It is not every operator who declares his views as honestly as M. Malgaigne, who says,—" Extraction presenting a considerable diffi-

culty in the formation of the flap, and a serious risk, viz., that of the discharge of the vitreous humour, I adopt depression as a general rule." * Thus it is, one operator prefers extraction to reclination, or discission, and consequently extracts all indiscriminately ; whilst another, more timid or less successful, reclines the cataract, for the most part, and extracts only to save appearances. It may be asked, of what consequence is it, the operation terminating successfully, whether the soft cataract be extracted or the hard one depressed ? Inasmuch as, under certain conditions, reclination is infinitely more hazardous than extraction, and the reverse ; and as there are cases in which certain operations appear to be indicated, their greater success being no longer doubtful, the operation selected should be that pointed out by a perfect consideration of the case, rather than that most convenient to the surgeon : and, as it is impossible to form an accurate diagnosis, considering alone the consistence of the lens, by so much the more will it be impossible to foretell the result of the operation, there being no single symptom constant, but each case in some sort peculiar, so, in every case, neither symptoms nor appearances should alone guide, but, also, the history. It would be easy to produce a thousand varieties to show the importance of judging less by what is seen, than by that is understood. It is too frequently the case that, the question being decided as to the den-

* Manuel de Médecine Opératoire, fourth edition, p. 399.

sity of the cataract, the cornea is opened, or the lens broken up, or reclined, and that more upon the whim of the moment than upon any predetermined plan; notwithstanding that these operations are really worthy of thought, and of as much care and delicacy of touch as any in surgery: for as no sense is so valuable as that of sight, or more frequently or more easily destroyed, it behoves, not only that dexterity be acquired in the performance of operations, but also, that the cause of the disease be so far considered, as to ensure a reasonable hope of the fulfilment of the prognosis.

The following table comprises every known variety of cataract; so that each being referred to its proper cause, the nature of the cataract may be at once seen; the reason why the operation adopted was selected, and the cause of failure, when such occurs. The second table is such as I have been in the habit of using, and merely filled up for illustration. It appears to me sufficient, though simple, and neither tedious to refer to, nor difficult to construct.

Table of the forms of Cataract.

Lentitis . .	Capsulo-lenticularis. Capsularis anterior. Capsularis posterior. Centralis.
C. Congenita .	Capsulo-lenticularis. Lenticularis. Capsularis. Centralis.
C. Morgagniana.	
C. Traumatica .	Capsulo-lenticularis. Capsularis.
C. Senilis . .	Lenticularis. Capsulo-lenticularis.

Date,	Name.	Age.	Sex.	Cataract.	Consistence.	Simple or complicated.	Operation.	Cause, with Remarks.
1845. Jan. 6th.	J. Beale.	4 mo.	Male.	Congenital.	Gelatinous.	Simple.	Discission repeated three times.	Inflammation. Capsules irregularly spotted. Pupils perfectly clear in six weeks. Both eyes operated on at the same time.
	A. Tyler.	18	Female	Capsulo-lenticular.	Soft.	Adhesions of the iris.	Discission.	Iritis. Rheumatic inflammation, which spread rapidly to the capsule of the lens.
1846. Nov. 21st.	J. Zakowsky	15	Male.	Traumatic.	Soft.	Complicated with disease of the humours of the eye.	Discission.	A kick from a horse. Sight was not restored by the operation, although the pupil was speedily cleared. A luminous appearance of the eye remained. See case.
	G. Glover.	65	Male	Lenticular.	Hard.	Simple.	Extraction.	Left his bed on the fourth day. Corneal wound healed without untoward symptoms: superior section performed: good sight restored: cataract forming in the other eye.
1847. March.	E. Calandria,	18	Female	Capsulo-lenticular.	Firm.	Synechia-posterior.	Reclination.	Chronic inflammation, which attacked first the cornea, then affected sclerotica, iris, and subsequently lens. On the fifth day after the operation, sight was wonderfully good.
August.	A. Smith.	32	Female	Capsulo-lenticular.	Soft.	Synechia-posterior.	Discission. Capsule removed with hamulus at second operation.	Conjunctivitis, sclerotitis, retinitis, and lentitis; recovered imperfect vision.

Thus, cataract is produced by inflammation; by deficient nutrition; by accident, or by wound; or it is congenital. To one or other of these causes must be referred every cataract that ever was formed.

Definition of cataract.

Loss of transparency is diminished vitality: complete opacity is death of the lens. Cataract is essentially a local disease, not necessarily implicating the other structures that enter into the formation of the eye, neither does it alter the shape of the organ, but occupies the same space devoted to the transparent lens. However, by deposit of lymph upon it, or effusion within the capsule, it may be rendered of more bulk than the normal lens, so as to press upon the iris. But, although it may be looked upon as a local disease, it may not be neglected, lest it entail serious changes on the more delicate structures in its vicinity; for, having lost its transparency, it has become useless to the purposes of vision, a truly hurtful material, as it were, a foreign body.

Cataract is known by the lifeless appearance it gives to the eye. Instead of the bright black pupil, a pale dull body is observed, situated immediately behind the iris, in the axis of vision, to obstruct the light. Yet, notwithstanding this barrier to the entrance of the rays of light, day is distinguished from night; and it is only when the cataract is mature that the light is so effectually shut out as to prevent all useful vision. The complete formation of the cataract is independent of its consistence; conse-

quently, the terms mature, and immature, cataracta matura et immatura, are well adapted to express the stage of progress at which any particular cataract may have arrived : the terms express well that it is most important to attend to; for, as a cataract may not be touched whilst it is immature, so it ought to be removed, when it has gained its maturity. The smaller the cataract, the better the vision enjoyed ; and the harder the cataract the smaller it is : so, when mature, the hard cataract allows a larger amount of light to pass to the retina than does the soft. The hard cataract forming slowly, the nucleus of the lens presenting the greater opacity, by dilatation of the pupil with belladonna, sufficient light may be admitted within a short time previous to the maturity of the cataract, to allow a large print to be read. With cataract, sight is lost gradually, varying from a few hours to several years. First, vision is troubled; objects are, afterwards, seen spotted or as through a mist ; then, the sight becomes muddy and indistinct, the object is, at last, lost, and light is only told from night. The softer the lens the more rapidly does the opacity spread; and, being quickly diffused throughout its substance, an impediment to the entrance of light is soon formed, and rendered still more complete by the increased size of the softened lens, which, pressing against the iris, so effectually closes the pupil as to allow of merely the faintest appreciation of light. But loss of sight is not invariably in a ratio to the opacity: some-

times there will be found what might be deemed an insufficient structural change to produce so great a degree of blindness; and, on the other hand, with a very general opacity, a very fair and useful vision may be retained. The eye being shaded or turned away from the light, the cataract patient is enabled to see better, than when a full stream of light falls upon the eye: for in proportion as the light is strong, so is the pupil contracted; and the greater density being in the centre, the most complete barrier is thus opposed to the entrance of the light. The greater opacity being in the centre, objects situated immediately in front of the eye may not be visible, even during an early period of the cataract's formation; whereas they are readily distinguished when moved to either side of the median line. Before opacity is complete, a large clear print may be read, the back being turned to the light, or the room being moderately darkened. Twilight, however, is the favourite light of the cataract patient; then he will go abroad without his shade, and will no longer hang his head, but fix the eye, as though he could discern objects. The cataract patient is always in a measure independent, and, unlike the amaurotic, can grope about and even amuse himself; whilst the latter, entirely dependent on the good-will and care of others, searches the light forgetful of himself, appearing to mistrust others in his great darkness; his head is thrown back, his brow raised, and the eyes widely thrown open; truly, "there is no speculation in those eyes."

As the greater density is in the centre of the lens, so is the greater opacity and the deepest colour. The colour varies from a cream colour, and bluish white, to yellow and amber. It is always less intense in situ than when removed from the eye, the colouring matter being rendered more equable and dilute by the light falling upon it: thus, a cataract with a hard, dark nucleus may not appear darker than yellow, and a black cataract before its removal, presents a reddish or dark orange tint. The colour of the lens is produced by the shrinking of this body, its solid particles being rendered more compact, whilst the watery are absorbed; thus, the harder the cataract the darker it is. The only colouring deposit in the cataract is black, and readily distinguishable from the natural solid old lens, which acquires colour just as a tendon in drying. The black pigment met with in the lens may exist in every degree, from a spot or two in the centre, to the complete blackening of the organ. Black cataract is very rare; it is, however, sometimes seen, and as black as black-lead: but, although it be perfectly black when extracted, it never appears darker than plum-purple, or puce, in situ: the pigment deposit to a less extent, so as to produce a bistre colour, and that, perhaps, partial, is more common. When the nucleus of the lens is broken down, and the natural consistence of the organ is lost, the opacity is white, bluish white, greyish white, cream colour, and so advancing in hue, there being the least colour with the

least consistence, and colour and consistence increasing together: for as the colour of cataract varies to correspond to each shade of amber, so does its consistence from that of water to that of stone. The deepest colour is there, where is the greatest density; for there colour is most appreciable; and as each colour is capable of being diluted until only traceable, how much more so yellow, which, when seen in a particle as separated from the mass, is scarcely to be told. If it were possible to colour the growing cataract with rubia tinctorum, to give to each particle an equal amount of colour, the greater condensation of the centre would so overpower the faint circumference, as to render it scarcely visible. What is now said of colour, may be said equally of opacity. Opacity is generally said to commence in the centre and to pass to the circumference. When the homogeneous nature of the lens is taken into consideration, and it is remembered that a cause operating on a part affects the whole, it will be granted, that the circumference equally with the nucleus is disposed to undergo a change of structure, or retain its integrity; and seeing that the diffused opacity is so faint, that apart from the mass it is scarcely distinguishable, so it may be inferred, that the dense centre only acquires a like opacity as the circumference, particle for particle, the greater agglomeration of particles producing the deceptive appearance.

Cataracta dura.

In senile cataract, cataracta dura vel tenax of

authors, the truly hard cataract, a common cause affects the whole, no one point is more exposed, or favoured, than another; a constitutional cause produces the opacity, and the same continuing, this advances. The opacity, at first, is so slight as not to be discernible to view, and its approach is only evidenced by symptoms; it proceeds gradually, and becomes visible, occupying a series of years from its commencement to its completion. When first remarked, it is seen as a central opacity, the dense nucleus occupying this position. I have examined extracted cataracts at every period of their formation, and, with an opaque nucleus, I have never been able to believe the circumference so cloudless, as in its normal condition. The nucleus being opaque, the circumference may still remain transparent, deprived, only, of a portion of its lustre, to appear sane, on a superficial examination, as compared with the greater opacity; but the same action has taken place in it as in the centre; it is deprived of its vitality in an equal degree, and, continues to be pierced by the rays of light, only by reason of its less compact consistence. I am unable to look upon cataract from deficient nutrition as analogous to gangræna senilis; and still it may be so likened, if it be held that opacity commences in the centre. The circumference of a healthy lens is frequently as firm as the nucleus of a cataract. If the lens be likened to a sponge to be nourished by the halitus arising from the capsule, its death will be considered

as owing to the non-secretion of its sustaining fluid : but, so long as the circumference remains moist, the nucleus must partake ; for, if this be its nourishment, it must ever be received through the softer circumference; but the circumference remains moist and inappreciably affected by the growing opacity, whilst the nucleus is already opaque. The centre, being more dense, would necessarily require less fluid nourishment than the circumference, and that part most served by it would feel its loss the most. Aqua Morgagni is a limpid fluid, scarcely, if at all, differing from the aqueous humour, yet, its office is to nourish that the other destroys ! I believe equally in the essential nourishing power of the one, and the destructive power of the other. The capsule is to the lens, that a theca is to its tendon ; to protect it and provide a lubricating surface, to moisten its circumference for the passage of light, that the transition from the rarer humours may be rendered less abrupt : whilst the aqueous humour distends the cornea and forms a connecting medium between the two surfaces of what may be regarded a meniscus, formed by the cornea and the anterior capsule. The aqueous humour appears to exercise some influence over the lens in causing its absorption ; but, the same is produced, the capsule being opened, without implicating either of the chambers of the eye. Its quicker absorption after discission is rather to be attributed to the disturbance of its particles, than to any direct influence of the aqueous

humour. Indeed, the solvent action of the aqueous humour is not more than that of common water.

The change that takes place from transparency to opacity, is as the bloom of health faded by death. It is not referrible to a deposition of lymph, but is an absolute change in the component parts of the organ itself, a change which, once entered upon, must be carried through, to the complete destruction of vitality.

Cataracta mollis.

In soft cataract, opacity spreads gradually from a centre, rapidly to embrace the whole, as in cataract from wound, the capsule being punctured; or from inflammation, the soft circumference being first affected, and then the nucleus. Opacity commences anteriorly or posteriorly as inflammation is developed in the anterior or posterior surface of the capsule, and spreads rapidly or slowly in proportion to its intensity. To the same cause is referrible, as has been before stated, the varieties of consistence to which cataract is subject. Every cataract, the result of inflammation, is capsulo-lenticular; for as inflammation is not first excited in the lens, but propagated to it, opacity of the capsule must precede that of the lenticular body. In proportion to the disintegration of the lens so is its size increased; it presses forward the iris to render it convex; it may may even thrust it against the cornea. With soft cataract, a narrow dark line is visible, girding the pupillary opening; this is formed by the uvea, which is slightly displaced by the pressure from behind, and is thrust forward to form what now becomes a

prominent rim to the pupil. A black line is also observed with hard cataract; not from pressure upon the iris, however, for the more the lens retracts the broader the shadow becomes. It is a shadow thrown by the iris, and only observable so long as the capsule remains transparent.

Cataracta fluida.

Fluid cataract is more common in brutes than in man: it is not unfrequently met with in the sheep and in the horse. This is by no means the ordinary cataract of infancy, but scarcely more common at this time than in later life; the cataract of children is soft and gelatinous, and never hard. One kind of fluid cataract, that I call *subsidens*, where the capsule retains its transparency, the lens being disintegrated to float through a clear fluid, is the nearest approach that I have been enabled to observe towards regeneration of the lens.

Of the productive causes of cataract.

The chief causes of cataract are, deficient nutrition and inflammation. The first, as being the companion of old age, is unquestionably the main predisposing cause; but inflammation is scarcely second to it. Every inflammation that attacks the eye, if allowed to proceed, may excite cataract, and each variety produces, in some sort, a peculiar opacity; as gouty inflammation is followed by glaucomatous cataract: acute ophthalmitis by soft capsulo-lenticular cataract: inflammation of the hyaloid membrane by posterior capsular cataract: iritis by the varieties of opacity of the anterior capsule, &c. Many causes are assigned as productive of cataract, without it being quite evident how the change in

question shall be brought about. For instance, lime-dust from lime-kilns; objects in rapid motion, as the machinery of the weaver's loom; smelting furnaces, &c. It is evident in all these cases that one cause operates to produce opacity, be it in the stoker, the weaver, or the smelter. In all these occupations, the individual is exposed to a high temperature, and to sudden vicissitudes of temperature. Thus, the lime-kiln, for the most part, in an exposed situation, offers no shelter to those attendant upon it, but when they are exposed to the intensity of its heat; they are, consequently, immediately removed from an elevated temperature to be exposed to cold winds. These persons are particularly sensible to the cold, and being exposed not only to sudden changes from heat to cold, but to the night air and consequent humidity, are also very subject to rheumatism. The same may be said of those working in factories: having to leave their beds at all hours of the night, according to turn, they hurry through the cold damp air, almost unclothed, anxious to enjoy their beds so long as possible, but fearful to exceed the moment that should find them at their work: through their long labour in crowded and ill-ventilated rooms, their exposure to a high temperature whilst at work, and their sudden change to the outer air and their cold habitations, with their badly nourished bodies, irregular hours, and undeveloped forms; their misery, hard work, and exposure, render this class of persons subject to all the ills that flesh is heir to, but to none more frequently than to

rheumatism. The smelter, attending to his duties in front of the furnace heated to a white heat, in raking the metal, and careful that it be neither lost nor insufficiently melted, is exposed to a glare and heat such as no other occupation requires. In consequence of the excessive heat that he is obliged to suffer from time to time, he slakes his thirst by long potations. He is, for the most part, in appearance, a robust man ; well paid, well fed, and well housed. Perhaps, his immoderate use of liquors, together with the changes from extreme heat to winter's cold, is sufficient reason why the smelter should be scarcely less subject to inflammation than is the miserable factory slave. The use of spirituous liquors, without frequent alternations from heat to cold, is not productive of cataract : neither is volcanic influence. Having passed several months in a volcanic country, and made careful inquiry into the circumstance, I find, that the opinion is founded erroneously. Amongst the productive causes of cataract, a strong natural light has been ranked. It would have appeared more consonant with that which might have been expected, had it been considered that the admission of noon-day light to the child's eyes had disclosed, rather than produced, opacity of the lens : for, as is well known, neither the retina is yet perfected, nor is the lens, until some months after birth, sufficiently clear to allow a feeble light to produce an impression. Nature would not require that the education of the eye should be commenced under circumstances peculiarly detrimental to the organ,

for her laws are eminently conservative, and the protection of faculties is ensured rather by following the dictates of nature, than through those artificial laws which govern society. It is natural that the young child should seek a brilliant light, and as its effect is less on the sensorium than when the lens and retina are prepared fully to receive and estimate it, it may, I think, be concluded, that light does not affect the lens to cause opacity. However, although the lens be the peculiar organ for the refraction of light, and, consequently, it might be thought to be itself uninfluenced by it, the reverse obtains. By the use of a powerful artificial light, such, for example, as is produced by the burning of phosphorus in oxygen, Werneck asserts, that the cataractous lens may be broken up, the light being concentrated by means of a lens, and the focus directed upon the crystalline capsule. Dr. Werneck, in his experiments upon animals, found that a strong light directed upon a cataract, by means of a lens, produced its immediate disrupture into three or four pieces, the disunion taking place through the membranous septa which partition the body of the lens. It was, also, found, that neither the retina nor the cornea were injured in these experiments; and it is worthy of remark, that absorption took place scarcely less rapidly than when the needle is used to produce this effect. Now, I never heard that infantile cataract, or that said to be produced by the influence of light, was more rapidly absorbed than congenital cataract, but that its absorption was effected in a

various space of time, generally, however, occupying from ten to fourteen years. For these reasons, infantile cataract, properly so called, will not find place in these pages, but will be distributed under the several heads of inflammatory and congenital cataract.

Some writers revel in anomalous cases, and that without explaining to their readers what they should in justice to them enter into. In this way, errors are begotten and propagated, errors founded on justice, but admitted too generally, are no less errors than though they were void of foundation. Of this kind is the rapid formation of cataract. It may be read that double cataract shall arise in the course of a single night: that an individual shall retire to rest in perfect health, with his sight unimpaired, and that in the morning he shall find himself almost helpless, double cataract having formed. That such a circumstance may have occurred is within the range of possibilities, but it is unquestionably of so rare a nature that the recital of such a case is well worthy of name, place, and date. Far more common is loss of colour in the hair: this I have known, as a consequence of grief, to have taken place in the course of a night. I have known, also, ophthalmitis to have run its course, and to have terminated in suppuration of the globe of the eye, in the space of twenty-four hours: but in explanation of such an unfortunate occurrence, it may be stated, that the person was at the time under the influence of mercury, and most thoughtlessly exposed himself

during the whole day to a bitterly cold wind, driving in an open carriage from breakfast-time in the early morning until a late dinner-hour. He went to bed without even so much as pain in his eye. Midnight had scarcely passed, however, before he was roused by intense pain, but, unwilling to disturb the house, he did not seek relief. By eight o'clock the following morning the destructive process was so fully established, that it was but too evident that vision was for ever lost.

It is yet, I believe, a disputed point, whether the presence of cataract in one eye may induce opacity in the other: and further, whether the removal of a cataract will prevent opacity of the other lens, will arrest its progress, or will cause it to disappear, having already commenced. These are questions which may be answered negatively and affirmatively. The term sympathy has a very extended sense, but a less well-determined signification. A certain sympathy exists between organs, as the brain and the stomach, through which vomiting may be induced, by the presence of a disgusting object, a disagreeable odour, or the knowledge of an untoward event; or such as exists between the uterus and the mammæ: but with reference to the crystalline lens, this curious hidden influence, sympathy, is used to express the idea, that inflammation may be propagated to the other eye, having affected one, without the combination of external circumstances, or an inherent predisposition to such affection; but from a singular disposition on the part of the eye itself to

follow a baneful example without a cause, further than sympathy, to its destruction. Such a use of the term sympathy I hold to be an absurdity. If rheumatic inflammation attack one eye, or strumous ophthalmia, or syphilitic iritis, it cannot excite surprise that, the cause being general, both organs should be attacked equally as one. If hordeolum be seated on one lid, with great intolerance of light, the lid of the other eye being unaffected, but light equally painful to both, it would surely be superfluous to attach sympathy in explanation of the photophobia. When cataract has been produced through old age, or rheumatic inflammation, say in the weaker eye, what is to prevent the same cause affecting the other, or in what measure can the removal of the already formed cataract prevent opacity of the other lens, the same cause continuing to operate? Notwithstanding, it is gravely asserted, that cataract is not only prevented by the removal of that already formed, but that, opacity having commenced, transparency may be restored to the lens, by removing the cataract from the other eye. Such was the opinion of the Wenzels, Charles de St. Ives, and others; but, although the opinions of these famous men are to be respected, we are not bound, our knowledge of pathology generally being vastly extended beyond that which governed them, to yield a well-digested opinion in consideration of that expressed long ago, or to hand down in perfect faith what to-day may be stigmatized as credulity or ignorance. Nothing is more certain, than that

opacity once commenced in the crystalline lens, be the cause what it may, is established, and must proceed to occupy the whole body : nor is the assertion, that transparency may be recovered, made on the slightest foundation ; for opacity having once affected the lens, though it be but the merest spot, does not yield its ground, but advances to occupy the whole, and is only removed by the absorption of the lens. Opinions at variance with this must be considered errors of diagnosis, a false cataract having been mistaken for opacity of the lens.

A mature cataract, if allowed to remain in situ, is injurious. It may give rise to inflammation, which may, unquestionably, be propagated to produce cataract in the other eye ; but, it is more especially injurious, by preventing the passage of light to the retina, by withholding its natural stimulus from the membrane, which, thus long deprived, may never recover its power, or only in part, and that after the lapse of time. It is, moreover, injurious, in inducing the too liberal use of the remaining eye, by obliging this to perform double duty, as though double power were imparted to the one through the extinction of sight in the other. For these reasons, a cataract should be removed so soon as it is mature, that the exposed retina may again be useful for vision, to remove the burden from the other eye. Frequently, when a lens has been removed, very useful sight may be regained without the interposition of an artificial lens ; but, if it be necessary for the accommodation of the two eyes to single vision, a lens may easily be

adjusted to that eye which has been deprived of its natural lens, that so the power of the two eyes may again be equalized.

So long as the retina retains its sensibility, the iris is obedient to it, contracting in proportion to the influence of the light, its motions being impaired in the same ratio as the removal of the stimulus or in proportion to the density of the cataract. The iris becomes sluggish in proportion as the cataract is developed; its motions may, however, entirely cease, without amaurosis being produced, a large swollen lens pressing upon the membrane mechanically to impede them. However, it will yield to belladonna, if it be not adherent to the capsule of the lens, but it will respond only to belladonna in proportion as it is free from adhesions, remaining immoveable, if adherent in its entire pupillary circumference, or becoming irregular in its forced contraction, retaining its points of adhesion, wherever lymph may be deposited.

Cataract is always undergoing absorption, and that in an equal degree to its production, its removal being slow or rapid as was its formation. Thus, the hardest cataracts are in time absorbed, frequently, merely a hard, dark-coloured, or even stony nucleus being found. The capsule, however, remains; becoming a shrivelled, dry, tough membrane, resisting all natural means of removal, and exists as an impediment to vision, until removed by art. The capsule, whether entire or in fragments, is scarcely influenced by the absorbent vessels.

Which sex is most liable to cataract.

Maunoir's observations * embraced 121 cases of cataract, of which 61 were males and 60 females. These cases were collected during four seasons at La Charité, in M. Roux' wards, an equal number of beds being devoted to either sex. The same result is found on consulting Dupuytren's cases; male and female being affected in the same degree: thus, of 207 cases, 135 were males, and 72 females; the beds in the men's wards being double the number of those appropriated to females. At the Josephinum, in Vienna, a different result has been found, with an equal number of beds for one sex and the other. Of 801 cases, 508 were males, and 293 females, as the annexed table, taken from Professor Jäger's protocol, will show. But, I deem it immaterial to establish absolutely, that cataract is developed more frequently in one sex than in the other, although it is very reasonable to believe that such should be the case, when it is remembered how much more exposed to accidents the man is than is the woman, how much more frequently inflammation of the eye is observed in the male, be it owing to general or local causes, be it in the child or in the adult: and when the greater age is remembered to which the man attains, it will scarcely be doubted that, in a given population equally composed of male and female, the larger number of cataracts might be found to belong to the former.

* Essai sur quelques points de l'Histoire de la Cataracte.

Of the Sex of those operated on for Cataract.

School Session.	Soldiers.	MEN.		WOMEN.	
		Unmarried.	Married.	Unmarried.	Married.
1826-27	2	3	8	4	9
27-28	3	4	29	1	17
28-29	3	6	14	2	8
29-30	4	7	20	6	8
30-31	2	2	9	5	15
31-32	3	5	7	6	12
32-33	4	9	16	4	13
33-34	2	9	24	5	11
34-35	4	4	25	2	16
35-36	1	4	18	3	11
36-37	2	5	14	5	11
37-38	6	8	32	3	17
38-39	3	8	14	4	4
39-40	1	4	27	1	16
40-41	1	2	42	2	14
41-42	3	10	27	3	16
42-43	2	9	10	5	17
43-44	2	7	18	9	8
	48	106	354	70	223
Total men, 508.				Total women, 293.	
Total, 801.					

Of the age at which cataract is most commonly developed.

A more important question, is the age at which cataract is most frequently developed. All the statistics to which I have referred, to determine this question, agree in so far as to show that the period between sixty and seventy years of age is that at which cataract is most frequently developed.

Fabini found the ages of 500 cataract patients who had come under his notice, to have been after the following order :—

From	1 year to	10	14
11	„	20	16
21	„	30	18
31	„	40	18
41	„	50	51
51	„	60	102
61	„	70	172
71 and upwards			109

Thus, placing rather more than one-third between sixty and seventy years. Maunoir, also, found one-third of the cases that he examined, 121 in number, between the periods sixty and seventy. On referring to the following table, the ages of the patients admitted into Jäger's wards, from the opening of the ophthalmic institution at the Josephinum, in the year 1826, until the close of the school session, 1844, will be found. It will be seen, that rather less than one-third of the whole number is placed between sixty and seventy years ; one-fifth, between fifty and sixty ; one-fourth, between the two periods forty and fifty, and seventy and eighty, each of these periods presenting almost a like number, each equal to one-eighth ; whilst the remaining fourth is found to occupy the three periods from ten to forty, each representing rather more than one-thirteenth.

The ages of those operated on for Cataract.

School Session.	4 to 7	7 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90
1826-27	—	1	2	—	3	2	5	10	—	—
27-28	—	2	2	1	3	4	9	25	1	—
28-29	—	1	3	1	2	2	7	10	1	—
29-30	—	2	4	2	5	7	12	3	2	—
30-31	—	—	4	2	1	2	5	12	2	—
31-32	—	—	4	3	3	3	4	8	—	—
32-33	—	1	7	5	3	5	4	9	3	—
33-34	—	2	6	2	5	5	5	15	3	—
34-35	—	—	—	4	5	4	8	14	4	1
35-36	—	3	1	4	1	3	10	8	2	—
36-37	—	1	3	4	1	3	6	10	3	—
37-38	1	—	4	5	2	5	12	15	5	1
38-39	—	—	2	5	2	2	7	3	5	1
39-40	—	—	2	1	—	2	11	15	10	1
40-41	—	—	2	—	2	9	13	26	10	—
41-42	—	—	3	5	1	14	4	11	11	1
42-43	—	1	4	6	2	3	4	12	5	—
43-44	—	2	2	1	2	6	10	14	5	—

Of the composition of cataract.

"It has been shown by Wurzer and Lassaigne, that when the lens is opaque (in cases of cataract) it contains an excess of phosphate of lime. This may be the cause of the opacity, or it may be due to the coagulation of the protein-compounds by the presence of a free acid. Wurzer determined the composition of an opaque lens from a bear. It contained (after the removal of the water):

Phosphate of lime . . .	68.9
Carbonate of lime . . .	12.6
Carbonate of magnesia . .	3.6
Peroxides of iron and manganese .	0.7

Mucus (?)	7.5
Phosphate of lime with an animal matter .	2.1
Chloride of sodium with animal matter .	3.2
Solid fat	1.1

Lassaigne analyzed an opaque lens from a horse; it contained:

Coagulated albumen	29.3
Phosphate of lime	57.4
Carbonate of lime	1.6
Soluble salts and other matters . .	17.7"*

Let it not be supposed that these analyses of Wurzer and Lassainge represent the composition of ordinary cataract: far otherwise, indeed, is it. It must be a rare cataract to yield sixty-eight per cent. phosphate of lime, besides other salts, or less than ten per cent. of animal matter. Nothing is easier than to define cataract: it is readily understood to be opacity of the lens; and the opacity is not less distinguishable from transparency of the same body than is light from darkness. But in what opacity essentially consists we have yet to learn. The chemist has yet to teach what is added, or what taken away, that may constitute transparency or opacity. The fœtal lens is opaque, but its chemical composition scarcely differs from that of the transparent lens. It contains a larger amount of water whilst its solid parts are deficient: its size is larger whilst its weight is less than that of the transparent

* Animal Chemistry, by Dr. J. Franz Simon. Sydenham Society's edit. vol. ii. p. 420.

lens: it is as yet in a crude state, and only perfected as it gains its transparency. Again, through the loss of its watery parts, it also loses its transparency: now, although the opacity of old age is very different from that of the undeveloped lens, the result is the same, opacity being complete in one and the other. Nothing is added to cataract from diminished nutrition; its watery parts alone are removed, and it becomes consolidated. If a transparent lens be pierced, with a fine instrument, to its centre, it immediately softens, its substance is broken down, its watery parts are increased, it swells to produce tension of the capsule and inflammation of this membrane, and it is rapidly absorbed. The same takes place if a cataract be pierced to its centre. In the transparent lens, vital action is possible, but impossible in the cataract, it being dead. The same result is induced in one case and in the other: one is removed equally quickly with the other. The action in the lens and in the cataract is rapid and violent, or slow, as is the depth to which the penetrating instrument is carried. Inflammation of the lens proper is scarcely produced even by a deep wound: it is impossible it should be produced in a cataract. Cataract, being produced without inflammation, is not a deposit of lymph, is not an increased vital energy, as inflammation would indicate; but is an intrinsic change of the particles of the lens itself from transparency to opacity. The capsule being only opened, without disturbing the lens, no essential change is produced, saving the loss

of transparency : so far from anything being added, its bulk is reduced as the opacity extends, until it is entirely absorbed.

The lens, then, being opaque during fœtal life, and approaching transparency only as development advances, and the fœtus is being fitted for independent life; and as it again assumes that state, when, through the body's defective nutrition, life can no longer be sustained, and as the same occurs, its individual life being attainted, through inflammation, disunion from its natural connexions, or other such cause ; cataract may be considered, not essentially a chemical change, but that change which every other part of the body undergoes from life to death.

Entozoa in the lens.

Entozoa have been found in the opaque lens of the human eye ; and of these three varieties ; viz., Filaria, and two varieties of the family Trematoda ; viz., monostoma and distoma. Dr. Nordman says:— "In the month of May, 1832, I was present at two operations of extraction performed on old women by Professor Juengken. I found a living filaria five lines and a half long, in the act of casting its skin, in one lens of the first patient, a case of lenticular cataract. No extraneous living body was discovered in the other lens. The second case was the first example of microscopical entozoa possessing suckers, which had been found in the human eye : eight individuals of the genus monostoma were found in the substance of the lens. These minute beings were found in the upper layers of the lens : they were one-tenth of a line long, and moved sluggishly

when placed in warm water. The examination took place immediately after the operation. In both cases the opacity was yet incomplete, and the lenticular substance was soft."

Professor Von Ammon mentions a case in which he found distomata. It was one of congenital cataract where the child died when four months old.

LENTITIS.

Although inflammation may not be the most common productive cause of cataract, still, the question of inflammation embraces a great variety of lenticular opacities, and the subject is more conveniently entered upon by first considering the production of cataract through inflammation.

The lens enjoys such a conformation as to be enabled to perform its purpose only so long as it remains undisturbed and healthy: once having lost the balance, it is impossible it should regain it: it does not possess regenerative power sufficient to overcome what may be imposed foreign to its pristine state. Consequently, though it may be retained throughout life in a state of transparency, it is not able to resist unhealthy action. It is as a fluid holding crystals in solution, the which will remain so, but a crystal of the same shape being thrown in produces consolidation of the rest.

In the lens, any disturbance, be it functional or mechanical, tends to destroy the vitality of the organ ; whilst in other structures, as fibrous tissues, &c., vitality is increased on the receipt of an injury, to enable the part to recover from what has been inflicted—to regain its healthy condition. Whether the lens be rendered opaque through deficient nutrition, inflammation, or mechanical injury, in no instance is lymph deposited within the body itself. Opacity is analogous to heightened sensibility in other tissues when affected by inflammation ; it is evidence that exertion is necessary, that an increased action must be substituted for that proper to the crystalline ; and as this cannot be reparative, it is destructive. Thus it is, that opacity once established, an increased action of the absorbents is required, and their work commences even before opacity is complete.

Some authors believe that they have seen a zone of vessels in the lens corresponding to that observed in the capsule when excited by inflammation: but there is not sufficient evidence to establish this position that it should be received as a fact. On the contrary, there is every probability that such appearance was deceptive, that the enlarged vessels formed no part of the lens itself, but were visible through this body, and situated in the posterior capsule. This, I have the more reason to believe, seeing that the vessels of the lens itself, even if enlarged to admit red blood, would not, from their evident distribution, present themselves as a zone,

but, ramifying, as they do, between each successive layer of the crystalline, would, if injected, tinge equally the entire pupil. Upon these grounds, and from observing the spread of opacity after a wound, without the slightest evidence of vascular excitement, or, indeed, of vascularity, I discard the idea, and hold it as fabulous, that a reparative process can ever follow an injury to the lens, and if a reparative process, by so much the more reason a regenerative process.

The human lens is more prone to become opaque than is that of brutes ; it is also less able to bear mechanical injury; nor can it resist falling into a state of opacity, disturbance, of whatever kind, being offered. Experiments have been instituted on the eyes of animals, and the results applied to the human eye,—results obtained through mechanical injury, or the artificial establishment of disease. Conclusions have thus been transplanted from one system to another, in the belief that all lenses were similarly constituted, and all equally able to bear or resist injury. This subject will again be considered, in the pages devoted to traumatic cataract.

Lentitis never exists alone, but is always coupled with, and preceded by, capsulitis, and is generally secondary to iritis, or internal ophthalmia. As in other structures so in the lens, inflammation runs its course, and produces its results, rapidly, or slowly, severely, or in a slight degree, according to its kind. The capsule always being first inflamed, and then the lens, it first becomes opaque, either in part or in

its whole extent. Its anterior surface is that most frequently affected, as inflammation of the anterior half of the eye is much more frequent than is that of the posterior hemisphere. Necessarily, when the anterior surface of the capsule has been rendered opaque, the slight changes that the lens undergoes behind it cannot be observed; nor can it be known that opacity has commenced, until it is so far advanced that its density is already considerable. Such, however, is not the case, when the posterior surface of the capsule is first affected; it is from this surface, therefore, that the progress of inflammation as propagated to the lens must be studied. A person working before a large fire is seized with headache; he does not pay much attention to it, and it continues; it becomes more concentrated and darting, and pain over the brow supervenes; his rest is disturbed, his appetite fails, and the tongue is furred. If attention be paid to the circumstance, sight is found to be dim; objects are discerned, but as through a mist, or rather as through a cobweb; a dull heavy pain is felt at the bottom of the orbit, the pupil is contracted, the eye intolerant of light, but without increased vascularity. Light gradually produces less effect until amaurosis is complete, and the pupil dilates: slight vascularity of the sclerotica may now be observed, and the pupil is less clear than formerly; inflammation of the hyaloid membrane is established; the vessels of the posterior capsule are enlarged, and may be observed, with a lens, covering it more or less completely: a point

Cataracta capsularis posterior.

of opacity is formed, not necessarily towards the centre, but as frequently towards the circumference : it extends, and other points are formed, which all converge to the centre in a striated manner, the intervals remaining transparent. Gradually the striæ are lost, and with them the perception of objects. The opacity is now seen greyish-white inclining to yellow, rather dull than glistening in appearance ; concave, in whatever manner it be viewed, whether on looking directly into the eye, or by examining it sideways ; and it is seen, not as a deep-seated opacity, but at a determinate distance behind the pupil, and as compared with the deeper-seated opacity through a deposition of lymph at the bottom of the eye, approached to the pupil. Before the opacity of the posterior capsule is complete, that of the lens may have commenced. The centre of the posterior surface becomes opaque, and the opacity passes from it, gradually gaining upon the transparent parts, those superficially seated being first implicated : consequently, the opacity varies in density from the complete to the commencing. The opacity behind or that of the capsule is, likewise, various ; for, in this membrane, it has extended in a striated manner, but in the lens uniformly. The greatest opacity is observed, then, in that part first affected, and the least in those parts corresponding to the interspaces of the opaque capsule. Opacity then, advancing from the posterior capsule, proceeds uniformly, as does that induced by wound ; but it

appears striated whilst the capsule yet allows a portion of light to pass, and the opacity is only as yet commencing in the lens. This striated appearance is, however, soon lost in the rapidly-increasing lenticular cataract. Its progress, however, is not always the same. The capsule may be partially opaque, and the opacity unobservable until the pupil has been dilated; then a point or more of opacity may be observed, always as it advances assuming a radiated character, as though it followed the course of the fibres of the membrane. Having become opaque in part, it appears as though it were essential that opacity should in time be distributed to the whole surface of the membrane: this may occupy many months before it is complete; nay, it has occupied years. In this respect, opacity of the posterior capsule differs from that of the anterior; here a single mark of opacity does not necessarily spread to involve the whole membrane, but may remain as it was formed. The posterior surface of the capsule having become opaque, opacity of the lens follows. Two or three years may have been occupied in completing the growth of this membranous cataract, so that its production differs widely from that formed, perhaps, in a couple of days: in the one case, acute inflammation is propagated to the lens, in the other it becomes opaque through defective nutrition; in the first the lens is softened, in the other it remains firm. Acute inflammation always gives rise to softening of the lens, disorganizing it, even to render it fluid or puriform. It may be said, that the consist-

ence of the cataract is proportionate to the degree of inflammation which produces it, varying to every known consistence, as inflammation varies in its course and character. Inflammation spreads from the capsule to the lens ; and the lens having become opaque, the functions of the anterior transparent capsule cease ; this, consequently, then becomes opaque. It becomes opaque, but not as through inflammation ; it is neither spotted, nor striated, but is rendered generally and uniformly opaque, and thus completes the *capsulo-lenticular cataract.* It dies, being no longer of use in the animal economy. For, as the lens is dependent on the capsule and the capsule subservient to the lens, opacity of the one induces opacity of the other ; and, though it may not be immediate, it is ultimately certain. A transparent lens was never long contained in an opaque capsule, neither will a capsule remain transparent, its function being completed. When opacity proceeds from before backwards, the anterior capsule having become opaque through inflammation, opacity of the lens soon follows, but the posterior surface of the capsule remains transparent. Thus, if this soft cataract be extracted, opacity is not found behind it, and still the capsule is not extracted with it. The same is to be observed when the lens becomes opaque through deficient nutrition ; in this case, the lens may be extracted, and immediately objects shall be perceived. But, also, the posterior capsule is observed to be opaque after an opaque anterior capsule and lenticular cataract

have been removed: the opacity, however, is confined to those cases in which the whole capsule has simultaneously been affected, for inflammation is not propagated through the lens to affect the other surface of the capsule, and the posterior surface never becomes opaque from defective nutrition, it being closely adherent to the hyaloid membrane, and through it, retains its vitality, when the rest of the body has lost its transparency. With opacity of the posterior portion of the capsule alone, vision is less affected, than when the anterior surface is opaque. Even when the opacity is considerable, a large print may be read, by dilating the pupil with belladonna, and a large amount of light enjoyed when the opacity is complete.

Cataracta capsularis anterior.

Inflammation having been propagated from the ciliary processes, or the iris, or developed spontaneously in the anterior capsule, the enlarged vessels of the membrane may be seen with a magnifying power, to form a complex zone, richly supplied by the innumerable windings and interlacements of the ciliary and retinal arteries. Slight pain is felt at the bottom of the orbit, with aversion to light and dimness of vision. The capsule is rendered nebulous and becomes opaque; seldom, however, equably opaque, but lymph is deposited irregularly, producing an appearance as of pearly white striæ, or spots upon a less opaque surface. These spots have a glistening appearance and mark the nature of the cataract, they being peculiar to cataract of the anterior capsule. The capsule never acquires a deeper

colour than greyish-white, and retains its glistening appearance. Anterior capsular cataract is known by its superficial position, being on a level with the edge of the iris, or only slightly removed from it; or else it may be protruded into the pupil. When it is alone opaque, it is distinguished by its thin membranous, glistening, or striated appearance. Complete capsular cataract differs in nothing from opacity of the anterior surface, nor may it be distinguished, but only when the opacity is observed to commence posteriorly. The opacity having extended to the lens, this may be seen behind the capsule, distinct from the membranous opacity,—two strata of opacity being distinguished, the more superficial having a glistening appearance, whilst the opaque lens is seen as a dull white or coloured body. As the loss of transparency varies from the slightest opalescence to a dense opacity, irregular in formation, at one time mottled, at another striated on its surface, so we have a series of names to distinguish accidental results, all referrible to a common cause. However, these appearances of the capsule have their attendant advantages, for each one notifies, by the opacity communicated to it, the amount of inflammation by which it has been produced, and consequently the consistence of the enclosed lens. I am not prepared to assert that a very slight opalescence of the capsule may not occasionally be removed and transparency restored, indeed, I believe this to be the case; but if the inflammation shall have advanced beyond this point to produce greater

change, unquestionably, it is irrecoverable. But though opacity may not be removed, it is not necessary that it advance to involve the whole membrane: it may be confined to a single spot, then neither will the functions of the capsule be interfered with, nor will the inflammation have been of such a character as to be communicable to the lens; of this kind is *cataracta dendritica vel arborescens.* Through inflammation, the iris having become attached to the capsule of the lens, and subsequently separated from it, the print of the adhesion is left, or a portion of uvea attached to the capsule. This is not a true cataract: its appearance is that of a brown mark, which differs slightly in colour, as well as in magnitude, in different cases. When the iris is inflamed, its pupillary margin is first affected, becoming thickened, of a deeper colour, somewhat irregular, or rather undefined, the pupil is contracted, vision is dim, the iris becomes dull, and inflammation is propagated to its attached border: the natural colour of the membrane is changed to green, reddish, or purple, and inflammation is communicated to corpus ciliare. The iris is immoveable, thickened, and convex towards the cornea; lymph is deposited on its anterior and posterior surfaces, attaching it to the capsule of the lens. The pupillary margin of the iris may be bound down in its entire extent, or by points only of adhesion, the tubercles of lymph, which form the connecting medium, being speedily organized and capable of injection: a false membrane may close the pupil, and the propagation of

inflammation to the lens only be discovered after the lymph has been absorbed. The production of lentitis depends rather on the amount of iritic inflammation than on any specific character it may have assumed. Syphilis has been considered very productive of cataract, and in Naples the prevalence of this disease is thought to account for the large number of cataracts there found. Certainly, in no city in Europe, is syphilis more generally distributed amongst its inhabitants than in Paris, and no man more fitted to speak to its prevalence than M. Ricord; he says:—"I know that there is scarcely a house in Paris where traces of it (speaking of syphilis) are not to be found, from the ground floor to the attic; and in the existing state of society, it is almost impossible for any one to avoid it: it either is, has been, or is to be."* Cataract is not more frequently met with in Paris than elsewhere; but, in Paris, every one is alive to the importance of seeking aid under suspicious circumstances, and the knowledge of syphilis is there so widely spread that aid is seldom sought in vain or delay promoted by doubt. Indeed, in Paris, the study of syphilis appears to be rather a part of general education than confined to one class of men only, as in other countries; but in Naples the Lazzaroni, amongst whom it is that cataract is so frequent, are inordinately affected with syphilis, but they are too careless of life to seek relief, too idle, and utterly ignorant of cleanliness, or comfort: even

* Lectures delivered at the Hôpital du Midi, A.D. 1846.

when driven by the force of circumstances to seek relief from pain, they refuse to execute that which others are only too glad to obey. How can it be otherwise, than that iritis shall be most common amongst such a population? It is not, then, the specific nature of the inflammation that produces the cataract. Every other form of iritis will equally induce opacity of the lens, but no form is more tractable than the syphilitic. It is, then, not the particular form of inflammation to which these cataracts owe their origin, but to the circumstances under which they are developed. Rheumatic iritis is, perhaps, the form of inflammation most commonly followed by cataract. During a wet season, rheumatism is readily excited, and no concomitant contingencies are found more favourable to the production of lentitis than a wet season, a rheumatic diathesis, and a light-coloured iris. As the opacity differs in degree, so it has not one fixed point of commencement, but begins as the most obvious result of inflammation. The circumference may first be affected, thence the opacity may extend to involve the whole membrane; and as every part becomes affected and lymph deposited, so different forms are produced, which are found to be repeated in different cases, with a more or less perfect resemblance. Thus, we have produced *C. punctata*, *C. striata*, *C. marmoracea*. *C. finestrata*, *C. stellata*; all differing slightly in appearance, as their names indicate; all produced by such an amount of inflammation as to involve the lens: consequently, all are

capsulo-lenticular cataracts, and not of the capsule alone; they are all produced by a more or less intense and rapid action, through which the consistence of the lens is reduced to a gelatinous, or even a fluid state. But these cataracts are not named merely after their external appearances, but also according to their various degrees of consistence, thus, *C. gelatinosa*, *C. caseosa*, *C. fluida*. There are, further, *C. dimidiata*, where one half of the capsule is covered with lymph; *C. trabecularis*, where a single bar stretches across the pupil; *C. centralis*, central opacity, the rest of the capsule remaining transparent, and *C. pyramidalis*, a central pyramidal accumulation of lymph, stretching into the pupil. These, excepting cataracta centralis, are produced by long-continued and severe inflammation, so that not only is the consistence of the lens, in general, lost, but vision is also destroyed. *C. trabecularis* is one of the rarest forms of cataract: it follows ophthamitis, and iritis. Two points of adhesion having been established between the iris and capsule, the deposit is formed between these two points, stretching as a bar across the pupil, either horizontally or perpendicularly, through which the iris is fixed and immoveable. This bar or girth is firm in consistence, and becomes almost cartilaginous; it has even been found to be osseous. Sometimes, it stretches across the entire diameter of the circle formed by the ciliary ligament, attaching itself firmly from point to point: more generally, however, its extent is less, and its consistence not greater, when first formed,

Balkenstaar. Cataracta barrée. After Schmidt, gegürtete kapsel linsencataract (cataracta capsularis cum zonâ.)

than is that of similar deposits, in other shapes, on the capsule. The inflammation that has given rise to this particular form of cataract, for the most part, if not invariably, extends to the posterior eye, extinguishing the power of sight, or rendering it exceedingly feeble, and causing the organ to become atrophic.

C. centralis is central opacity on the anterior surface of the capsule, the capsule and lens retaining their transparency. This opacity is in contact only with the capsule and apart from it: it is in the form of a circular spot, invariable in its situation, and scarcely differing in its extent; having, for the most part, a diameter of about one line: it is somewhat variable in density, sometimes being striated or fibrous in appearance, at others, its substance is equable: it never appears as a mere point, nor does it extend to occupy a greater space than that already defined. Central cataract has been spoken of by authors as of the lens; with reference to it, Mr. Lawrence writes as follows:—"Central opacity of the lens seems to be known only as a form of congenital cataract. Here, one-fourth, or a larger portion of the diameter presents a greyish opacity, and the circumference is completely transparent, so that, when the pupil is dilated, there is good, or even perfect vision, although under other circumstances the patient is nearly blind. This partial central opacity sometimes presents exactly the appearance of a small opaque lens, surrounded by an opaque capsule: this appearance, however, is quite decep-

tive; the opacity in such cases affects only the nucleus of the crystalline, and it is surrounded by the rest of the organ in a transparent state. In this form of the affection, the lens retains its natural magnitude; it does not become reduced by absorption."* Professor Jäger, in his admirable lectures, delivered annually at the Josephinum, says:—" I know no such cataract as central cataract of the lens; nor do I understand that such can exist, when the homogenous nature of the crystalline is taken into consideration. Truly, the opacity may commence centrally, but it extends more or less rapidly to occupy the whole body. Central cataract, *par excellence*, is central opacity of the anterior capsule."

Central cataract is always the consequence of inflammation. This opacity, as has been said, is not of the capsule, but lies upon it, and may be separated from it, without interesting the membrane of the capsule. Further, it never increases to occupy more than the small central space, nor is it ever removed or in any degree modified, but by the operation applicable to it. Central cataract is generally preceded by blennorrhœal ophthalmia, through which all the structures of the eye have been somewhat affected, slightly deranged in function, if not inflamed. Why this central spot should be chosen as the invariable seat of this form of cataract, may be explained after the following manner. Membrana pupillaris, having been ruptured at birth by the action of light upon it, falls down to be attached to

* Diseases of the Eye, third edition, p. 648.

the anterior capsule: there, it remains, a transparent membrane, in no way affecting vision, until disturbed by an unhealthy action. That such is the case may be seen, on opening the eyes of a young kitten under water, when the membrane may be observed and broken at pleasure; whereas, without this precaution, it is ruptured before the observation is complete. The fœtal pupil differs slightly in size in different cases, and the size of membrana pupillaris, which corresponds to the extent of the pupil, is small as the pupil is contracted. Membrana pupillaris is thrown down to occupy invariably the spot devoted to central cataract, and it corresponds in extent. It is this fine membrane which yields its small vitality, influenced by disturbance that may not be sufficient to induce inflammation of the adjacent textures. It immediately loses its transparency, and is seen as the central spot on the anterior capsule, described as central cataract. As life advances, this membrane attaches itself more completely to the capsule; to be involved in its changes and its changes alone: it is, then, incapable of a distinct action, and becomes opaque only with the rest of the membrane. For this reason, it is, that central cataract is generally found in the young child, either following blennorrhœal ophthalmia, or, else, formed in utero. So small an amount of inflammation is alone necessary to rupture and produce the opacity of this membrane, that the capsule of the lens, although, in utero, easily affected, is not necessarily attainted. It is of the utmost importance to distin-

guish between central opacity and opacity of the lens. The latter, although it appears to affect the nucleus alone, more or less rapidly extends to occupy the entire organ; whereas, central cataract never in any degree affects the lens, causing it to become opaque, but this remains, behind the membrane, perfectly transparent. A considerable degree of sight is often permitted, nay, not unfrequently, exceedingly good vision, especially when the eyes are shaded, or the pupil dilated by means of belladonna. The opacity in question may be removed from the capsule without injury to this membrane, but it is so intimately connected with it, that during life it must be considered as a part of the capsule. The opacity never spreads from membrana pupillaris, having at first affected it alone, but once having become opaque, it ever remains so, without the slightest modification.

Through violent internal inflammation of the eye, affecting particularly the iris and lens, a deposit of lymph may be formed on the anterior capsule in the centre of the pupil, not unfrequently, upon central cataract, this being the base for the new deposit, and the provocation, as it were, to this particular form of cataract. The lens is, at the same time, softened and its substance increased: it presses upon the iris; and the deposit of lymph being added to, it assumes a pyramidal shape to protrude through the pupil, the pupillary margin of the iris being more or less entirely bound to the opaque capsule.

Kegelförmige Kapsel-linsen-cataract. (Cataracta capsularis pyramidata.) Schmidt.

Cataracta pyramidalis may not only thus extend into the anterior chamber, but may, eventually, with its apex reach the cornea. It is a very rare and not less unfortunate form of cataract, the entrance of light not only being prevented by its form, but the power of vision being extinguished by the amount and extent of inflammation through which it has been produced ; or should there not be total loss, there is a fearful abiding impairment of vision. Together with this form of cataract, is found, if not invariably, very usually, conical cornea : through the same inflammation, softening and loss of elasticity in the corneal laminæ are produced, and the membrane is conically projected, not indeed by pressure from within, but having lost its elasticity, it has lost its power of resistance.

Thus, as the result of inflammation, there may be a clouded state of the anterior capsule, which is possibly remediable ; or a mere speck may remain and vision be uninjured : increasing from this, every degree of opacity obtains until, through the opacity alone, artificial amaurosis is produced, with differences of vision, through different degrees of opacity, from that only known as a mere difference in power between the two eyes, until complete extinction of sight.

Ophthalmitis being induced, the capsule and lens become affected with the rest of the organ, or, rather, consequently on inflammation attacking the adjacent structures. The disease may be acute, or chronic : in the former, the changes are rapid,

opacity of the capsule and lens is produced, the substance of the lens is broken down, and reduced to a purulent condition : it is then known as *C. purulenta.* The yellow opacity is seen through the pupil, or, projecting forward the capsule, it may assume a tubercular, or pyriform shape, protruding into the anterior chamber through the pupil. Ulceration of the capsule takes place, and the pus escapes into the anterior chamber ; or it may be absorbed, leaving a shrunken capsule to be removed by operation. Internal ophthalmia is sometimes seen to follow typhus fever, especially during the middle period of life, and this inflammation not unfrequently extends to the lens and destroys vision ; but it is not an intractable form of disease, and extinction of sight is not the ordinary result. One eye alone is generally affected, and it has been said, usually to be that corresponding to the side on which the patient sleeps. I greatly doubt such a mechanical apology. It is usually seen about six weeks or two months after the fever has subsided ; during the state of convalescence, whilst the person is still in a debilitated condition, and unable to provide himself with what may be deemed necessaries during convalescence. It is not an acute form of inflammation, and requires rather support than indiscriminate depletion.

Kapsel-linsencataract mit einem eiterbalge. (Schmidt.)

Cataracta capsulo-lenticularis cum bursa ichorem continente is a very rare form of cataract ; perhaps, of all the varieties, this is the most uncommon. Necessarily the whole lens is cataractous, but a portion of

it only is reduced to a purulent condition. The pus is generally formed on the posterior surface, between the lens and the capsule ; it is contained in a distinct cyst, which may be removed from the eye without being ruptured. The pus, which is often fetid, on which account the cataract has been termed *putrid*, is seen through the cataractous lens : the lemon colour that it imparts to the cataract being one of its chief characteristics. The opaque lens is firm, but its size is increased to obliterate the posterior chamber and to press on the iris, to render it convex. By reason of the pressure, the movements of the iris are impeded, so that they are either entirely prevented, or are rendered exceedingly sluggish. The pupil being thus sealed, light is scarcely perceived, or the sense may be entirely obliterated. Although the bag of pus is for the most part seated between the lens and the posterior capsule, it may be found in any part, and is not limited to this position. It is probably formed in the substance of the lens, and approaches the surface as its size increases, following in this respect the course observed by abscesses in other parts of the body. Its sac is probably the substance of the crystalline itself, altered to this purpose, rather than a deposit of lymph, within which the pus is formed. However, no reason may be assigned, that the cyst should not veritably be a deposit of lymph. The abscess is produced by a slow and long-continued inflammation, and always in a remarkably cachectic state of the system. The chronic character of the inflammation, the colour

Cataracta putrida of Schiferli.

and size of the opaque lens, together with the unmistakeable cachexia of the patient, mark this cataract.

Glaucoma.

The most terrible and unmanageable form of inflammation is that occurring in the gouty. Arthritic inflammation is apt to lead to a most fatal disorganization of the eye. It may be combated, but seldom conquered, for it recurs with renewed vigour at the moment it was supposed to have been destroyed; and a relapse is still more unfortunate than its first approach. In the acute form of the disease, vision may be utterly and irrecoverably destroyed, in two or three days. Chronic inflammation, however, is more general though scarcely less fatal, for it becomes more intractable with its duration: its attacks may be repeated at intervals, repelled only to reoccur, during a course of many months: nor is there any certainty as to the course the inflammation may take, or what structures it may attack. The lens, however, is not necessarily affected; nay, it generally escapes, when the inflammation is chronic, or is only rendered opaque by the continued duration of the inflammation: but, it may be said always to be implicated when the inflammation is acute. Arthritic inflammation affects the sclerotica and iris, the choroidea, retina, vitreous humour, and lens; indeed, no structure in the globe escapes, and, if allowed to run its course, atrophy is the certain result. The choroidea, retina, and hyaloidea, are the structures most essentially altered by this form of inflammation. The choroidea is rendered varicous; the retina loses its consist-

ence, and is reduced to a soft pulpy condition; whilst the hyaloidea is completely destroyed. A reddish exudation takes place into the vitreous humour, by means of which a greenish colour is imparted to it, as the light falls upon it. Inflammation is then propagated to the capsule and lens, which become opaque; and, in the substance of the latter, a similar exudation to that found in the vitreous humour is likewise poured out. From its acquired colour it is termed *cataracta viridis*; or, if named after the inflammation which produced it, *cataracta glaucomatosa*. Through the effusion into the posterior eye, the lens is thrust forward, even to lie in contact with the cornea; the globe is rendered tense; vision is utterly lost, and this stage of the disease is accompanied by great pain, both orbitar and supraorbitar. The happiest termination of this form of disease is in atrophy of the globe of the eye, and this is not tardy in being produced: absorption of the effused fluids proceeds, and, at the same time, that of the lens. This is reduced to a small hard body, with a shrivelled capsule; or it may acquire an osseous consistence. Thus, it shrinks, and with it, atrophy of the globe results.

When inflammation is propagated to the lens, from the posterior eye, the consequences to vision are more fatal than when iritis, or inflammation of the ciliary processes, gives rise to the opacity: consequently, it is happy that affections of the posterior hemisphere are rare as compared with those of the anterior. Acute lentitis is rare as compared with

chronic : the more acute the inflammation, the more disorganization is produced, and in proportion to its amount and the rapidity of its course, in the same ratio is vision temporarily and ultimately impaired. The consistence of the lens can only positively be known when the opacity commences from behind. The anterior capsule being opaque, it can only be decided that the lens is hard, or soft ; or it may be impossible to learn the state of the lens, such may be the opacity of the capsule, excepting by that knowledge through which the state of the lens is known, a certain appearance of the capsule being present. By soft cataract is understood every degree of consistence between the hard and the fluid cataract : thus C. gelatinosa, C. caseosa, &c. The former is that usually found during infancy ; it presents no resistance to the needle, consequently cannot be depressed ; neither can C. caseosa. This has the consistence and somewhat the appearance of curds ; it has a clouded appearance, its opacity is irregularly distributed, sometimes white as drifted snow, with other parts of a greyer tint ; it appears dull or pearly white as the light falls upon it. This cataract is not viscous, but crumbles under its own weight : it differs from the gelatinous, perhaps, in no single character more essentially than in its tenacity. Chronic inflammation in a young healthy subject may produce a firm, not a hard, cataract, but one capable of being reclined. Its colour is white, though it has not the snowy appearance of caseosa, and it is necessarily capsulo-lenticular, for every

cataract is so as the result of inflammation. Inflammation is always first excited in the capsule, either anteriorly or posteriorly, and as its course is rapid, so does disorganization advance.

Fluid cataract, with an opaque capsule, will not be recognised until the capsule has been punctured. Then, it will flow through the wound into the anterior chamber, having the appearance of thin milk. It is large, and globular in shape, pressing forward the iris, mechanically to impede its movements ; and it closes the pupil so effectually, that a faint glimmering only is allowed. The pupil is dilated, and the cataract may be slightly protruded through it, to be indented by the pressure against the pupillary border of the iris.

Thus, it will be understood, that capsular cataract must bear a very large proportion to all the cataracts known, for inflammatory cataract must be capsular, and every other form of cataract would, in time, likewise, become capsular. It will be seen by referring to the following table, taken from Jäger's protocol, that of 1011 cataracts operated on by him, 247 were capsular.

Varieties of Cataract.

School Session.	CATARACT.			Total.
	Capsular.	Lenticular.	Capsulo-lenticular.	
1826-27	—	19	17	36
27-28	5	26	25	56
28-29	2	26	9	37
29-30	7	39	8	54
30-31	2	41	1	44
31-32	3	33	2	38
32-33	3	40	13	56
33-34	1	50	8	59
34-35	—	59	6	65
35-36	10	29	13	52
36-37	—	32	13	45
37-38	2	48	24	74
38-39	—	28	14	42
39-40	—	57	7	64
40-41	—	58	19	77
41-42	2	73	10	85
42-43	1	45	16	62
43-44	2	61	2	65
Sum total	40	764	207	1011

As the retina and vitreous humour undergo an osseous transformation, so, also, the lens and capsule. In the capsule it is not uncommon to find calcareous deposits as small bright flakes upon its surface, which communicate a gritty sensation to the needle. And, of the lens proper, it is not rare to find the nucleus of an old cataract reduced to a stony condition : nor are cases wanting where the entire lens, either alone

or together with the vitreous humour, has been found ossified. The best instance, that I remember, is that recorded by Dr. Menteath, in which he removed a completely circular ossified lens from a labourer's eye.

CONGENITAL CATARACT, AND IMPERFECT FORMATIONS OF THE LENS.

When the lens differs from that state which we are accustomed to find in healthy nature, either in shape or in consistence ; when, by reason of its too great convexity, or otherwise, the rays of light are not brought to a focus upon the retina, but are either collected too soon, or the focus not yet formed, when the retina is reached ; or when, by its deficient consistency, its refractive power is greatly decreased, or by its unattained transparency, it is useless to vision ; and these several states neither dependent upon age nor disease, but so formed at birth, constitute anomalies rightly understood as imperfect formations. When the shape of the head is irregular, the length from the ear to the nasal spine being large, whilst the occipital portion is defective or much flattened ; or where the contrary obtains, the occiput being large, whilst the forehead is small and retreating ; or when the head is wanting in rotundity, being undeveloped laterally ; in these seve-

ral cases, sight is, for the most part, imperfect. The most prominent cause is, unquestionably, a defective brain: but, with a markedly misshapen head, there is found a large and staring eye, or a particularly small eye; where the cornea, or lens, or both are preternaturally convex, or on the other hand, flattened beyond that is admissible for perfect sight. An observation, to which I attach some importance, was made on the eye of a lad, twelve years of age. The eye was particularly small and deeply set in the orbit, and the head was remarkably flattened laterally. The boy was sharp and witty, and wanting in nothing but his eyesight. Since childhood, he had not been able to distinguish objects at a distance of three feet. Nothing abnormal was to be seen in the eye, the iris was dark, the pupil contracted, and its motions obeyed readily the light. From an acquaintance with these circumstances, the anatomy of this eye was interesting to me, and being allowed an opportunity of gratifying my curiosity, I found every part of the eye in its natural condition, saving the lens. The consistence of the crystalline, as far as it could be appreciated, was that of the healthy lens, but its form was strangely altered. Its antero-posterior diameter was increased fully one line beyond that usual to the human lens, and its anterior surface was equally convex with the posterior. So, the power of the eye was no longer that of the human eye, but its refractive power was inordinately increased, through the abnormous form of the lens, which, occupying an unusual space, ne-

cessarily lessened the depth of the anterior chamber. Consequently, instead of the focus being formed, by the normal distribution of the finer and the denser humours, upon the retina ; by the greater bulk of the lens, the eye approached in shape that of the fish. When myopy is produced by the too great convexity of the cornea, the cause is seen and readily distinguished ; but, when it may depend on an immaterial curvature of the anterior surface of the crystalline capsule, it will be almost impossible, during life, to determine this as the actual cause. A misshapen eye is generally found, as has been said, with a misshapen head : indeed, it might be expected that the development of the orbit and its contents should advance equally with the cerebrum and its case, (and this more especially if the views, which certain physiologists have propounded, be entertained, that the eye is protruded from the brain case). We know this, however, not to be the case ; consequently, with a misshapen head, although it is probable that imperfect sight may depend on deformity of the eye itself, it may, also, be referrible to an imperfectly developed brain : but where the eye is externally well formed and the shape of the head good, it will not be presumptive to suppose that the lens is the part in which the imperfection exists. Of course these observations are strictly referrible to congenital myopia. In after life, so many causes conspire to produce myopes, that the question requires to be considered distinctly from that to which reference is now made.

It is difficult to judge of sight in children ; they can themselves only very imperfectly estimate it, and seldom or never complain, not knowing what is wanting. The deficiency becomes known to those only, who, watching them, care for them assiduously. But, as they grow up and measure their sight with that of their companions, they discover what, indeed, was common to them always, but unknown was unfelt. This state of purblindness is very different to that acquired at puberty. The first never alternates, the second recurs from time to time ; the first depends upon malformation, the second on an increased secretion ; the first is constant, *i. e.* until age alters the shape of the lens, or the cornea, flattening them ; the second is never constant, but changes from day to day according to the irregularities committed, through which it has been produced. This is neither disease nor malformation, but arises when the course of a man's life is, for the most part, very irregular, when the passions are developed, when the approach of manhood is reached, and full course given to the pursuit of some end. This becomes, in some sort, the measure of excesses committed, and passes when the habits that provoked it are dismissed. Three great and prominent causes operate to produce it, and in the same order of frequency in which they are here arranged, viz. libertinism, reading, and sickness ; and of all the eye-glasses that are in use, nine-tenths may be referred to the first cause. This, as has been stated, depends on an increased secretion ; and that, either of the aqueous

humour, or of aqua Morgagni, or probably of both. It is well known, that persons who are in the habit of using their eyes immoderately, either to gain their daily bread, or for the advancement of literary pursuits, become myopic. This myopia is constant as the close engagement of the eyes is durable ; consequently, it becomes habitual to those whose subsistence depends on their employments ; such as, engravers, watchmakers, writers ; but is removed, if, from one cause or another, the employment cease. Mr. Ware's case, of a mathematical instrument maker, is as apt as any I could adduce in illustration. This individual had been accustomed for many years to use convex glasses, when reading. He found, however, that when he was engaged in looking through a double microscope, during several hours of many successive days, he was then enabled to read without his glasses ; but that, discontinuing his employment, he was again, after the lapse of a few weeks, obliged to have recourse to them.

Congenital cataract is of three kinds. First, undeveloped lens, or natural cataract, *C. naturalis.* Secondly, the consequence of inflammation propagated to the lens in utero, *C. congenita.* Thirdly, the consequence of inflammation, membrana pupillaris alone being affected, *C. centralis.*

C. naturalis. Thus I take the liberty of distinguishing this form of congenital cataract, terming it a natural cataract, whilst it is an undeveloped lens, not a produced cataract ; but remaining an opaque lens is, therefore, a cataract ; not the result of disease, but nature's

formation ; a process commenced with fetal life, but discontinued from some cause unknown, through which its formation was arrested, its transparency unattained. Being an undeveloped lens, its appearance will necessarily be that of the opaque fetal lens. When the anatomy of the lens was considered, it was stated, that, during fetal life, the lenticular body is opaque, gelatinous, and of a reddish colour ; that it becomes more and more transparent as this period is completed, until at birth it is transparent, though not so beautifully clear as it becomes during the first few months after birth. Such, then, is the appearance of this form of cataract, differing only as the period at which its development was arrested. It retains its gelatinous character, its reddish colour, and its muddy opalescence. This is a rare form of cataract, as indeed all arrests of development are rare, and dependant on causes beyond man's control ; nor does his knowledge serve him to elucidate their production. Doubtless, monstrous productions are instruments in the hands of all-ruling Providence, as chastisements for sin ; but how they are distributed, or why reserved for the few, is not for us to inquire. This cataract has not the clear white aspect of that produced by inflammation, but has a duller appearance, without spots, or streaks, or marks of any kind, on the capsule. I believe it to be particularly difficult of absorption, having found it scarcely diminished in bulk at thirty-five years of age.

C. centralis. Membrana pupillaris closes the pupil during fetal life, and at birth is ruptured by

the action of light: but it is not only ruptured at birth, for being remarkably susceptible of inflammation, this fine membrane may be ruptured in utero, the surrounding textures remaining uninjured. Then, it is detached from the pupillary margin to occupy the same position as when ruptured at birth, viz. the centre of the crystalline capsule. It has been rendered opaque, however, and at birth is seen as a central spot known as central cataract. For its production, it is essential that the inflammation be so limited in degree as only to affect this membrane: then it will be seen surrounded by the healthy capsule and lens, nor does it in any degree influence these structures to produce their opacity, but, on the contrary, they may remain throughout life serviceable to vision, without undergoing absorption, or necessarily altered from their sane condition. Central cataract, however, always remains, and is not alone capable of removal; nor may it be influenced by medicinal agents, not being a lymph deposit, but an opaque membrane. So thin has the membrane become when the term of fetal life is nearly complete, and so slender its attachment to the iris, that contraction of the iris alone is sufficient to produce its detachment. An increase of inflammation from that now described, may produce inflammation of the crystalline capsule and lens; which, becoming opaque, constitute capsulo-lenticular congenital cataract. This is the true and common form of congenital cataract, and although the other two varieties are equally congenital, this, be-

ing the result of notable disease, and the more complete and ordinary form of opacity, may be well distinguished as *Cataracta Congenita*, congenital cataract, par excellence. This form of cataract is for the most part of a soft gelatinous consistence, with an equally diffused opacity ; or, here and there, a slight increase of consistence with a like alteration in colour. The capsule, also, for the most part, presents a dotted or striated appearance, never entirely covered with lymph deposit, but always marked irregularly : and it is never found transparent, for inflammation never, in utero, first attacks the posterior surface of the capsule. The opacity may not be complete at birth, indeed, not unfrequently, it becomes more marked soon after birth. The consistence of this cataract is never greater than that of the natural lens at birth, but it is reduced from this degree of consistence until the adhesion of its substance is entirely lost, and it becomes a fluid or milky cataract ; its solidity being lost in the same ratio as inflammation is developed : thus, with milky congenital cataract, there has certainly been acute inflammation, and, generally in these cases, the iris has been affected together with the lens, and atresia iridis is known as a result. Amongst the congenital cataracts observed by Mr. Saunders, four were fluid; two with opaque capsules, and the other two with opaque capsules and closed pupils. If unheeded, congenital cataract undergoes absorption; and that more rapidly than in the adult, by reason of the greater activity and excitability that reigns, than in after

life. Usually, before twelve years have passed over the child's head, the lens is absorbed, and a shrivelled capsule is alone left, or, with it, a small nucleus of lens remains. The capsule now becomes a tough, dense membrane, and constitutes a membranous cataract, known as *Cataracta Siliquata*, which nature is incompetent to remove.

Trockenhü'sige Kapsellinsencataract. (Cataracta capsularis arida siliquata.) Schmidt.

There is yet one more form of congenital cataract —a fluid cataract. It is composed of a clear fluid, which distends the transparent capsule, and is only rendered opaque by the crumbled lens, which floats through it. In consequence of the child's eyes being in constant motion, this cataract is not allowed to be precipitated, but during sleep only. Consequently, as usually seen, it appears to be an ordinary soft cataract of irregular consistence, some parts appearing firmer than the rest, but with a transparent capsule. This cataract I have named *C. subsidens*. It is an undeveloped lens, the fluid parts preponderating over the solid : or it is rather an error of formation than an arrest of development. (See page 121.) Errors of formation and arrests of development are frequently not limited to one member of a family, but may affect each and every : as an additional finger or toe to each member ; or imperfect formations of the tongue, palate, or lips, by which distinct speech is prevented ; or of the ear, rendering those affected deaf and dumb : so we find congenital cataract to be congregate, affecting three, four, or more members of a family ; as in the interesting but very painful example cited by Mr. Gibson, where five

children, the families of two sisters, were all cataractous, amaurotic, and idiotic; or that mentioned by Mr. Lucas, in which five children, the family of a clergyman near Beverley, were all born with cataracts. Mr. Saunders also mentions instances of families thus affected: in one, three members, two girls and a boy, were all born cataractous; in another, three boys and a girl; and in a third, two boys. In Germany, I saw a Bohemian family of three children thus affected, two girls and a boy. Their respective ages were six years, two years, and five months: each had double cataract, and in all the character of the cataracts was the same, an equally distributed opacity being apparent in each: nor was the capsule marked with striæ, spots, or other irregular formations. It is not surprising that cataract should be hereditary, for, indeed, most diseases are so that are incident to age; and he that is not affected by the peculiarities of one, at least, of the three generations preceding him, may scarcely be said to be his father's child. But it is singular that cataract should declare itself in the fœtus, as an hereditary malady. Dupuytren makes mention of a case in point, nor are others wanting; three children, their mother, and grandmother, were all affected with cataract.

When cataract is produced by inflammation, one eye only may be affected; in the same manner as the variolous pustule is formed on one cornea or on both: but when it is a natural cataract, the probability is, that both eyes will be found to be simulta-

neously affected, in the same manner as are both ears in the deaf and dumb: nor am I aware, although it is very possible that such may be the case, that an instance has ever been recorded of a child born deaf on one side only. Indeed, it were difficult to understand that development should be permitted to proceed in one and abort in the other. If the child be not amaurotic, it discerns the light: but it cannot distinguish objects, excepting only when the cataract is central, *i. e.* of membrana pupillaris. When objects cannot be distinguished, and light makes only a feeble impression, the child remains unsatisfied, this sense not being applied to, and being debarred the use of that, which of all others delights the infant. Instinct teaches it to seek that, against which either nature or disease has planted an obstacle: so, in search of the light, the infant's eyes are constantly wandering, and never fixed; for as light is estimated equally on the inside and on the outside, but objects nowhere, so, there being nothing to arrest the eye, it wanders on and wanders perpetually, until the muscular power becomes so far superior to volition, that, in time, it refuses to obey the will. This continual flitting to and fro movement, to which the eyes are subject, when once acquired, is ever after retained, or conquered only after the expiration of much time and with great difficulty. It is, therefore, advisable that the cataract be removed early, that time be not allowed for the growth of this habit. To this end, the operation for congenital cataract should be per-

formed as early as possible. If it be delayed until three or four years of age, these spasmodic-like movements of the eye will have become so habitual to the child that they will scarcely be restrained: however, by means of a broad artificial iris, this may be accomplished, but only after the lapse of years. If the operation be delayed until six or eight years of age, the retina will be found to be so much impaired, that objects will never accurately be discerned. At twelve or fifteen years, a confused sense of light and shade is alone afforded by the removal of that which remains of the lens. At this time, the cataract is no longer capsulo-lenticular, but purely siliquata: or, if the lens have not been entirely removed, it is the merest remnant that is to be found. These movements, now alluded to, in no degree impair vision. If the cataract be removed before the retina lose anything of its power, the motions of the eye, which are so unpleasant to see, may remain, and sight be perfect; but, if the retina be long shaded from the light, it will, as in the adult, though more readily, lose its power: for so long as a mature cataract exists, the retina cannot be actively engaged; consequently, lying useless, it falls into decay, just as any other neglected structure ceases to be preserved in a state of perfection: it is deprived of its sensibility, retaining merely sufficient to distinguish the light. This law, which ordains against the disuse of any part in the animal economy, we see obeyed in each particular system, power being lost or increased in a direct ratio to the demand,

provided that demand be not an abuse. A cataract existing for some years, and only admitting a faint light to the eye, does not permit of the development of the retina in proportion to the other parts of the body : objects never having been painted upon it, its education is prevented : increasing years are loss instead of gain : it becomes as uncultivated ground, insufficient to give root to good seed, on which spring up weeds alone. Nay, it is as a rock, on which the utmost efforts of the husbandman are vain. As with the brain, so, perhaps, with the retina, the time may differ at which it begins to lose its power, if allowed to lie inactive, varying with individual peculiarities ; for whilst, in some, education becomes almost impossible, and the intellectual faculties are limited, and scarcely more extended than to be subservient to the ordinary purposes of life, if the years of childhood be lost ; in others, the vigour of manhood, with all its qualities, appears to be tenfold increased by freedom from restraint of every kind during early years. At a given age, in one, the estimation of objects shall be perfect, and the complete use of the organ gained on the removal of the cataract, whilst the power of vision may already be much impaired in another. Doubtless, this depends, in a great degree, on the amount of inflammation by which the cataract has been produced ; but it appears probable, also, and the same is to be observed in old age, that the retina of one is less able than that of another to be deprived of light with impunity. As a general rule, however, the longer it is buried

in obscurity, the less power it possesses when light is admitted, and the less probability is there that it shall acquire its natural power. Not to speak of the loss of years to the child, through the postponement of the necessary operation, but considering the retina alone, there being no advantage in delay, but, on the contrary, direct loss and injury, so the removal of the cataract can scarcely be undertaken too early. If the health permit it, a clear pupil should be obtained before the expiration of four months.

When one sense is impaired, others are largely developed, in some measure to make amends for this loss. So, the cataractous child having become intelligent, distinguishes objects by the touch, and judges of an approaching person by the footfall: and although light be admitted to the eye through the removal of the cataract, and there be no impediment to vision, the child will still continue to use its fingers and ears, as though deprived of the sense of sight: it sees, but it does not perceive. The eye requires to be educated that it may be used; and, to this end, it is not unfrequently necessary temporarily to deprive the child of the use of those senses by which it judges of surrounding objects, that it may be compelled to have recourse to the eye for information. By confining the hands and closing the ears, the use of the eye is soon acquired.

MORGAGNIAN CATARACT.

Of fluid cataracts, there are two kinds, namely, *simple* and *compound.*

The simple is where the fluid within the capsule is alone opaque: the compound, where the fluid is in itself clear, but rendered opaque by the admixture of particles of the broken down lens.

A simple fluid cataract may be formed through inflammation, the lens having undergone such a degree of softening as to be deprived of every trace of its normal consistence. It is reduced to a thin milk-like fluid, and is known as *C. fluida* vel *lactea.* It is the result of acute inflammation, in the young for the most part, and is analogous to purulent change in other parts. It differs, however, from the purulent cataract in this much, that it is the result of not unhealthy inflammation, and that it is produced without a wound of the capsule. This is the true fluid cataract, though not Morgagnian cataract.

C. Morgagniana is formed suddenly by the exposure of the eye to certain vapours, which have the power of rendering the fluid within the capsule opaque, the rest of the body retaining its normal state. Mineral acid vapours, as well as those of alcohol and naphtha, have been found to be productive of this change. A thin milky opacity is observed in the pupil, and objects become dim or as undefined shadows. Beer, in his Lehre, relates a case where this peculiar form of cataract was in-

duced by the exposure of the eye, for a quarter of an hour, to a fluid, the nature of which he did not know. The following day he removed the cataract, (as he assures us, at the urgent instigation of his patient, a woman, fifty-two years of age,) and found the lens of its natural consistence, and perfectly transparent: the capsule likewise quite transparent.

This opacity, in an uncertain time, affects the lens, and ultimately the capsule; the lens becoming opaque merely, without losing its consistence, and the anterior surface of the capsule universally and uniformly opaque. When seen at this stage, it has been termed C. fluido-dura. Morgagnian cataract is an exceedingly rare form. Although Beer's investigation was interesting, as showing the state of the capsule and lens, this cataract, seen thus early in its formation, might, perhaps, have been turned to better account, by first learning in what measure this opacous fluid might have been influenced by the exhibition of medicines. Nothing could have been lost had the professor been able to abstain from the course he pursued, only for a few days. Indeed, if medicinal agents are sufficient, in any case, to remove opacity within the crystalline capsule, this must be that in which their employment can be useful. When the substance of the lens itself is rendered opaque, any other than surgical interference is vain; but inasmuch as aqua Morgagni is not essentially a part of the crystalline body, but separated under peculiar circumstances, and removed, and again secreted, it seems probable that, although

opaque, it might be capable of absorption. The lens itself not being affected, but the fluid only, and the cause withdrawn, it might, a priori, have been supposed that a fluctuating medium (that is to say, one not constant) would not necessarily have communicated opacity to the lens. It would be interesting to learn, if opacity of the lens might not be prevented, and the fluid rapidly removed by the judicious administration of mercury. Many call in question the very existence of this cataract, merely, however, because they have not seen it. I am not so sceptical, but inclined to give implicit credence to a statement of this nature, though it rested entirely on Beer's assertion. It were much to be desired, however, that more might be learnt respecting it.

As in congenital cataract, so in that formed in adult age, the crumbled lens floats in a bag of clear liquid. The fluid is an abnormal measure of aqua Morgagni, and the lens, having been broken down, through some uncertain process, lies, at the bottom of the capsule, as a thick stratum. On the least motion being communicated to the eye, the sediment rises to render the whole contents of the capsule opalescent : the disintegrated lens appearing with spots, or streaks of greater opacity, of uncertain size and shape, which vary in position with each movement of the eye ; these being less minutely divided portions, which floating through the mass, now come into view, and are again withdrawn, alternating with each movement. This cataract is generally seen as two strata, the lower being the denser ; but if the

eye be kept at rest for a considerable time, the fluid will become almost pellucid, through the precipitation of the rest: then a faint vision will be obtained. This form is much more common in brutes than in man; indeed, it is not uncommon in the sheep and in the horse, but it is rare in man. The capsule remains transparent, and becomes opaque after the lapse of time only; then the fluid ceases to be secreted, and the contents of the capsule are slowly absorbed. This appears to be an error of formation—an effort to distend the capsule as the lens ceases to occupy it: it is the boldest attempt and that nearest approached to regeneration of the lens that I have witnessed. This is not a Morgagnian cataract, for here the lens constitutes the opacity. The term *C. subsidens* would not be inappropriate to distinguish this from true Morgagnian cataract, arising from noxious vapours; and from fluid cataract, the result of inflammation.

TRAUMATIC CATARACT.

Under this head are included all cataracts arising from wounds or external violence: the term traumatic being derived from τραῦμα, vulnus.

It is wonderful how large an amount of injury the eye will bear, without permanent loss of sight. The frightful appearances induced by some forms of

inflammation, and through external injuries to the organ, seem almost sufficient in the eyes of the multitude to entitle the surgeon to rank with agents non-human.

> "Τοὶ μὲν δαίμονες εἰσὶ, Διὸς μεγάλου διὰ βουλὰς,
> Ἐσθλοὶ, ἐπιχθόνιοι, φύλακες θνητῶν ἀνθρωπων."

Being shrouded by the cornea the lens is necessarily less exposed than the latter to external injury, and requires that the wound be penetrating to affect it, or that force be applied so suddenly and violently as to rupture entirely, or in part, the connexions between this body and the surrounding structures. Thus, traumatic cataract may be divided into two categories; *uncomplicated*, as it may be said to be, when the lens is wounded by a fine instrument, as a needle: and *complicated*, when, through concussion, amaurosis is produced; when the iris or other parts are extensively divided; or when such injury is induced that the cataract shall be but of trivial importance.

The lens, being wounded by the finest instrument, becomes opaque: be the wound never so small, it becomes turbid, and in forty-eight hours is generally opaque.

The capsule may be wounded without the lens, but, inasmuch as it is a fine membrane, it is almost impossible that this should occur by accident. When wounded, it may, perhaps, heal without leaving a visible scar: if, however, the entire thickness of the capsule be divided, opacity of the lenticular body

will follow. If a more extended wound, an incised wound, be made in the capsule, the lips of the wound will be drawn asunder, and the lens will protrude: this protrusion of the soft parts will continue, until the greater part of its substance has been removed. This exudation is as a little pellet of lymph, of a bluish-white colour: it increases and stretches through the pupil, when it breaks off and falls down into the anterior chamber, to be succeeded by a fresh protrusion: when detached, it is readily absorbed. Or, through its greater cohesion, the pellet may increase in size, being constantly added to, until, almost, or actually, in contact with the cornea. Also, of the posterior surface of the capsule, it may be remarked, that, being divided, the membrane does not re-unite. Hernia of the lens, however, does not follow a wound of the posterior capsule, it being supported by the vitreous humour. The structure of the posterior capsule is similar to that of the anterior; it differs only in being thinner. There is no reason, therefore, why a wound of the membrane, not involving the entire thickness, should not heal equally with that of the anterior surface. From its position, however, it is scarcely possible to wound it, without, at the same time, wounding the lens: therefore, it may be said, that the anterior and posterior surfaces of the capsule are, in so far, similarly disposed, that a traversing wound of either does not heal; but that the more exposed position of the anterior surface permits of a wound being inflicted, which may not involve the whole diameter of the membrane. A

Hernia of the lens.

punctured wound of the capsule occasions opacity of the lens. A small incised wound of the anterior capsule, hernia of the lens. A more extensive wound, dislocation of the lens.

With respect to the pellet observed on the anterior capsule after a wound, it is only correct to state, that some, eminent for observation, have regarded it as lymph, or described it as a "semi-transparent albuminous matter." A wound having been inflicted, and the eyes directed to a distant object, sufficiently minute that an effort be made rightly to perceive it, the recti muscles having been brought into play, the soft lens may be seen to exude. It is well known that the lens will exude after a small punctured wound of the capsule, sufficient inflammation having been excited by the passage of the wounding point to the centre of the lens. I prefer to understand, however, that hernia of the lens more commonly follows a larger opening, as that inflicted by the point of a knife, or through the rent after acute traumatic inflammation has been excited.

The capsule being a brittle and elastic membrane, splinters when wounded: and when the wound is sufficiently extensive to allow of it, it curls up to uncover the exposed lens: it splinters or stars, as a very thin plate of glass, or as the thin skin of a very ripe, full grape, when touched after the first slight frost: then, it speedily becomes opaque, loses its brittle character and elasticity, becomes tough and hard, and long resists absorption.

Together with the lens, the iris is, for the most

part, wounded. A certain amount of inflammation always follows an accidental wound of the eye, though the sclerotica, or cornea, alone were wounded: but inflammation is very various in degree. A fine needle may be introduced through the cornea to puncture the capsule of the lens without giving rise to inflammation: opacity and absorption of the lens will necessarily follow. This has not unfrequently happened inopportunely, and in the hands of the most expert and justly celebrated. Indeed, it requires great care, not to touch the capsule of the lens, in opening the cornea. If the capsule alone be merely punctured, and the lens only touched by the wounding instrument, the probability is, that little or no inflammation will follow: the lens will be absorbed, and the capsule become opaque, but without effusion of lymph upon it. A wound of the iris is followed by inflammation, and of the ciliary processes, by effusion of blood. If the wounding instrument pass deeply into the lens, to attain its centre, immediate softening will take place, and the body swelling will produce tension of the capsule to excite acute inflammation in this membrane; the posterior chamber will be obliterated; and the iris, being pressed upon, will be rendered convex: adhesion will take place between the iris and capsule, and the pupil will become irregular or be closed by lymph; and the lens, at the same time, may be reduced to a purulent condition. When blood is effused into the anterior chamber, it sinks to the bottom, and continues fluid, to change its level with each motion of

the head. It is quickly absorbed, though its actual presence is of little or no moment. It discovers, however, that serious laceration of some of the structures behind the iris has taken place. When the iris itself is wounded, blood does not flow; but when it is separated from its ciliary attachment, it may flow freely.

The following cases may not be without use in showing the course and results of different kinds of accidents to which the eye is exposed, and in whch the lens is implicated. Most of them came under my own immediate care, during the time that I was house-surgeon at the London Hospital: the others I observed later, on the continent.

James Tate, aged eight, was admitted into the London Hospital, September 13th, 1845. The previous day, when at play with his sister, she threw a pair of scissors, which struck him on the foot, and, rebounding, wounded the eye. When he was brought to the hospital, the conjunctiva was inflamed, the cornea and sclerotica were wounded, the iris was cut across from its attachment to its pupillary margin, and its cut edges were engaged in the wound; a small wound in the capsule was distinctly to be seen, and the commencing opacity of the lens was just appreciable, extending from the wound in a radiated manner. There was considerable intolerance of light and pain in the eye: vision, however, was immaterially affected, indeed, with a faint light, it was difficult to observe any difference in the power of the two eyes. The following morning, the lens

was generally opalescent, and in two more days, it had become perfectly opaque and flaky. The iris was dragged out of the corneal wound by the use of belladonna, and the divided edges then floated loosely in the anterior chamber; they became adherent, however, to the cornea at the wound. Through the division of the iris, the natural pupil was destroyed, and the large irregular opening, made by the wounding instrument, admitted light to the retina, notwithstanding that the cataract was now complete, so that objects could be distinctly discerned. Inflammation was combated, by leeches, calomel, and opium. Absorption of the lens was very rapid, and a membranous cataract alone remained.

Elizabeth Isaac, aged nineteen, received a blow on her elbow, whilst she had a needle in her hand. The needle entered the eye, wounding the cornea, iris, and lens. Momentary pain was excited, but it speedily subsided. The following day a blush of inflammation was to be observed at the point where the needle traversed the conjunctiva, and the lens was already turbid. In two more days the lens was completely opaque and flaky. At a later period, the membranous cataract, which remained after the lens was absorbed, was torn down with the cataract needle.

Mary Blackmore, aged fifteen, April 12th, 1845, in unfastening her boot-lace with a pin, wounded her eye. The pin passed through the cornea, iris, and capsule of the lens. Very little pain was occa-

sioned by this accident, so that it excited but little notice ; indeed, ten days were allowed to pass before surgical aid was sought.

April 22nd.—She was admitted into the London Hospital. The conjunctiva and sclerotica were much inflamed; the iris was thickened, dull and darker than that of the other eye; the pupil was dilated, and the lens opaque and disintegrated: some portions of it had passed into the anterior chamber, and a nodule adhered to the wound in the capsule. There was considerable pain, both ocular and supra-orbitar; and light could only be distinguished. Active antiphlogistic treatment was observed, such as, leeches, cathartics, and hydrargyrum cum cretâ ; under which, the iris became clearer and the eye less painful.

May 5th.—From time to time, fresh exudations took place from the wound in the capsule, pushing forward and detaching the nodule that had already exuded. The protruding matter had a bluish-white appearance, which, after collecting during two or three days, was cast down into the anterior chamber. These exuding portions of lens fell to the bottom of the chamber, without rendering the aqueous fluid turbid : they were absorbed, but not so rapidly as to prevent a considerable accumulation in the anterior chamber. The convexity of the cornea was increased. A drachm of turpentine was given, three times a day, instead of the other medicines.

May 12th.—The cataract was much diminished in bulk, but the sclerotica remained congested : the

anterior chamber was almost free from the portions of lens; a nodule still adhered, however, to the capsule.

June 6th.—Unhealthy action had subsided; the iris had regained its normal colour; a thin plate of lens alone remained, with the opaque capsule broken up and hanging in shreds in the pupil. Vision improved as the cataract diminished, and the healthy appearance of the eye was restored, so that, at this time, objects could be distinguished. She left the hospital. The happiest change followed the use of the turpentine, nor were any unpleasant symptoms excited by it, nor loss of appetite. One month later, shreds of capsule alone remained to impede vision; nor, indeed, was this hinderance great, but, on the contrary, a very useful degree of sight was obtained, and that without the employment of an artificial lens.

James Arnold, aged twenty-two, carpenter. In cutting a piece of wood with a pen-knife, his hand slipt, and the point of the knife wounded the eye. I saw him two hours after the accident, September 3rd, 1845. The cornea was wounded at its junction with the sclerotica, the pupillary margin of the iris was divided, and the point of the knife had entered the lens. Momentary pain was excited by the wound, but soon, however, subsided. Sight was not appreciably interfered with; objects were seen as distinctly as before the accident, but with a black spot in the centre. The pupil was irregular, the iris having contracted from the wound, and a small portion was drawn down to fill up the corneal wound.

The following morning, the whole lens was opalescent. A portion of its substance had been forced through the wound and was lying in the anterior chamber, whilst a nodule was adherent to the wound. Considerable inflammation was present, both of the conjunctiva and iris, and a dull heavy pain was felt at the back of the eye. Objects could not now be perceived, and the shadow caused by passing the hand before the eye made but a faint impression. Leeches were applied to the lower eyelid; blood was taken from the arm, and unguentum hydragyri cum opio directed to be smeared on the brow. Thus the pain was allayed, and the inflammation checked. The lens exuded, sometimes as a conical mass extending through the pupil, and at last, as though broken by its own weight, it fell to the bottom of the chamber. The divided edges of the iris became adherent to the corneal wound. The whole substance of the lens was entirely removed, and after the lapse of six weeks from the time of the accident, the merest shreds of capsule remained, but in no degree to impede vision. Oleum terebinthinæ ex misturâ mucilaginosâ was here relied on, and found sufficient to effect the desired purpose. Three months after the accident, this individual had acquired the use of the eye so perfectly, that he always used it, it being his right eye, to judge of right lines, rather than the other eye.

Pierre Latouche, aged sixteen, Hôtel Dieu, Paris.

February 17th, 1846.—He was admitted to the hospital the previous evening, his eye having been

wounded by the discharge of a pistol. As he was entering his father's house on his return home in the dusk of the evening, his brother, who was standing in the door-way, raised a pistol to the level of his face and fired. The integuments about the right eye were much swollen and blackened with the powder, so that the eye was with difficulty sufficiently exposed to ascertain the exact amount of injury. However, four or five grains of powder were seen to be lodged in the cornea, and two particles were counted on the anterior capsule, to which two opaque spots corresponded. The conjunctiva was much inflamed, with some serous chemosis. Sight, which was lost on his admission to the hospital, was in a great measure regained. The powder was removed from the cornea; general and local blood-letting was had recourse to; and a cold lotion to bathe the face. Aperient medicine was ordered, and a spare diet.

February 19th.—All the general symptoms, such as pain in the head and intolerance of light, were removed, but the chemosis was somewhat increased, and the eye more generally injected, but paler. Two circles of faint opacity were established around the grains of powder on the capsule.

February 22nd.—The lenticular opacity was complete, and the cataract loose and flocculent. The inflammation had subsided. The cataract underwent rapid absorption, and the capsule was torn into shreds in the pupil.

Thus the productive cause of traumatic cataract is

itself also a cure. The cataract is quickly formed, possibly without pain ; softening of the lens follows ; absorption commences, and the whole body is speedily removed. The capsule remains transparent, until the whole lens has become opaque, and is then either rendered opaque through inflammation, or becomes so, its functions being completed. The wound in the capsule is readily distinguishable, and its edges become opaque : if it be extensive, the membrane will be torn into shreds : though it be the smallest opening, it will likewise be torn into shreds, if the wounding instrument have passed deeply to excite acute inflammation. If the capsule be punctured, the lens will become opaque, without inflammation being excited ; it will be removed, leaving the capsule as an opacous membrane to be torn down with the cataract needle. Opacity always commences at the wound and radiates from it, progressing with speed proportionate to the softening that ensues, or to the depth to which the wounding instrument has affected the lens.

Numberless experiments have been made to ascertain the exact amount of injury that the lens will bear without becoming opaque. Dr. F. C. Dieterich, in his inaugural dissertation, has given the result of experiments made by himself upon animals, when contesting a prize offered at Tubingen.

Thirty-six times, he wounded the anterior surface of the crystalline capsule with a cataract needle. Opacity of the lens followed in one case only, and the wounds of the capsule healed without leaving opacity or producing a cicatrix.

Seven times, he punctured the posterior surface of the capsule, and opacity of the lens followed in one instance only.

Twelve times, he made an incised wound of the capsule, and in eleven of these lenticular cataract succeeded. Incisions of the posterior capsule did not heal, but the membrane did not become opaque.

Seventeen times, he punctured the posterior surface of the lens; lenticular cataract followed in three of these cases, and in other two violent internal inflammation was excited; in the rest, the wounds were not followed by any marked change.

Nine times, incisions were made in the lens, five of which were followed by cataract. Superficial incisions, whether of the anterior, or of the posterior, surface of the substance of the lens did not produce loss of transparency: but when the wounding instrument was passed to the centre of the lens, cataract invariably followed, together with ophthalmitis.

Eleven times, the lens was displaced; of these, eight were followed by cataract and internal inflammation: the other three remained unchanged.

It is obvious, at the most cursory glance, that the result of these experiments bears scarcely the most distant relation to that observed in the human eye. I am ready to admit that the lens of animals will bear a greater amount of injury than may be inflicted on the human lens. I do not find, however, through the limited experience that I have allowed myself to ascertain how far mutilation is compatible with

transparency of the lens, that the results accord with those of Dr. Dieterich.

If the capsule be wounded with a cutting needle, but not divided in its entire thickness, it will heal, without cicatrix or opacity. If it be divided to a small extent only and the point of the needle be brought into contact with the lens, opacity does not necessarily immediately follow, but the lenticular cataract will be completely formed before six months have expired. If the needle be passed gently into the lens, very slightly beyond the capsule, opacity does not immediately follow, but if it be passed to the centre, the change is rapid, and with acute inflammation. The slightest rotatory motion communicated to the needle, though the extreme surface of the lens alone be affected, is soon followed by opacity.

Incised wounds of the capsule do not heal; if small, they allow the lens to exude after softening has taken place: if a crucial incision be made across the anterior capsule, dislocation of the lens will follow. No amount of force can be applied directly to the lens to remove it from its position, without lacerating the capsule: nor can any such force be applied without deeply wounding the lens and causing its immediate opacity. The capsule cannot be removed from its connexions by violence applied to it directly; therefore, to suppose that the lens may be removed from its position by means of a needle or other instrument, is a gross fallacy.

OF CONCUSSION AND SUCCUSSION.

Force applied directly to the eye may produce the separation of the lens from its attachments, either entirely, or in part. Succussion may produce the same result, but the violence not being directed immediately to the eye, is transmitted, as from the feet, the occiput, &c.

Concussion with complete detachment.

Concussion, with complete detachment of the lens, is produced by a sudden effort rather than through the employment of great force. It is accompanied by, at least, temporary amaurosis, as is partial detachment; with hæmorrhage and inflammation, not inflammation, however, of the capsule and lens, they become opaque slowly, their nutritive vessels being torn asunder. Whether partially or completely detached, the capsule may or may not be ruptured.

That the lens shall be separated from its attachments, it requires that the external tunics of the eye be not ruptured by the blow: these giving way, the force is not transmitted to the lens. The following cases will illustrate my position. The first occurred at Vienna; the second was seen at the London Hospital, from which I made the accompanying sketches.

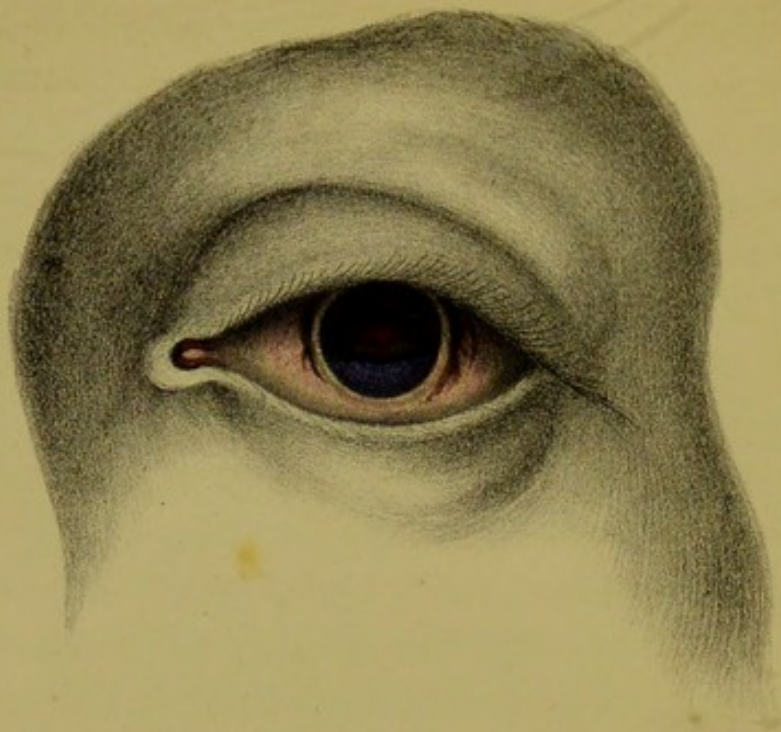
Vienna, March, 1847.—Franz Ziglauer, aged twenty-six, was struck on the eye with a piece of thin rope. The patient, a robust young man, experienced excruciating pain at the moment of the occurrence of the accident. He immediately returned home, and bathed the eye to the marked al-

leviation of pain : he discovered, however, that he had lost the sight. The following morning, he presented himself at the hospital. The state of the eye was as follows :—The upper lid was considerably swollen, blood was suffused beneath the conjunctiva, and this membrane was inflamed ; the anterior chamber was half filled with blood ; amaurosis was nearly complete. Leeches, mercury, and, later, counter-irritants were indicated. Under such treatment, amaurosis soon disappeared ; but, in proportion as the retina gained its tone, light was shut out by the lens becoming opaque. On the eighth day, the lens was slightly opalescent, and the opacity increased rapidly until the cataract was fully formed. It was large and white, and pressed upon the iris, which it rendered convex. The iris was discoloured. Belladonna was used to dilate the pupil, upon which the lens passed through it into the anterior chamber : it gave rise to much irritation ; but more especially when in the pupil itself, which it passed with difficulty. When returned behind the iris, it no longer excited pain or trouble, but, on any forward movements of the head being made, it was again readily thrown into the pupil. The inflammation having been subdued, the cornea was opened and the lens, contained in its capsule, extracted. The patient recovered with very imperfect vision.

The London Hospital, Oct. 26th, 1845.—Mary Henessy, aged forty-five, was struck by her husband, on the eye, with his fist. The sclerotica was ruptured to the extent of two-thirds of its circum-

ference, the rupture extending regularly around the cornea, distant about one line from the junction of the two membranes. The anterior chamber was filled with blood; the cornea was rendered prominent: a considerable effusion of blood had taken place beneath the conjunctiva, and the conjunctival vessels were injected. Light could not be distinguished from darkness. Leeches were applied, and mercury given to affect the gums. In a few days, the blood in the anterior chamber was entirely removed, but long before the process was complete, light was distinguished, and even objects could be seen. When the blood was removed, a large print could be seen, though not read; the letters appeared as though not separated, an irregular confused line. At this time, the whole iris was displayed: it occupied precisely the lower half of its usual position; the pupil was, consequently, all that semicircular space between the sclerotic border above, and the straight iris below. The iris extended horizontally between the chambers, in a gentle semi-lune: its free edge had a reddish-brown margin, which corresponded in colour to the pupillary margin of the other eye. The irides were very peculiar, of a bluish-grey colour, inclining to violet, with a reddish-brown pupillary margin. The free edge of one iris corresponded to the pupillary margin of the other, so it was evident that, by the force of the blow, the iris had been split up from the pupil to its ciliary attachment, and detached in the upper half of the eye, to fall down upon the remaining half, the pupillary

1



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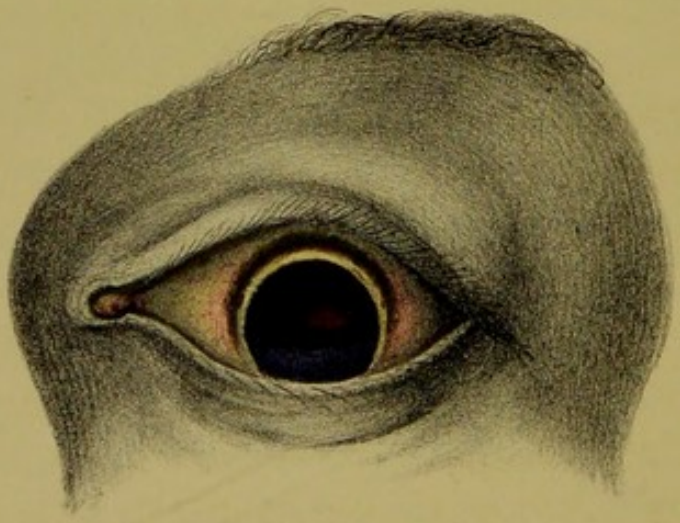

B.F.Brodhurst, ad.nat.del.

H.Adlard, lith.

margin being extended with the retraction of the membrane. But, notwithstanding all this injury to the eye, the crystalline lens retained its transparency. With an artificial pupil, good sight was obtained. Staphyloma had commenced, and the cornea was already rendered very prominent by the increasing breadth of the rent in the sclerotica, when she left the hospital, November 22.

The first plate shows the state of the iris ; the second that of the rent in the sclerotica.

This case is related to show that the lens is not separated from its attachments, either entirely or in part, when the external tunics or the iris are lacerated. Now, although there are numbers of cases on record where every possible injury has been sustained by the eye ; where, with laceration of the sclerotica, the lens has been found immediately beneath the conjunctiva, and has escaped, this being divided ; or, where all the tunics being ruptured, the humours have at once protruded : it may be stated, that a lesser degree of violence than this will occasion the separation of the lens from its attachments, the outer tunics not being ruptured ; or, that this separation will not take place, the cornea or sclerotica being ruptured, and seldom indeed when the iris is lacerated. Complete detachment of the lens is not followed by inflammation of this body. It slowly becomes opaque, and after the lapse of time is reduced in size ; but absorption is extremely slow. Indeed, the lens is never entirely

removed through this means, but may be seen, for any number of years, in the anterior chamber, or alternately passing backwards and forwards through the pupil. Also, it remains unaffected when depressed into the vitreous humour. Beer has related a case where the lens, unreduced in size, passed backwards and forwards through the pupil, during twenty-six years. Mr. Lawrence bears testimony to another instance of the same kind, where the lens with its capsule had occupied the anterior chamber twenty-eight years. This is *C. natatilis*. As the capsule of the lens, when torn into shreds, is unaffected by the absorbent vessels, or so little affected, that it may, without fear of contradiction, be said to be unaffected; by so much the more reason, when it remains entire. Nor, under these circumstances, do its proper vessels retain the power of removing the lens, which it envelopes. Both become opaque, and the lens, losing its moisture, gradually shrinks from its original size; but whether sunk into the vitreous humour, or allowed to float through the pupil, occupying both chambers of the eye, it ever retains so large a size as, for all practical purposes, to be said to be undiminished. This same form of cataract is produced, and apparently without a cause, in young feeble females. Many of these unaccountable cases, where a capsulo-lenticular cataract has been produced in a young person, without any morbid influence developing itself, may be attributed to succussion. This form of cataract may, not unfrequently,

Succussion, with complete detachment of the lens.

be found to have followed a fall or a leap, or succussion received in one way or another, which probably excited little, if any, attention at the moment. In the year 1847, I had an opportunity of seeing a case of this kind, at Prague. It happened after the following manner. A complete virago, a Hungarian of stalwart form, had occasion to correct her little son for some real or imaginary misdemeanour. Not wishing, however, to execute the full rigour of her law, she preferred the milder punishment of shaking, to any better established mode of administering correction. Having seized him by the collar of his dress and his coarse shirt, she used her formidable powers to the best of her ability, and seemed not disinclined to repeat the lesson, when desired to explain the how and the wherefore. The child was a puny boy and delicate, but not in bad health. The shaking having been administered, was forgotten, (excepting by the boy, perhaps,) and only recalled to the mother's memory by cross-examination, and the suggestion of falls, blows, &c., in explanation of the case. Then, it flashed upon her mind, and she made a ready confession. It appeared that about ten days had elapsed before anything extraordinary was observed in the eye: at the end of that time, a scale, ein häutchen, as the mother said, was seen in the eye, (the cataract was seated in the left eye,) but she thought it might disappear, and consulted with a neighbour as to the probable cause. Failing to suggest a remedy, and the opacity growing more confirmed, she at last sought advice. It

was on the eighteenth day, as near as may be, that I had an opportunity of seeing the lad. The cataract was whitish, capsulo-lenticular, yet incomplete, without adhesions to the iris, without lymph spots or irregularities of opacity. The iris was healthy in appearance, and the pupil dilated. There had not been pain in the eye, nor was there evidence of any unhealthy action. Light could be distinguished. No other probable cause, than that now assigned, could be arrived at; nor, indeed, is it important to search for other, for the appearance of the cataract denoted an unusual productive cause, denoted that inflammation had not been present, and the age of the child, and the circumstances of the case, fully warrant the conclusion that this cause was not only sufficient, but the actual cause. I am not aware that such are generally admitted as sufficient for the production of cataract: nor am I unmindful of the maxim of Cicero, "Opinioni confirmatæ natura ipsa cedat." It will be remembered, however, that convulsions in infants, and tetanic spasm in children, are causes assigned as productive of cataract. If either cause be allowed, then, this more violent cannot be denied: not that I will rest this upon such comparison, the truth of which I am in no condition to substantiate, but, on the contrary, greatly doubting these to be instrumental or efficient causes, I prefer to draw conclusions from greater. Each one knows the effect of concussion in loosening the lens from its attachments; sudden jerks of the body are, in fact, so many lesser concussions, which produce, in

a weakly person, the effect of the direct and positive blow. Again, the lens has been known not only to be loosened, but to pass through the pupil in its undiminished, transparent state. Such cases are very rare, but there are of this kind well attested, which can carry with them no doubt. That the lens should be loosened implies a certain degree of force or the presence of disease; disease, however, is contradicted by the retained transparency of the lens, and no absolute violence has been offered to the eye; consequently, the lens has been shaken out of its rest, it has been displaced by a jerk.

Complete detachment of the lens demands force, rather sudden than violent, such as a sudden flirt with a handkerchief; a lash with a whip or with a horse's tail; a blow with a light switch, or with a piece of wood brought into forcible contact with the eye, as in wood-chopping, or as from a cork flying from a bottle, &c. All or any of these are sufficient causes to produce detachment. The eye is seen, in the first instance, with abundant lachrymation, and, probably, amaurosis; with some chemosis, and conjunctival injection; with blood effused into the anterior chamber, but without external wound, excepting, perhaps, abrasion of the conjunctiva.

Of partial detachment of the lens.

Concussion, with partial detachment of the lens, is occasioned by a blow on the eye, as with the fist. It is accompanied by considerable hæmorrhage into the anterior chamber, and it occurs without rupture of the external coats of the eye. It is followed by acute inflammation, and not improbably by suppura-

tion of the lens. Mr. Travers, in his *Synopsis*, relates the following case, and mentions it as the single instance that he had witnessed of abscess of the capsule : " It was that of a lad, who, after a severe blow on the globe of the eye, which produced acute inflammation, had a suppuration within the crystalline capsule, which projected through the pupil in a globular form, and was filled with pus. There was no deposit upon the iris. Under the action of mercury, the pus and lens were absorbed together." *

When the lens has been in part loosened from its connexions, it rapidly becomes opaque ; it is softened, and partially absorbed ; the capsule shrinks, and is rendered hard and tough ; it is coated with lymph, to be seen as a shrivelled and mottled capsule, and known as *C. siliquata.* In its substance may be deposited calcareous matter, consequent on the inflammation that has been excited, when it is seen speckled over with bright flakes upon its surface, and is named *C. gypsea.* The flakes are shining, white and yellow, and the smaller the flakes, the whiter and more sparkling they are. If the capsule be converted into a calcareous mass, its solid parchment appearance, and the gritty sensation communicated by it, through the cataract needle, serve to distinguish it.

If the external tunics of the globe be not ruptured by the blow, the lens does not alone suffer, but, with it also, the vitreous humour. The consistence of the latter is lost, the eye becomes flaccid or loses its

* Page 211, Ed. 2.

elasticity, it ceases to respond to the touch ; synchysis is produced, which is followed by atrophy of the organ. The iris, wanting its accustomed support, is no longer tightly drawn between the chambers, but flaps backwards and forwards, as a linen cloth shaken by the wind. The lens decreasing, its soft parts having been absorbed, becomes tremulous, and is known as *C. tremula.* It hangs loosely behind the iris, until removed by operation, or until it may be completely detached, through the rupture of, perhaps, the last connecting filament. A sudden shake of the head may pass it through the pupil, when it floats from the posterior to the anterior chamber, causing, at times, great inconvenience and irritation. It is retained with great difficulty behind the iris, firstly, on account of its diminished bulk, and, also, by reason of the pupil being dilated, there being, at the same time, amaurosis, complete or incomplete. Now, it is termed *C. natatilis.* Subacute continued inflammation may produce an osseous change in the lens, or in its capsule. This change having taken place, though the cataract be tremulous only, its pressure on the iris causes exquisite pain with each movement of the head ; so that the hitherto insensible iris has become, through the friction of this rough body, most painfully sensitive. The patient is in consequence compelled to seek relief in perfect rest, with his head on the pillow. When entirely detached, the cataract readily becomes entangled in the pupil, the iris closing, as it were, spasmodically upon it ; and, so long as it remains clasped in the opening, it

Schwimmende Kapsel-linsen-cataract.

excites an inordinate degree of pain. The capsule has been found under these circumstances to have been converted into a complete stony shell.

Of rupture of the capsule of the lens.

There is yet another form that requires to be noticed under this head, namely, with partial or complete detachment of the lens, rupture of the capsule. The rupture may be so complete as to allow the lens to escape, at the same moment, into the anterior chamber. As with pieces of the lens, so with the whole lens, when introduced with care into the anterior chamber, excessive inflammation may be excited; how much rather when it escapes suddenly through force applied outwardly! It may, however, lie innocuous in the anterior chamber, until removed by the absorbents. If the rupture of the capsule be not sufficient to allow of the escape of the lens, inflammation will be excited, which will probably proceed to suppuration: or the inflammation being less considerable, softening, together with rapid absorption, will be excited, the capsule being torn into shreds in the pupil, as in the following case.

London Hospital, September 20, 1845.—James Neal, aged forty-five, when eight years of age, was struck on the eye with a stone. The accident was followed by considerable inflammation, but without wound of the eye. Loss of sight was immediate, but regained, and again lost on the formation of the cataract. Ultimately, however, and without manual interference, the cataract was entirely removed, so that, at the present time, very small shreds of capsule alone remain, hanging down behind the iris,

to be visible in the pupil, but not to interfere with vision. The sight of the eye is not impaired by the loss of the lens, but one is equally useful with the other. It is a singular circumstance, that this person presented himself at the hospital on account of a similar accident that had occurred to his own child, in the same manner, and at the same age at which he himself was a patient of Mr. Headington's at the same hospital, differing in this much only, that the external tunics being ruptured, the lens remained unhurt. James Neal, aged eight, was struck on the eye with a stone: the cornea was ruptured at its junction with the sclerotica, to the extent of one eighth of an inch; the iris was dragged down, and protruded through the wound. Vision was unimpaired (as the child, who was very intelligent, seemed to believe); there was slight pain in the eye, and the conjunctival vessels were somewhat injected. The iris was returned within the cornea, and the corneal wound closed; not, however, without a considerable amount of inflammation, which necessitated active measures for its abatement. The pupil was necessarily rendered irregular, but the transparency of the lens remained perfect, and sight was not in the least injured. He left the hospital, October 7.

By reason of the injury done to the eye, be it through rupture of any of its parts; through extravasation of blood consequent on such injury; or upon concussion of the retina, or although the primary injury be not so considerable as to excite much

alarm, or to disfigure the eye, such an amount of inflammation may probably be excited, which shall prove highly detrimental to vision: through which, either immediate changes are produced, or more remote, the latter of which are, perhaps, the more fatal. Thus are produced, as consequences, synchysis, atrophy, calcareous transformations, and the like. Concussion, with bruising of the eye itself, is necessarily a very formidable injury, and is generally attended by more serious consequences than succussion; as, for instance, external rupture, amaurosis, laceration of the retina and choroidea, &c.; but the distinction between concussion, with, or without, external wound or wound of the iris, is, for the sake of prognosis, important to attend to. With a certain amount of force, the external membranes may be lacerated and the lens remain uninjured; nay, the entire iris may be detached and rolled up as a pellet to lie in the anterior chamber, as I have witnessed, without injury to the lens: or, neither the iris, sclerotica, nor the cornea receiving the impression of the blow, it will be transmitted to the lens, either partially or wholly to detach it, with or without rupture of the capsule, and, moreover, possibly, with laceration of the fine membranes of the posterior eye.

SENILE CATARACT.

Deficient nutrition is the most productive cause of cataract; for as old age is common to every man who attains to his three score years and ten, so this cause, predominating over all other causes, produces its effects in a like degree. In old age, cataract can scarcely be considered a disease, but rather in harmony with the wearing out of the whole man. Certain affections are hereditary, and appear to belong rather to the blood, than to be induced by any peculiar course of life that may be adopted. Of this sort, are gout, baldness, grey hairs, and cataract: and as hereditary gout will show itself where luxury is not admissible; or baldness during youth, in every member of a family; or grey heads appear in early life, without any assignable cause, further than a family tendency; so with cataract, it occurs, we know not why; any more than we can explain why one man should be bald, and another have an abundance of hair. Ricord says, "Beware of young wigs!" Loss of hair in early life, however, is not necessarily a sign of disease; on the contrary, it is not incompatible with robust health. As the advance of old age is marked differently in different persons, by the imperfect performance of functions, and this, probably, traceable to abuse or over-exertion of that particular system, so the eye, not being exempted more than any other part from the influence of time, is, in some, selected to be the evidence of the establishment of old age.

Old age may commence before advanced years have been attained; even at thirty-five years of age deficient nutrition may have fully established the attributes of the old man. Truly, this is a green old age, more worthy of pity than respect.

Cataracta senilis is essentially of the lens, and in this it differs from that form induced by inflammation, where the capsule is first affected, and the lens secondarily. In this form of cataract, the progress is reversed: here, the lens first becomes opaque, then the capsule. The cataract of old age is, for the most part, hard, dark, and smaller than the natural lens. From youth, as life advances, the watery particles are being removed, and the substance of the lens gradually acquires a firmer consistence; the whole body shrinking to become consolidated, and, in the same degree, the capsule around it, consistence being increased in a similar degree to its original distribution, the nucleus always remaining firmer than the circumference. The shrinking of the lens—its consolidation, through loss of its looser material, naturally increases its colour, so that the firmer it is, the deeper amber hue it assumes, gradually shaded off, proportionate to its diminished consistence, until the circumference acquires a faint yellow hue, or a greyish colour. Over and above this colouring, which is natural to the lens, black pigment may be deposited within it, to the complete blackening of the organ. Twice, I have seen perfectly black cataracts: their appearance, however, before extraction, was scarcely such as to induce the belief that they

were indeed black : one was seen of a reddish-brown appearance, the other had a dark orange tint. The lens shrinks, and consequently rather increases the size of the posterior chamber ; the motions of the iris are free, and the pupil not being sealed, as with the large, soft, inflammatory cataract, light is always perceived.

When the opacity of the lens is complete, the capsule loses its transparency, the opacity commencing from the circumference to invade the whole membrane. Thus it acquires an equable appearance, not being affected irregularly as when inflammation has been present. Its fibrous and more superficial appearance enable it to be distinguished from opacity of the lens. It has been observed by Schön that, arcus senilis being formed on the cornea, a similar opacity, and equally limited, is to be found on the capsule of the lens, and also in the lens itself. I have not observed the change now referred to. Arcus senilis exists without opacity of the lens, but cataracta senilis never without arcus senilis. When opacity is once planted in the lens, its progress is not stopped, until the whole organ is changed and the loss of transparency is complete. The time necessary to this change, however, differs as the change itself, as has been seen in lentitis and traumatic cataract. The same occurs in old age. Deficient nutrition, suddenly induced, provokes alterations in the same manner as those attributed to old age—produces disorganization, softening of the mass, a rapidly

formed cataract, or proportionate to the rapidity of the change produced in the whole organismus: whereas, in the hale hearty old man, this change is as that of every other organ, slow and gradual, occupying as many years, perhaps, as old age itself; often incomplete, when the powers of life are already exhausted. Although the lens becomes smaller in old age, it would scarcely be correct to say that absorption takes place. It is rather consolidated than absorbed: indeed, when it has become opaque and operation has been resorted to, to produce absorption of the cataract, the process is so slow, that life will be yielded, with much probability, before a clear pupil is obtained.

The cause being common, both eyes may be affected simultaneously; but, inasmuch as it is not unusual that one eye shall be somewhat weaker than its fellow, or that one shall have suffered from inflammation, at one time or another, in all probability the weaker will first lose its transparency, its nutrient vessels being in part closed, to render it more susceptible than the other of any organic change.

It is laid down, in some sort as a rule, not to interfere with cataract, the lens of the other eye retaining its transparency. In a former page, it has been stated, that an immature cataract may not be touched with impunity. This restriction, however, applies more immediately to inflammatory cataract, in which, should operation be resorted to, during the period of increased action, the result would neces-

sarily be to heighten that action. Senile cataract is formed, without increased action, by reason of diminished action. Consequently, there can be no risk of interfering with an unhealthy process, the cataract not being the result of an unhealthy process, but simply the removal of a healthy one. It is, therefore, immaterial to wait until the cataract be mature before an operation is performed. Cataract must ever be considered a foreign body, which requires to be removed. If nature be vigorous, she may demand no assistance to this end; but, when the powers of life are decaying, absorption of the hardened cataract is so slow, that long before it is complete, the functions of the eye may be irrecoverably impaired: not only so, but its formation is at times so slow, that the operation shall be scarcely available at its completion. The retina, being shaded, loses its power; and being necessarily less sensitive, during old age, than in early life, its power is not only impaired by the want of its proper stimulus, but, this being withheld, it may not be regained, on the readmission of light: nay, it may become completely insensible, and its functions, being long discontinued, will, probably, never be regained. Therefore, when the use of belladonna no longer commands useful vision, it is advisable, on account of the patient's health, his personal comfort, and that the retina be not thrown entirely into disuse, that the cataract be removed. The residence of the opaque lens in the eye is a greater evil than may

probably occur through the operation. Although the result of an operation is unquestionably not altogether certain, nor is anything human, yet, if it be carefully conducted, no operation in surgery is more happy in its results than is extraction of the cataract from diminished nutrition. Belladonna does not lose its power over the iris by constant use; it should, therefore, be employed, so soon as effective vision is prevented by the growing opacity of the lens, and operation resorted to, whenever useful vision ceases to be obtained through the application of this drug. The cataract is mature, long before the sense of light is destroyed and shadows cease to be appreciated. If operation be deferred until amaurosis be complete, is the operator justified in removing the cataract, in the hope that the readmission of light might again stimulate the retina to sensibility ?

The Josephinum, Vienna.—Y. A., aged sixty-two, an old man, and poverty-stricken, was admitted an in-patient by Professor Jäger, during the spring of 1847. During the space of six years, sight had been very imperfect, and was gradually extinguished until light was only discerned. The sense of light was, at last, also, lost, and for two months prior to his application at the hospital, he had been in total darkness. In either eye was a hard, dark-coloured, capsulo-lenticular cataract, with a dilated pupil. The case presented nothing peculiar, saving the total loss of sight. With amaurosis, however, there was not

the amaurotic stare. Considering the formation of the cataracts, and the time during which light had been extinct, and because the eye was natural to the touch, and not unhealthy in appearance, it was determined to extract the opaque lenses. Both were, consequently, extracted, and the wounds in the corneæ healed favourably. Counter-irritants were applied. The sense of light was gradually restored, and, after the lapse of considerable time, objects were, through the medium of artificial lenses, discerned accurately. Thus, amaurosis will not, in itself, forbid an operation for cataract. It will demand greater care, however, in the necessary investigation, to know in how far amaurosis depends upon the cataract.

Cold and damp considered as causes of cataract.

Cold and damp are, also, causes of deficient nutrition and decay. If admitted in undue degree, the same results are attributable to them, that are referrible to old age. The cases, in which I have observed this cause to operate, have been, excepting two, in seamen. The following case will serve as an illustration.

The Josephinum, Vienna, April, 1847.—P. W., aged fifty-five, a captain in the Austrian navy, a strongly-built man and stout, of a healthy appearance and florid aspect, without being bloated, but weather-beaten and hardy. He was led into the room by his wife, and gave the following account of himself. Since his youth upwards, he had been at sea, almost without intermission; cruising, for the most part, in the Adriatic. He had always enjoyed

the most perfect health, had been temperate in his habits, and had led a regular and sober life. His appearance bespoke health, and robust health. Three months previous to his appearance at the Josephinum, his sight had suddenly begun to fail, and was very rapidly extinguished, so that shadows could only be distinguished. In either eye was a greyish-white lenticular cataract, a moveable iris, and a circular pupil, without change of colour, or increased vascularity. Sight was lost without pain, either in the head or eye, and excepting through the gradual extinction of sight, there was no evidence of the presence of disease. The patient had been in the constant habit, for years past, of washing his head, each morning, with salt water, and of allowing the hair to dry in the wind, whilst he paced the deck of his vessel. Jäger gave it as his opinion, that these repeated ablutions, without subsequent careful drying of the hair, had produced the opacity in question. The opinion was then novel to me. During the last summer in Rome, when the air was excessively hot, all refreshing means were naturally had recourse to, to make the climate more bearable; and amongst others, that of washing the head, to allow the hair to dry in the cold morning air, was very common. Two cases, that came under my observation, were, the one an Italian, the other an American. In both, lenticular cataracts were produced, without pain; and, at the same time, the American lost his hair, and the occiput and nape of his neck were covered with eczema. It is evident,

that the same means will produce congestion of the vessels and cataract through inflammation. In the cases now cited, however, the reverse was induced; through constriction of the vessels, atony, and death, resulted.

SECTION III.

OF THE DIAGNOSIS OF CATARACT.

When a cataract is examined, its colour will be observed to be tinted with yellow, when hard; to be whitish, when soft; and, to be glistening and irregular as to its opacity, when capsular. A dark ring will be observed, formed by the uvea, when the cataract is soft; and a broader ring or the shadow cast by the iris on to the lenticular capsule, when it is hard. An appreciable shadow will be produced, by carrying the hand before the eye, the head being turned away from the light. But, that every circumstance may, at the same time, be learnt regarding the cataract, its peculiarities and formation, together with any complications of disease that may be developed in other parts of the visual organ, it is necessary to dilate the pupil with belladonna. Then, the patient being placed in a good light, not only the freedom or adhesions of the iris will be seen, but the precise stage at which the opacity has arrived,

together with the density of the cataract and its nature, whether it be capsular, capsulo-lenticular, or lenticular, will be learnt. And, without the previous use of this narcotic, it is rash, it is unwise, both for the operator's sake and the patient's, to commence an operation. Without its use, or that of a similarly constituted drug, it is impossible accurately to define what may be the freedom of the iris, or in how far the opacity has advanced towards maturity: for as in a contracted state of the pupil, the nucleus of the cataract will alone be seen, and the circumference of the lens be hidden from view, and there being no appointed degree of consistence or colour for the nucleus, but a slightly-coloured nucleus may be found in a mature cataract, and a deeply-coloured one in a yet immature cataract, so it is not the nucleus of the cataract that specially demands attention, but the circumference. Vision may be troubled before any discernible opacity exists, and an old lens may be dull without being cataractous. When cataract begins to be formed, objects are seen as through a mist, the mist thickening as the opacity is developed, until objects in front of the eye are no longer distinguished, not even luminous bodies: the flame of a candle will not be perceived, but the halo around it. Rays of light passing through the circumference of the lens, objects will be perceived, the view being directed sideways, or downwards, long after they are undiscernible when situate in the median line. This, however, is not the case, when the circumference first becomes opaque, as

may, at times, be observed on the anterior capsule. Further, owing to the striated opacity that is sometimes produced, more especially when the posterior capsule becomes opaque, objects are seen as though multiplied; this is more especially the case with luminous bodies seen distantly; when approached to the eye, they appear as though broken. Nothing is more simple than the diagnosis of cataract, nor can this opacity be mistaken for glaucoma, effusions of lymph upon the retina, or any more deeply-seated opacity than that of the lens itself; for, when doubt exists, the flame of a candle held before the eye will remove it. If a light be held on either side of an amaurotic eye, or one in which the pupil is dilated, the humours and membranes being transparent, whilst the observer looks directly into the eye, three images of the flame will be observed. The one nearest to the observer is upright and the brightest, it is reflected by the cornea; that apparently most deeply situated is, also, upright, but faint, and is formed by the anterior capsule; whilst the third, which is inverted, and as though between the other two, is reflected by the posterior capsule. As the flame is moved, so does the inverted image follow, always resting over against the flame. So that, with opacity of the capsule, or lens, these images will not be formed, whereas, the opacity being situated more deeply, they will ever be seen.

This method of diagnosis will be found particularly useful, when the posterior surface of the capsule is suspected to be opaque.

OF PROGNOSIS.

When cataract is complicated with other affections, it must be lost sight of for the more important, or it must be considered together with them, be they of the eye itself, or influencing the system generally. Cataract being but prevenient to vision, there must be a certainty in the mind of the operator, that the removal of the opacity will again admit of the perception of objects, to render an operation justifiable. It must be known, that neither muscæ nor scintillations exist; that the retina is still sensitive, and that no unhealthy action is going forward, either in the eye itself, or in its immediate neighbourhood. The estimation of light by the cataractous eye is essentially necessary to justify an operation, one case alone excepted; viz., where amaurosis has been produced by the long residence of the cataract. Extension of inflammation to the retina, after the formation of the cataract, will, likewise, give rise to amaurosis: a deposit of lymph is formed either upon or beneath the membrane, and pain, deep seated in the orbit, or over the brow, mark the case. Nothing can be more unfavourable than such a circumstance, and seldom indeed is it possible effectually to remedy this misfortune. Indeed, it terminates, for the most part, in permanent amaurosis. If amblyopia be produced by the long

duration of the cataract, the removal of the lens will generally be sufficient to restore the power of the retina, light alone being employed: but should this natural stimulus fail to promote the object in view, irritating substances may be used; and, probably, with the desired effect.

Glaucoma may follow cataract, when the case is almost hopeless. Alone, this form of inflammation is most intractable, and scarcely yields when attacked early: before light is extinguished, however, this disease becomes obstinately rooted, indeed, not to be eradicated: so, I know no means by which this particular form of inflammation might be distinguished, until too late, a cataract existing.

Cataract may exist with inflammation in each texture of the eye. During the presence of such morbid process, the organ is not in a state to undergo operation: on the contrary, atrophy of the globe must be the result, should such be undertaken. Cataract is only in a state for operation, when it may be looked upon as a disease existing alone, other disease, if other have been, having passed from its active state, the results alone remaining. Thus, a partially opaque cornea, a thickened iris, a wasted hyaloid membrane, none of these would in themselves contra-indicate an operation, but would be only so many guides to assist the operator in the choice of the operation he might adopt. Inflammation, or disease of the conjunctiva, or of the eyelids, render an operation for cataract impracticable; pterygium, and inflammation of the lachrymal sac, are

unquestionably disqualifying causes; and by so much the more reason is hydrophthalmia, atrophy, varicositas oculi, pannus, or any other change, through which the natural shape of the organ, or its texture, is lost. Synchysis is a very unfavourable complication, whether it be produced by inflammation or external injury; but, in a slight degree, it does not forbid an operation for cataract. Even the flow of the greater part of the vitreous humour from the globe does not prevent very useful vision being acquired. Its loss will necessarily diminish the refraction of light, and the globe will be rendered flaccid: an artificial lens will, however, greatly compensate for the one, and the secretion of aqueous humour, which is rapid and plentiful, again distend the globe. Congestion of the vessels of the head, a tendency to apoplexy, epilepsy, hysteria, chorea, or other nervous or mental affections, may be considered unfortunate complications, but do not contraindicate an operation: neither will pulmonic affections, nor a tendency to erysipelatous, or rheumatic inflammation. Rheumatic inflammation is, perhaps, the most unfortunate and fatal complication that is known. It is insidious, and especially in England is to be feared. It supervenes when least expected. A slight change in the atmosphere is sufficient to induce it, notwithstanding that care be taken to create an artificial atmosphere around the patient, most opposed to its access.

The supervention of this inflammation is less dependent on atmospheric changes, or constitutional

causes, than upon the high living that is indulged in, for the most part, in England. The same causes, barring the mode of living, exist to a greater extent in Vienna than in any part of the British empire. There, the easterly winds are most bitter, and atmospheric changes, throughout the day, of the most marked character, are to be observed; changes unknown in Great Britain, the which are not attended by the same untoward results which so frequently mark operations, especially those performed early in the season, in Britain. The constant meat diet and liberal potations, which are used amongst us, induce, far more than atmospheric changes, unhealthy and excessive inflammations after operations; and although the appetite be restrained, and a low diet alone allowed, before the operation is performed, still, the previous habits and course of life unquestionably operate to induce an unfavourable issue. It would be foreign to this treatise to examine into the diet tables of our London hospitals, and compare them with those of the Germans. Any one conversant with the subject, however, will be struck, on visiting a foreign hospital, with the amount of food that is deemed sufficient for a patient, when compared with that which is necessary to keep an Englishman alive. When admitted into a London hospital, it would appear that care should be driven away through the stomach. Now, unquestionably, the stomach is very dear to an Englishman, and much care is dispelled thereby, but other is begotten. It seems monstrous, however, that when by mischance

an unfortunate labourer is taken from his every day toil to lie idle in bed, it should be thought necessary, forsooth, to feed him with the best provisions the land can afford, undoubtedly with some restriction, though in such plenty that, when at his work, the same individual would be only too happy to furnish a similar meal for his Sunday's dinner. Far be it from me to inculcate the imposition of hardship, or unkindness in any shape, on the poor man; I would deem nothing more unseemly: yet, how far removed from kindness to pamper; very animals die of repletion intended for care. It is notorious the change that takes place in those admitted to hospital care; hospital nurses, as well as hospital patients, acquiring such an embonpoint, not to say obesity, that might astonish visitors to a charitable institution for the sick. The higher classes are habitually exposed to this evil: accustomed to limit themselves in nothing, but to indulge freely in the pleasures of the table, they forget to put a restraint on their will, when no longer, through age or infirmity, enabled to take the same amount of exercise that was formerly a pleasure; but, to kill time, they become more assiduous in their attention to this great resource, this charm of life. Apoplexy, gout, and rheumatic inflammation, are amongst the many forms that nature delights to adopt in revenge for the serious inconveniences to which she has been exposed.

To judge by the writings of the ancients of the influence exercised by medicines over the opaque

lens, it might be supposed that the greater difficulty consisted in the selection of a remedy rather than in the removal of the opacity. Of the many forms proposed by Pliny, and attested as excellent, perhaps the following may not be inferior to any. "Hieracium vocatur collyrium, quod ita maxime constat: temperatur autem id Hammoniaci unciis quatuor, œruginis Cypriæ duabus, atramenti sutorii, quod chalcanthum vocant, totidem: misyos vero una, croci sex. Hæc omnia trita aceto Thasio colliguntur in pilulas, excellentis remedii, contra initia glaucomatum et suffusionum, contra caligines, et scabritias, et albugines, ac generarum vitia." * But also, Nostier removed opacities of the lens, through hyoscyamus applied to the eye; Champesme, by means of a seton in the neck; Larrey and Gondret, by moxas applied to different parts of the head, especially the sinciput, &c. Now-a-days, however, be the cause what it may, medicines do not affect the opaque lens, either to retard the progress of or remove opacity. Opacity is as leaven, which leavens the whole mass; nor can it be neutralized, once having been introduced: it proceeds, without alternative, to the total loss of transparency, chasing before it conservatrix naturæ. Lymph, deposited external to the capsule, is to be removed as from other parts: but when the changes are wrought in the capsule itself, they are but slightly under our control, and that only when recent and faint. Lymph deposited external to the capsule is frequently supposed to be

* C. Plinii, Nat. His., Lib. xxxiv., cap. xi.

opacity of the membrane itself; and its removal through medicinal agents has begotten an error, an error complete for all practical purposes, which indeed were better treated as an error, than to suppose that transparency may be restored to an opaque capsule. However, to remove doubt, where doubt may exist, it is not only admissible, but recommendable, to try the effect of drugs and herbs, as their employ may be suggested. Belladonna to dilate the pupil, and mercury exhibited to produce a very mild constitutional effect, are the most potent and direct means, together with the local abstraction of blood, if such be necessary, that we have in our power to use against these opacities. It is almost impossible to render any exact account of what may be understood by a more rapid development, or retardation of opacity, there being no fixed laws for its completion; but it is proportionate to the existing inflammation, proportionate to the power of resistance, and to the access of the cause, be it what it may: rapid, as this is sudden and violent, and prolonged, as the cause is natural and removed from sudden influences.

The removal of the cataract can only be guaranteed by operation. Before the operation of extraction be undertaken, however, it is necessary to premise certain conditions, both concerning the patient himself, and of exterior causes. And first of the atmosphere. Cold winds, and cold and damp weather, are certain to bring with them misfortune, if an operation be undertaken, either during their

prevalence or immediately prior to their commencement. Consequently, it is usual to abstain from operating between the months of November and March inclusive. A dry cold atmosphere is not prejudicial, if care be taken to raise the temperature of the patient's apartments, so that the cold be not felt, and the temperature be constantly maintained at one point; bearing in mind, however, that more than sufficient heat for the patient's comfort, is scarcely less prejudicial than cold. Further, it is essential to attend to the patient's immediate health, to know that the system be not affected by any morbid poison, and that individual functions are well and properly performed; that there be neither cerebral congestion, nor gastric irritation, nor pulmonic affection; neither constipation, cutaneous irritation, nor other disquieting cause, which may be in the surgeon's power to remove, and whose presence must operate injuriously on the divided structures of the eye.

A modern author says, "Some days before the operation recommend temperance to the patient, and let him take care to avoid catarrhal affections;" a piece of advice that seems very proper for every day of the year, but a singular preparation for operation. The preparation necessary to extraction differs as the cataract itself. If this be produced by inflammation, it may be necessary, to let blood, to administer active cathartics, to adopt a spare diet, to avoid every kind of stimulus, lest the inflammation be reproduced: but, if the cataract be from deficient nutri-

tion, and the patient an aged and infirm person, it may be necessary, before resorting to operation, in some sort, to raise the powers of life by a liberal diet and the use of spirituous stimulants; lest the wound in the cornea, through want of power, should remain an open wound—lest the cornea should slough, or healing, should heal slowly, with spreading opacity, and a broad cicatrix through granulation. The preparation necessary is, to raise the vital powers sufficiently for the emergencies of the case or to depress them when more than enough; to ensure in either case sufficient vascular excitement for the adhesion of the corneal wound, preventing all undue action, to attain the juste milieu.

Both eyes may be operated on, at the same time or singly. If the cataract be a natural formation, and the patient tractable and healthy, the double operation is, perhaps, preferable; but, if there be fear of inflammation, or any untoward circumstance may have arisen during the first operation, then, a more cautious practice is to be recommended. He is a rash operator, and careful of his own eclat rather than of the safety and comfort of his patient, who, having been unfortunate in his first operation, endeavours to mend matters by proceeding to the second. But whether both eyes be operated on at once or not, is of no great importance; it is advisable, however, that the second operation be performed so soon after the first as may be convenient, that the education of the two eyes may proceed simulta-

neously, so that sight being restored to one, it may not be obliged to bear the burden of both, but that, so soon as possible, it may be relieved, sight being restored to the other eye. In London, it is the prevailing opinion, that it is preferable to operate at two distinct times, than to undertake the double operation on the same day. In the hospitals in Paris, where it is an object to have as many operations as may be in a morning, two extractions of cataract are very generally preferred. Professor Rosas operates on the two eyes, the one immediately after the other; and in the hands of this most able operator, I have never, during the period that I attached myself to his wards, by the failure of a single case, as attributable to this double operation, been enabled to understand that this practice might be censured. Professor Jäger prefers, as a general rule, to operate on one eye and await the result; but, notwithstanding, it is not unfrequent with him to operate on both eyes at the same time. This question is to be viewed apart from that, where one eye alone is cataractous. The patient not being deprived of sight, there can be no reason why the cataract should be removed, until by its residence it is detrimental to the organ; then the operation for its removal is but the choice of two evils. Certain it is, that it is a less evil to remove a perfectly formed or mature cataract, than to allow it to remain a burden to the eye. In the young and strong, it is liable to give rise to inflammation, and in the old and infirm to amaurosis. If the operation be mated to the case,

and both the choice of operation and the amount of interference be properly adapted, little fear need be entertained for the result. When the sight of the eye is lost, when the cataract resulting from severe inflammation is to be removed for the gratification of vanity, then the risk of such an operation, there being nothing to attain but the removal of an unsightly spot, with the probability of again lighting up the inflammation that produced it, must be fully explained to the patient, lest a beam be substituted for the mote that existed. Inflammation, in such a case, could only be followed by atrophy of the organ, and being thus unnecessarily lighted, must blaze as a beacon of folly to all parties concerned.

With respect to the calcareous changes that the lens is liable to undergo, it may be said, that they depend rather on the continuance of the inflammation, than upon any peculiarity of course or nature it may have assumed. External violence, not seldom, gives rise to this change, and, also, arthritic inflammation. In old age, also, stony particles are not unfrequently found in the lens, or the entire nucleus may be thus altered. It is rare to find the lens alone ossified ; the vitreous humour generally partakes with it ; and being amalgamated together, they form one earthy mass, for the most part, inseparable, though anatomically distinguishable. It is scarcely necessary to observe that, under these circumstances, vision is utterly lost, and the globe atrophic. The more usual change, of this description, is of the capsule, and this varies from the smallest

scales upon its surface, or in its substance, to the formation of a complete stony shell. Here, manual interference is not indicated, until the cataract shall have become detached, until, moving with each movement of the head, it so irritate the iris that extraction of this rough body is imperatively called for, to relieve the exquisite pain excited by its presence.

OF THE OPERATIONS FOR CATARACT.

Three operations are practised for the removal of cataract, namely, extraction, discission, and reclination. *Extraction*, by which the cataract is removed from the eye. *Discission*, when it is broken up *in situ*, to be removed by a natural process. *Reclination*, when it is depressed below the axis of vision; or modifications of one or other operation, as each case may require.

Some points are common to each of these operations, which, being detailed, will not again require to be alluded to; such as, dilatation of the pupil; the position of the patient; and the closure of the other eye. For the two minor operations, little or no preparation is necessary, their performance being very simple; but necessarily, as with every other operation in surgery, a reasonable power is to be desired, whilst more than sufficient is to be combated.

Before any operation be practised on the lens, it is

necessary to dilate the pupil. To this end, the extract of belladonna may be smeared around the eye, or a solution of its active principle (atropia,) be dropped between the lids. The pupil is to be fully dilated the day before that on which the operation is to be performed, and again on the morning devoted to the operation. Two grains of atropine dissolved in one drachm of rectified spirits of wine, with seven drachms of distilled water, form a convenient solution; a single drop of which, in half an hour, will produce a very sufficient effect. This is a cleanly and convenient mode of producing dilatation of the pupil. A stronger solution than this can never be required; indeed, this is not always to be used with impunity. It may produce dilatation during four or five days. Should such a powerful effect be obtained, during inflammation of the iris, that the membrane, being furled, should be seen as a narrow black circle only, it would in all probability become adherent and never again be able to expand. With the extract of belladonna, the dilatation is neither so complete nor so durable. Should lymph be thrown out, during the contracted state of the iris, to glue together any two portions of this membrane, or the membrane itself to another part, its natural tension, the effect of the drug being overcome, would break through the slight adhesions of soft lymph to restore the curtain membrane. As it is the pupillary margin of the iris, around which lymph is more particularly deposited, it should not excite surprise that adhesions, sufficiently strong to retain the folded iris,

might be formed in the space of three days, a powerful and durable dilatation of the pupil having been obtained through the employment of atropia. This has occurred; and it is, therefore, worthy to be borne in mind, that the solution of atropine, although admirably adapted to produce the required effect, the iris being healthy, being uncertain both as to the extent and duration of dilatation that it may produce, and this being always more complete than when the extract of belladonna is applied, this is not to be superseded by the former, the iris being inflamed. The cataract knife passing across the chamber restores the narcotized iris: by a violent effort, the pupil is almost closed. The membrane, thus tensely strung, forms an impediment to the propulsion of the lens, which, through spasm of the muscles of the eye, is forced against it. Should the pupil not have been dilated, before the operation, it will still contract, on the entrance of the knife: if it remain immoveable, it is evidence of synechia posterior.

It is usual to bind up one eye, when operating on the other; and when the patient cannot be made to fix it upon an object, this practice is useful in restraining the motions of both; but it is not imperatively called for, and indeed frequently omitted. It will often be found impossible to fix the eye: with the best intention, the patient will be unable to restrain the oscillatory movements of the globe. These will greatly distress the inexperienced operator, and demand of one who is master of his art, the

sacrifice of much time. Some recommend, and themselves practise, the mechanical fixation of the globe by means of a tenaculum passed through the conjunctiva. Little can be said in favour of such a practice. On the part of the surgeon, it shows an inaptitude for the performance of this operation; but, besides, there are positive evils attendant upon this course. The conjunctiva is frequently lacerated; effusions of blood take place beneath it; and the instrument necessary, together with the additional hand, is a great inconvenience, impeding the operator's movements. Instead of binding up the other eye, it will often be found useful to fix it with the middle and index finger of an assistant's hand, thus to restrain the motions of both. An instrument, shaped as a concave piece of steel, with an opening large enough to expose the cornea, was lately shown to me by the ingenious instrument maker, M. Lüer, of Paris, as suited to prevent the motions of the globe. It is intended to fit to the globe of the eye. It appears to me that a little more or less convexity of the globe would render this instrument useless, and that the pressure of such an instrument would tend to evacuate the vitreous and to the early expulsion of the aqueous humour.

The sitting position is the most convenient for all the operations on the eye. It is convenient for the surgeon, both as to the position he assumes in front of his patient, and for the light, that it may fall upon the eye. Further, and not least important, it is a less formidable position to the patient, than is the

recumbent posture. The latter frightens the nervous beyond measure. Indeed, it requires no little confidence for a blind person quietly to submit and yield himself as though he were lying down to sleep, when he feels his legs grasped by one, his arms by another, and an elbow on his chest, and he not knowing precisely what is going to happen. Spasm is, for the most part, induced, not of the muscles of the orbit only, but the whole body is in a tremor. The patient is to be seated in front of a window, which commands a good light, but to either side of the centre of the light, with his legs extended. His head will be supported on the breast of an assistant, who, standing behind him, will, with the palm of his hand on the patient's forehead, gently but firmly press the head against his breast, holding it, at the same time, perfectly erect, *nec citrà nec ultrà*, but in such a manner, that the face be directed neither upwards nor downwards, neither obliquely to one side nor to the other, but immediately towards the operator. The operator, seated with his back to the light, will raise his stool so high, as to bring his shoulder to a level with his patient's eye. Having removed any moisture from the lids with a piece of fine linen, the assistant will raise the upper lid with the index finger, the nail securing the tarsal cartilage without projecting beyond it, to hold it against the edge of the orbit : the operator will then depress the lower lid with the index and middle fingers, making a point d'appui of the lower ridge of the orbit : at the same time, he is enabled to make such pressure on

the globe of the eye with the tip of the finger, as he may require, to steady it. Then, balancing his instrument, in the hand opposed to the eye to be operated on, between the fore-finger, middle finger, and thumb, he rests his little finger on the malar protuberance, or zygomatic process, and, thus steadying his hand, he touches the eye with the needle or knife, as it may be.

EXTRACTION.

For the operation of extraction, it is favourable, that the eye retain its elasticity ; neither, on the one hand, having acquired hardness and an unyielding character, nor, on the other, having exchanged its natural firmness for a flaccid and unresisting sensation to the touch : that the cornea be transparent, and the anterior chamber sufficiently large : that the iris present its natural colour, and preserve its normal position, acting freely under the stimulus of light and without morbid adhesions ; contracting fully under the influence of belladonna to expose the lens : that the cataract be, at least, mature, exclusive of the capsule ; and that light be appreciated.

An overhanging brow; a deep orbit ; a small eye ; a shallow anterior chamber ; a flattened cornea ; a constricted palpebral fissure, are all naturally superinduced difficulties to the operation, that must be

overcome by the art and patience of the operator. An unsteady eye; an unnaturally bowed cornea; with an increase or diminution of substance from that which usually obtains, will be so many inducements to the surgeon to watch, if possible, more carefully than usual, the passage of the knife across the chamber, and more especially the puncture of the cornea.

Cataract from deficient nutrition is the form to which this operation is particularly applicable. Here, there has not been inflammation to cause softening, or new deposit; or thickening and induration of surrounding parts; neither are there abnormal adhesions; but each adjacent structure retaining its natural consistence and other property, lends itself readily to the different necessities of the operation, yielding and contracting as need be, and afterwards disposed to a healthy re-union and regeneration of lost substance. The operation is applicable to the soft cataract, though not in the same degree as to the hard. It is the only operation that should be performed for cataracta senilis, without there be some very peculiar reason for a different course. It is always to be preferred to reclination, when the shape of the organ is good and its substance unaltered by disease, and when discission is not applicable. It is to be preferred, when not forbidden by the extreme feebleness of the individual, or by the disease to which he may be subject, which might render violent movements of the body, if not necessary, not improbable. Age, in itself, is not a dis-

qualifying cause. Sir William Blizard, at the advanced age of ninety-two years, had a cataract extracted, by Mr. Lawrence, with complete success. It is necessary that the patient be reasonable, and, if not anxious to be operated on, that, at least, he shall not resist. That he be sufficiently old to know the importance of the visual organ, and that he be so tractable, that the result of the operation be not endangered by his perverseness. Further, that the operator and his patient speak the same language. Extraction is not to be performed, when an affection of the chest prompts to coughing, or when the patient may be subject to violent sneezing. And it may be well to remember the influence of new hay in exciting, what is termed hay-fever, *i. e.* violent and continued sneezing, together with slight febrile excitement.

Of cataracta cum bursa ichorem continente, Schmidt says, "The operator, with forceps, or with the hook, draws out the capsule, and with it a sac, which encloses a thick, yellow, bad smelling ichor. Immediately, the pupil is clear and the patient sees distinctly. But iritis always follows, and sight is again lost. In eight instances, this always happened to me, and now, when I meet with this variety, I never extract, but I recline the cataract." *

With regard to cataracta tremula and cataracta natatilis, destructive inflammation is said to follow their removal by extraction. Now, these cataracts are liable

* Uber nachstaar und iritis nach staaroperationen, von Dr. Joh, Ad, Schmidt. Wien, 1801, p. 21.

to give rise to excessive irritation and inflammation of the iris and aqueous membrane. Doubtless, should the cornea be opened during a state of vascular excitement of the interior or exterior structures, inflammation must be expected, which will probably be destructive inflammation. But if, through rest and palliative measures, the lens having been returned to its own seat, vascular excitement be dispelled, and a normal state regained, the cornea may be opened with absolute safety, or with not more danger than would, under other circumstances, have attended the operation. Not only so, but it is preferable to extract these cataracts when possible. Being moveable cataracts, and separated from their natural attachments, the capsule cannot be lacerated, there being no fixed point of resistance; consequently, though reclined into the vitreous humour, they cannot be removed as a lenticular cataract, the capsule not being influenced by the destructive process to which the lens is subject; they will, therefore, remain scarcely altered in size, and apt again to rise into the axis of vision on the application of any sudden force to the head or feet, or even without concussion of the body. It has been stated, that the capsule is not influenced by the absorbents. If it be divided by a crucial incision, it folds up to be drawn out of view, and becomes as an opaque ring at its junction with zonula Zinnii: this is, probably, never removed: it may be found twenty years and more after the removal of the cataract. If it be divided less completely, it will hang as shreds in the pupil, which

gradually become thinner and thinner, until they are removed; but this is almost the work of a life-time. If it remain entire, as after absorption of the lens in congenital cataract, or in cataracta natatilis, it is exceedingly questionable, whether any number of years would suffice for its removal. Such cataracts have been known to remain closing the pupil, or floating in the anterior chamber, scarcely altered, during fifty years. When broken into small pieces, to lie in the anterior chamber, it constantly rises, momentarily to impair vision, as floating through the aqueous humour it changes its position: after the lapse of many years, however, this ceases, sometimes from a lodgment having been effected; sometimes, perhaps, having been absorbed. It may be said, that no structure in the body is so resisting as the external layer of the crystalline capsule.

The patient and operator being placed as already directed, and other measures taken, as before detailed, the surgeon will carry the blade of his knife before the eye, to measure upon it the breadth of the cornea. He will touch, once and again, the cornea with the flat blade, to accustom the eye to the knife, having already gained his position, that no further movements shall be requisite. The knife is to be held lightly, not grasped, between the middle, index-finger, and thumb; and it is to be moved horizontally only, motion being imparted to it by the fingers moving on the metacarpal joint, the thumb being held straight, to move at its carpal joint only. The desired level having been gained for the knife, it will be made to pierce the cornea,

as nearly as may be, at the middle of its circumference, and as near to the sclerotica as possible. The cornea punctured, resistance ceases; the knife is carried rapidly across the anterior chamber, parallel with the iris, and the cornea transfixed at an equal distance from the sclerotica as at the point of entrance: gently the blade is thrust on, until the corneal flap is formed: or, if there be danger of wounding the nose, or caruncula lacrimalis, before the flap is yet complete, let the knife be retracted, supported only against the divided edge, and it will probably be formed before the point of the knife has again reached the cornea: should the flap, however, not yet be complete, let the knife be passed again, and thus a regular, semicircular flap will be formed, at all points equi-distant from the sclerotica. When it is desired to form the flap of the lower half of the cornea, the edge of the knife will be turned downwards, and the operation proceeded with in the same manner. The knife may be entered at the nasal or the temporal side of the eye; the latter, however, is the most convenient. The blade having been carried across the chamber, the least upward pressure would complete the flap, and that with an audible snap; but the flap would not be semicircular, and the snap is evidence of the bruising of the cornea: it is of all things to be avoided. Spasm will surely follow the hasty completion of this first part of the operation; the eyelids will be violently closed, the capsule may be ruptured, and at the same time the lens and vitreous humour escape. The division of the cornea is without pain,

and, the chamber once traversed, all danger is at an end ; the surgeon has the eye under his control, and the escape of a drop of the aqueous humour is then immaterial. That the flap may be perfectly formed, that spasm may not be excited, and that healthy reunion may not be prevented, the division of the cornea can scarcely be too slow.

It is recommended in books to enter the knife at an angle of forty-five degrees, and immediately to depress the handle towards the temporal fossa, thus to bring the blade parallel to the iris : but, although this is inculcated, it is never practised, not even by those who recommend it; and there would be danger of wounding the iris if it were done. It is sufficient to enter the chamber as directed; to traverse it and transfix the cornea ; then, the eye being in the power of the operator, he will draw it away from the inner canthus, if it be necessary, by inclining the handle towards the temporal fossa, and complete the section at pleasure. It is advantageous, for the easy escape of the lens, to divide largely the cornea. The danger is thus lessened, for if the opening be small, the lens, escaping, will bruise the cornea. A section of one half of the cornea is always ample, and should never be exceeded, lest, if the flap be too large, it should fall forward : great difficulty might then be experienced in permanently replacing it. It is sometimes recommended to puncture the cornea at half a line before its junction with the sclerotica : suffice it to say, that the point of the knife should be entered so near the junction of the cornea with the sclerotica, as not to interfere with their junction.

The section is not to be made more anteriorly, lest the cicatrix be brought too much into view; nor is the sclerotica to be divided, lest the insertion of the iris be interfered with, lest the wounded sclerotica should not again heal. The exit of the knife is to be equally distant from the sclerotica as is its entrance, and the whole circumference of the wound at a like distance; which can only be obtained, the patient's head being held perfectly erect, the operator square with his patient, and the knife parallel to the iris. From the inclination of the eye to roll towards the inner canthus, it may be impossible to see the point of the knife as it passes out of the chamber to transfix the cornea, the inner edge of this membrane being buried in the conjunctival folds; consequently, the sclerotica may be pierced. The knife is immediately to be retracted, sufficiently to disengage the point, and then to be passed through the cornea. Or again, the iris may be traversed: here, the knife must not be withdrawn, or the aqueous humour flowing, the operation will be completed with difficulty; but being held against the cornea, this may be gently rubbed with the finger-nail, which will generally be sufficient to disengage the iris, when, under any circumstances, it has fallen upon the edge of the blade. A wound of the iris is, at the moment, of no great consequence; but the divided edge is apt to become engaged in the corneal wound, to prevent its speedy healing, or to heal in it: by keeping asunder the edge of the wound, it prevents the aqueous humour collecting, and, consequently, the natural distension of the cornea; it is productive

of great irritation, the prolapsed portion coming in contact with the closed lid, and excites an inclination on the part of the patient to rub the eye, which is indulged in instinctively: thus the wound heals with deformity, by reason of the black and probably broad cicatrix; and a misshapen pupil is the necessary consequence. Should the iris be wounded, and a piece taken out, amends must be made by the neatest patchwork possible: with a pair of fine scissors the two pupils must be joined, so soon as the operation is complete. Care must be taken not to alter the inclination of the blade during its passage through the chamber: this is very likely to happen, when, from one cause or another, an impediment has arisen, such as the iris falling upon the knife. Then, instead of being divided in its thickness alone, the knife may divide the corneal lamellæ obliquely, to produce a well-looking flap exteriorly, but within, so contracted, that the lens will not be able to escape. It will be necessary to increase the opening with the corneal bistoury. But it is clumsy work to have to enlarge the section, the cataract knife having been withdrawn. The rolling of the eye inwards, the troubled state of the patient, or the hurry of the operator, may cause the knife to pass out of the chamber before it is traversed in more than half of its extent. Such a section will be far too small for the escape of the lens, and will require to be enlarged with the corneal bistoury. Scissors produce a contused wound, and, consequently, should not be used. If, after having punctured the cornea, the eye should slip from the knife, the aqueous

humour will escape. Under such circumstances, it is preferable to postpone the operation until a more convenient opportunity, rather than prosecute it under such great disadvantages. But, if it be necessary to complete it, the knife must be introduced with a gentle wriggling motion, until the pupil is covered; the tip of the index finger distending the cornea, by slight pressure on the globe beneath it. It may happen that the point of the knife shall break, or bend, against a tough old cornea, within the chamber. The knife is immediately to be withdrawn, and the operation completed with a smaller blade, which is to be passed across the chamber through the wound made by the first.

Of the comparative advantages of the upper and the lower section.

The section of the cornea does not interfere with vision, and often is scarcely perceptible; more especially if arcus senilis exist, and is well marked. Arcus senilis in no measure interferes with the healing of the wound. The upper section of the cornea is that most frequently performed; the lower is, indeed, comparatively rarely made. However, the advantages of the one over the other are so small, that it requires a devotee to discover them. It is said that the aqueous humour does not collect so quickly, the lower section being made; that the iris is more likely to prolapse; that the lower section does not heal so regularly and readily, because the lids closing meet upon the wound, impress the cornea, and consequently separate the edges, but that it is easier of formation than is the upper. On the other hand, it is said of the upper section, that the lens does not escape so easily; that the flap

may not only not lie in contact with the surface of the wound, but that it may fall over and not unite, the which cannot happen the lower section being made. These are nothing better than party questions, to cavil at one operation or the other. Practice makes one more easy than the other, but both are equally eligible. Should there be slight opacity of the cornea, either at its upper or lower surface, that part should be chosen for the section: for, if inflammation succeed the operation, and a part of the cornea be already spoilt, it is most important that the other should not also be implicated. Again, if the upper edge of the cornea be habitually covered by the upper lid, then, ceteris paribus, the upper section is to be preferred; for thus, at least a part of the cicatrix will be constantly hidden. The same rule will of course apply to the lower section. Professor Rosas performs the lower section, whilst the Professor of the Josephinum prefers the upper; and without some rule to guide the choice, it would indeed be difficult to prefer one operation to the other, so accurately does the knife obey the fingers of these masters. The aqueous humour collects so soon in one as in the other; nor is it necessary that union shall have taken place for this fluid to collect. Though the edges of the wound be merely in contact through lymph, the fluid will not escape as it is secreted; but, on the contrary, will tend to close the wound, as it restores the shape of the organ. When the powers of the patient are at a very low ebb, the aqueous humour is scantily secreted, and the edge of the wound is apt to be slightly everted.

It is most desirable to find the edges of the cornea in contact, and the flaccid state of the membrane removed, before union can have taken place; and it is found indifferently with one operation and the other. I am at a loss to understand the advantages of the external and inferior section, without it be recommended by the peculiar formation of the palpebral fissure: for the surgeon is in great danger of wounding his own fingers, and the manipulation is difficult. This method was adopted by Baron Wenzel. But although there may be reasons for adopting peculiar fashions, the same may fail to perpetuate them. However, unquestionably the formation of the face may be such as to render this operation preferable.

In the young, the cornea is thicker and more pulpy than in the old: consequently, greater care must be taken that the point of the knife traverse the cornea to enter the chamber. It is not difficult to pass the knife between the corneal layers, and a timid operator should bear it in mind.

It is a bad habit to acquire the necessity of resting the elbow whilst the section of the cornea is being made. The operator's hand is neither so free nor so steady as when supported by the little and ring fingers on the patient's cheek.

It is, unquestionably, an admirable practice to make such arrangements with self as to be independent of others: but the advantage of an able assistant—one who, seeing and understanding all that is taking place, moves as a part of the operator himself, is too evident to be insisted on. Amputa-

tion of a limb may be performed without an assistant, but how much more conveniently with the aid of a trusty one! To detail all that is not to be done, or to allude to such accidents that may occur, were to occupy too much space; let it suffice to have an accurate knowledge of what is to be done; a little experience will soon teach that is to be avoided.

The section of the cornea being made, the assistant will allow the lid gently to fall, the patient, at the same time, being directed to raise the eye, that so the flap may not be displaced by the falling lid. The knife is now to be laid aside, and a needle, held in the same manner as the knife, to be introduced, after a brief breathing-space has been allowed to the patient. It will be introduced, the lids being separated as before, so that, the neck of the needle lying horizontally in the wound, the point shall be directed towards the nose. It will then be drawn through the chamber over the inner edge of the wound, until the point reach the pupil, when a crucial incision will be made in the capsule. Whilst the needle is being introduced, the surgeon, with his finger on the lower lid, makes slight pressure upon the globe, to raise the flap for the entrance of the needle, and to render the capsule tense, that it may be the more readily divided. The needle is then withdrawn. Again, the lid is allowed to fall. The pupil enlarges, the lens falling against it, and muscular contractions continuing, it appears as though the iris would be ruptured rather than open sufficiently to allow the lens to pass. Muscular contrac-

tion is increased by the slight movements of the globe, as when the eye is turned upwards. The lens is protruded through the wound, or is removed from between the edges with the curette. Thus the operation is concluded. Before the patient is sent to bed, notwithstanding, it will be necessary again to see the eye. The patient may be directed to open it, or the surgeon will raise the lid, to see that the edges of the wound are in contact, and that pieces of the lens do not remain in the wound: these, if there be any, he will remove with the curette, and having adjusted the flap, will close the eye. If possible, it is preferable that the slight muscular contractions shall expel the lens; but, if this prove insufficient, gentle pressure may be made above and below, with the operator's finger and the handle of his instrument. If, through adhesions, it will not escape, un accouchement forcé must be had recourse to. The Daviel spoon is to be introduced through the pupil and behind the cataract to scoop it out: and that it be done boldly. Nothing is more hurtful than with a too great nicety to displace the lens by piddling behind the iris with the scoop. When this abominable practice must be had recourse to, it should be effected at one stroke. Should the cornea fall down upon itself, the surgeon, seizing the lashes between his finger and thumb, will raise the lid, replace the flap with the concave surface of the curette, and sweeping this over the globe, from below upwards and outwards, will, at the same time, draw down the lid and close the eye. The iris is

sometimes caught in the wound, but will be withdrawn on making a little rotatory pressure with the tip of the finger on the closed lid, and suddenly opening it to a strong light. Should small portions of lens be left in the anterior chamber, it will be unnecessary to remove them: they will be rapidly absorbed: those only on the edge of the wound, which, by separating the two surfaces, would retard their re-union, are to be cared for.

Before the patient is sent to bed, it is well to attach a light bandage around the head, and, at the same time, to allow his night-cap to be put on, if he be in the habit of wearing one; also, to pin to the bandage two triangular pieces of fine linen, which, hanging down before the eyes, do not heat them, whilst they serve to remind him of the necessity of keeping them closed. During my residence in Vienna, it happened to Professor Jäger to meet with a patient, who was so unruly that he would not suffer the operation to be completed. The section of the cornea had been made, and the capsule lacerated: in this condition he was sent to bed: or, as Jäger afterwards expressed himself, "I sent him to bed, and his eye to the devil." On paying his first visit to the patient, the Professor raised the lid, when, out dropt the lens. The corneal wound healed perfectly, in the usual time, without inflammation, and without untoward circumstance.

The escape of the vitreous humour is an unfortunate circumstance: it will sometimes occur with the greatest care. If the eye be large and protruding,

it is to be expected, for here the muscles have so much power to contract upon the globe, that all the surgeon's care and art will scarcely prevent it. If the eye, having lost its natural elasticity, be rendered in the least degree flaccid, the hyaloid membrane being softened, the loss of the humour will not excite surprise. But, for the most part, this additional loss and complication of the operation depends on the operator himself. It is occasioned by a wound of the hyaloid membrane, through the too free use of the needle, in dividing the capsule. In the hands of some, it is almost necessary to the completion of the the operation, whilst, with others, it is one of the rarest accidents that occurs. When the support is removed from the eye by opening the cornea, the vitreous humour is thrust forward, and bagging over the lens, envelopes it more completely. The needle being used to divide the capsule, and free movements being permitted, the posterior wall of the canal of Petit is wounded; so that, together with the lens, the vitreous humour protrudes. The original wound may be very slight, but the fluid gushing through it, enlarges it; so that, it appears as a considerable rent. A fourth of the whole humour may be lost, without materially affecting vision: nay, I have seen two-thirds of the whole vitreous humour flow through the opening in the cornea, and, notwithstanding, useful vision regained. Inflammation is not to be dreaded as a consequence of a small, or of a large, escape of the vitreous: if it follow, it will rather be in consequence of the diseased state

of the humour and of the hyaloid membrane, than as a natural consequence of this loss, as supposed by many. On the occurrence of this accident, the eye is immediately to be closed, and so left until all spasm has subsided. After the lapse of sufficient time, the operator, raising the lid by means of the lashes, may see that the flap is in apposition with the cut surface. It will not be necessary to warn an English reader against M. Velpeau's practice under these circumstances: it would, I believe, occur to very few to adopt it. I will not alter the force of the original language, but give the author's words. " Il faut absolument s'en abstenir, (i. e. from operation,) néanmoins, dès qu'on a la certitude d'une altération profonde de l'œil. Chez un homme qui était dans cet état, et aux instances duquel je finis par céder, le cristallin sortit lentement de lui-même, enveloppé de sa capsule, quelques moments après l'ouverture de la cornée, et l'humeur vitrée se trouva tellement fluide, qu'elle se serait échappée comme de l'eau, si je n'avais, sur-le-champ, comprimé le devant des yeux avec de la charpie. Des accidents cérébraux sont survenus et ont été assez graves, pendant quelques jours, pour me donner la plus vive inquiétude. L'œil gauche est tombé en fonte purulente, et le droit, quoique parfaitement clair, reste insensible a toute lumière." *

Thus, the operation is divided into three principal parts ; viz., the section of the cornea, the division of

* Nouveaux Eléments de Médecine Opératoire, p. 219. Bruxelles, 1832.

the capsule, and the extraction of the lens. But it is capable of being so modified, as to be performed en un tour de main, i. e., that the three divisions of the operation shall apparently merge into one. Nor is this difficult, though the result is not always equally happy. When operations are performed against time, the surgeon being surrounded by a large and admiring class, he is sometimes observed to sacrifice something of that he owes to his patient, to his own éclat. To a reflecting and humane mind, few spectacles can be more disgusting than these feats of dexterity, which we are called upon to witness from time to time. That an operator should be most dexterous, all must earnestly desire, but that he should prostitute his talent to self-gratification and theatrical applause, is unworthy of his calling and derogatory to the profession he acknowledges. To bystanders, who only know that a cataract is to be extracted, it appears an admirable operation, when they see the lens on the operator's nail almost before they are aware that the operation has commenced; and effected without changing the instrument.*

* The operation of extraction of the cataract was not generally known, and had been but rarely practised, until Daviel drew attention to it, through a paper communicated to the French Academy of Surgery, as well as through a treatise, styled, Une nouvelle méthode de guérir la cataracte par l'extraction du cristallin, 1748. Daviel's operation was rude: he punctured the cornea, and enlarged the opening with scissors. Prior to his time, depression of the cataract was performed, and that without any important alteration in the mode of operating since the time of Celsus, and before his time. So long ago as the days of

When the operation is finished, and before the patient is led to bed, it is not unusual to test the power of sight. It was an old practice, especially in Germany, to fill a glass partially with water, and bid the patient point to the height at which it stood in the glass. Now, it is usual to hold the spread hand before the eyes, that the fingers may be told. If a patient be very anxious to know the result of the operation, it is better to gratify him ; but it is wise to abstain from this display of curiosity. An old lady, having been operated on, and two cataracts extracted, to which she submitted and was most tractable, was about to be led to bed, when the operator requested her to open her eyes. She immediately responded, and exclaimed, astonished, that she could see him perfectly : she congratulated him on his good looks, and proceeded to examine the room ; thence her eyes were directed to the garden beyond ; and neither entreaties nor threats were sufficient to repress the old lady's inquisitiveness. It was impossible to keep her eyes closed when at last she consented to be removed to bed. Twice the corneal flap had to be replaced, having fallen down upon itself. I remember an old man at the London Ophthalmic Infirmary, who could neither be persuaded to remain in bed, nor to close his eyes : more than once, he was found, on the morning that the

Avicenna, cataract has been extracted through a section of the cornea ; but, until the time of Daviel, it was done as though by chance, and rather prompted by curiosity than led by certain knowledge.

operation had been performed, staring out of the window. It is only natural that patients should be anxious to enjoy that which they have been so long deprived of, and which is now within their reach. How can it be detrimental, when the surgeon himself taught them to employ it? It is an evident abuse of power to restrain them! Light admitted suddenly to the weakened retina may produce amaurosis. Many have not sufficient fortitude to restrain themselves, but knowing themselves in possession are anxious to enjoy the boon: a constant slight movement of the eyelids may be observed, and the patient is unable to rest quietly. Speedy union is, perhaps, prevented; the motion of the lid irritates the cut edge, if it do not displace it. Therefore, the surgeon himself knowing what must be the result of the operation, if properly conducted and properly chosen, need not seek a proof of that his own knowledge rendered a certainty to him before he commenced the operation.

After-treatment.

If possible, let it be provided that there shall be no stairs to ascend, not even one step, on the way to bed: for, although the patient be on a faithful arm, the knowledge of an obstacle in his path, causes unwonted spasm of the eyelids, with, perhaps, escape of the vitreous humour as he plants his foot upon the step. When he has been made comfortable in bed, the surgeon will again raise the lid very gently, to see that the corneal flap has not been displaced, and, at the same time, if there be any doubt as to the patient's control over himself, it is advisable to apply

a strip of court-plaster lightly over each eye, extending from the forehead on to the cheek, and a piece of fine linen, moistened with cold water, may be laid on the eye. The head and shoulders are to be raised with pillows, green curtains to be drawn around the bed, and the room to be so darkened that the attendants may have only sufficient light to find their way about. Everything must be done to make the patient as comfortable as possible ; but as the comfort of one is the distress of another, it is necessary to have a hawk's eye to minor matters, for on their disposal much of the success of the operation depends. The surgeon must not despise the office of nurse, for he alone can direct what is, or is not, to be. Sleep should be invited during the first twenty-four hours, and perfect rest insisted on: that the patient neither rise in bed, nor talk, nor masticate hard food. Should he be restless, sedatives may be necessary, but they should be avoided, if not imperatively called for : nor is sleep to be encouraged in excess, for thus congestion of the head and eye will be produced. Hyoscyamus is to be preferred to opium, if its effect should be deemed sufficient to produce the purpose in view.

If perfect juxta-position of the edges of the wound be obtained, without wound or prolapsus of the iris, the patient will not suffer pain, nor even sensation in the eye, after the slight smarting produced by the knife has ceased, the which is quickly forgotten. As the aqueous fluid collects, it runs away ; but, when

sleep is induced, the eyelids become adherent, and then a collection of this fluid, and an increased secretion of tears, is formed. It is much to be desired that, in twenty-four hours, the flap shall be adherent, that the slight necessary movements of the patient may no longer excite fear. After the lapse of twenty-four hours, the eye may be gently bathed with luke-warm water and a piece of fine linen, to remove the secretion, and to allow of the escape of the tears. If there be no pain in the eye, nor heat of the lid, it may be hoped that all danger is past.

Cooling beverages, such as lemonade, orgeat, or any other that may be grateful to the patient, may be allowed; and such light food as shall not disturb him, such as broth or any light farinaceous food. It is to be desired that the bowels shall not be moved during the first and second day after the operation: they should have been so sufficiently solicited previously, that this might not be necessary. In three, or four, days it may be considered that the flap has united. The patient may then be allowed to sit up in bed, and a more substantial nourishment may be given. On the fifth, or sixth, day after the operation, the eye may be gently opened and the result of the operation seen; if it be satisfactory, the patient may leave his bed, to sit in an easy chair, or to take gentle exercise in the room. The temperature of the room is to be maintained, and that without variation. After ten days, the eyes may be opened, without, however, admitting more light to the room. Then

the daylight is to be gradually admitted, until fully borne, a green shade, to cover both eyes, being worn, when the light is increased.

It may happen that so great prostration of strength shall follow even this slight operation, in an old, infirm person, as almost to simulate death. Old women, especially, who have summoned up all their courage for the operation, may be removed to bed, to lie down and die, if they be not prevented. They will lie perfectly quiet, without movement or expression, and not recover from the great cold which has seized them: shivering and low muttering will soon terminate the scene. Such an one must be placed in a warm bed, and some slight stimulus be administered, which will probably produce the desired reaction.

Of inflammation after operation.

But, instead of the course so much to be desired, one more active may be run. A darting, or burning, pain may be felt in the eye, the natural heat may be increased, and the tears become scalding: the lids will, then, be red and swollen, the pulse will be increased in frequency, and general febrile symptoms will be excited. Ice-cold water is to be applied, under these circumstances; blood-letting is to be had recourse to; and nitrate of potassa in almond emulsion may be given. After the venesection, a quarter of, or half a grain of acetate of morphia conduces to quiet, and tends greatly to allay irritation. If inflammation supervene, it will probably arise during the first three days after the operation: it is to be held in so just a dread, that its first approach

shall be recognised and powerfully combated. The more urgent symptoms are not to be awaited; a sensation as of sand in the eye, with a restless state of the patient, will indicate the propriety of venesection, with the withdrawal of blood according to the strength of the patient. Venesection, leeches, opium, calomel, and belladonna, are the remedies that are to be relied on. Inflammation is more conveniently and readily prevented, than subdued. Such prompt measures must be had recourse to, as shall prevent its access; always bearing in mind, that there is an incised wound of the eye, for the rapid healing of which, increased action is necessary, but inflammation preventive. When inflammation has advanced to ophthalmitis, the eye *must* become atrophic. After inflammation has become general, cold applications, leeches, and calomel, are useless; and opium and belladonna alone afford relief. Iritis, after extraction, is not to be dreaded, although in a slight degree it is far from uncommon. When it occurs without other inflammation, it is generally induced by the too earnest desire to obtain immediately a clear pupil. The introduction of instruments within the corneal flap, to remove any loose portions of lens is most injurious: it is useless, as these are readily absorbed; but it is injurious in irritating the iris and the fine lining membrane of the anterior chamber; but further, it is injurious by admitting the atmospheric air, which, without doubt, is most irritating to the interior eye. Although iritis may arise when the greatest care has been taken to prevent its oc-

currence, it is seldom so severe in character, as when produced by any of those predisposing causes, which, excited by the least provocation, baffle the attempts of the most able. Rheumatic inflammation is the most common form, and the most formidable, that follows this operation. When the iris has been wounded, or irritated with the curette, the supervention of inflammation cannot excite surprise: when, also, it has been bruised by the sudden and forcible passage of a large lens through the pupil, this must be expected. When time has not been allowed for the pupil to expand, to allow of the spontaneous escape of the lens, but that the operation might be completed in a given time, pressure above and below has been made on the globe, as though such pressure could be made with impunity,—as though the iris, suddenly forced open, the membrane being tense as though it must rend, and its support as suddenly removed, must not necessarily suffer: as though the removal of the cataract were the sole consideration of the operator. When the operation is undertaken without the previous use of belladonna, the freedom of the iris being unknown to the operator; when it may be necessary forcibly to break down the adhesions of the iris to allow of the necessary expansion of the pupil, for the escape of the lens; when the operation is performed indiscriminately for the removal of the hard and the soft cataract, and without other consideration than the removal of the cataract, can M. Roux' ill success, his equal loss and cure, be wondered at?

Without inflammation of the eye, so much general irritation may be excited, that the catheter may be necessary to relieve the distended bladder; and other disquieting circumstances may be induced, which require to be treated locally as well as generally.

After extraction, astringents are not to be used, without the most urgent necessity: they are liable to induce ulceration, even after cicatrization of the wound is complete.

The progress being favourable and no adverse circumstances arising, in a fortnight, or three weeks, the patient will be able to bear daylight, and to use his eyes. They must be used, however, with moderation, and sight will improve during several months after the removal of the cataract. So long as the eye is gaining power, glasses must not be had recourse to, but only when improvement ceases. After the destruction of the lens, and when a perfectly clear pupil has been obtained, sight differs according to the age of the patient and the state of the retina. In the young, the eye may so accommodate itself to the estimation of objects, that an artificial lens may not be required; the power of the one eye differing but slightly from that of the other, which still retains its lens. Short-sighted people do not necessarily require artificial lenses, after the loss of the natural lens. In these, extraction of the cataract is always more happy in its result than in those who were previously long-sighted. Double convex glasses are required after extraction, and of different

powers to distinguish far and near objects : further, each eye may require a lens somewhat differing in power, and each must be so accommodated according to its power, that the sensation of straining may not be produced. When the glasses in use are found to be insufficient to produce easy vision, others more powerful must be substituted, for the eye is injured by straining to distinguish objects, rather than by the use of a powerful lens. When, by the too early use of glasses—before the retina has regained sufficient power—whilst it is yet gaining strength, and the image is being received and understood more perfectly, the eye is brought into use, a tendency to an early loss of sensation in the retina, with a rapidly diminished power is begotten. This is a circumstance not to be forgotten, for the loss, when it occurs, is irremediable.

That the operation terminate favourably—not only that the cataract be extracted, but that sight may be restored—it is necessary, both to discriminate between the productive causes of cataract and to employ that operation most suitable to each case. This was, indeed, my starting-point, and I feel that the injunction has been repeated *usque ad nauseam*. However, I will now direct attention to the results of operations as performed by different professors, to show that success depends far more upon an accurate knowledge of the history of each case and a consequent adaptation of the method of operating, than upon manual ability alone ; to show that the patient is far better served by a faithful judgment,

than by manual dexterity without it. Of every five cases of extraction of the cataract, Prochaska had one unsuccessful. Beer had one in every nine. Jäger has one in forty-two, and Roux one in two. For Jäger's cases, I will refer to the following table, which was taken from his protocol. There, will be seen, the number of operations performed during eighteen years, the operation selected, and the success attendant on each operation. Thus, of seven hundred and thirty-seven cases of extraction, thirty-three were unsuccessful, which is as 1.22. It must not be overlooked, however, that in taking the sum total of the eighteen years, a manifest injustice is done to the operator. During the latter part of this period, there has been a sensible diminution of losses, or if the half be taken, namely, nine years, it will be seen, as already stated, that the loss is as 1.42.

Table of Operations for Cataract.

School Session.	Extraction through the section of the cornea.			Partial extraction.		Discission and laceration.		Reclination.		Total.
	Superior section.	Inferior section.	Eyes lost.	Operations performed.	Eyes lost.	Operations performed.	Eyes lost.	Operations performed.	Eyes lost.	
1826-27	24	3	3	2	—	2	—	5	1	36
27-28	28	3	2	5	—	7	1	13	2	56
28-29	29	—	2	2	—	3	—	3	—	37
29-30	37	—	2	7	—	2	—	8	—	54
30-31	31	2	2	4	1	3	—	4	1	44
31-32	26	—	3	3	—	4	1	5	1	38
32-33	27	—	3	10	2	10	2	9	3	56
33-34	44	—	3	1	—	9	—	5	1	59
34-35	57	—	3	1	—	4	1	3	1	65
35-36	39	1	1	2	—	6	—	4	1	52
36-37	27	—	2	2	—	6	1	10	2	45
37-38	44	—	1	1	—	8	—	21	3	74
38-39	29	—	1	—	—	8	—	5	—	42
39-40	52	—	—	1	—	1	—	10	2	64
40-41	68	—	1	2	—	1	—	6	1	77
41-42	71	—	2	5	—	5	—	4	1	85
42-43	39	—	1	7	—	6	—	10	1	62
43-44	56	—	1	3	—	2	—	4	—	65
	728	9		58		87		129		1011

In his Essay " Sur Quelques points de l'Histoire de la Cataracte," Maunoir has given the result of one hundred and seventy-nine operations by extraction, which were performed by M. Roux, during four seasons, at La Charité, in Paris. These operations

were performed on one hundred and fifteen individuals, and ninety-seven operations only were successful. The following category of misfortunes will show how the remaining eighty-two eyes were lost.

Fourteen were destroyed by suppuration.

In nineteen, the corneæ became so opaque, that nothing could be distinguished.

In nine, together with an incompletely opaque cornea, false cataracts prevented vision.

In fifteen, membranous cataracts were formed.

In six, false cataracts, with distorted pupil.

In one, total occlusion of the pupil.

Eighteen others were equally unfortunate, the operation failing from one cause or another; in two of them, the pupils were clear, but sight was not restored. Yet, with such a concatenation of misfortunes, that I verily believe would be impossible to surpass, that I am sure no awkward quack might not safely challenge, M. Roux has succeeded in establishing a far from unenviable reputation in his own country, and, indeed, more or less of an European reputation, as an oculist. His unpardonable recklessness, in extracting every cataract that comes under his care, together with great manual ability, has procured for him that eclat, which another, with less vanity and more moral courage, would, perhaps, never have obtained. The result of operations is known only to the few; (and this most especially in Paris;) a showy impudence in performing them, through the ignorance of the multitude, is

allowed to usurp that place which should be reserved for knowledge wielded with modesty.

PARTIAL EXTRACTION.

When the cornea is partially opaque; when cicatrices have been formed, from one cause or another; when the iris is adherent to the cornea—synechia anterior; or to the capsule of the lens—synechia posterior; or when, through lymph exudations, the pupil be closed, contracted, or distorted, and, at the same time, there be a secondary cataract, especially when it may be capsular; or when there be cataracta centralis; cataracta arida siliquata; cataracta tremula; cataracta natatilis, or cataracta cystica, this operation is to be preferred to any of the others in use. An opening is to be made in the cornea, midway between its centre and the edge of the sclerotica, and sufficiently large for the easy removal of the cataract. The sharp-pointed, double-edged, spear-headed knife is generally employed to make the opening in the cornea. This opening is made at a thrust, and if not sufficiently large to enable the operator to manœuvre, it may be enlarged in withdrawing the knife. A strong eye-hook is then to be passed through the wound, and the opaque substance to be firmly seized and dragged out. Or, if the cataract be capsular, a fine curved forceps

may be found more useful to seize and remove it. The forceps will be introduced into the wound, closed, and only opened in the pupil; then, the cataract, falling between the blades, will be seized, and removed with a gentle dragging motion. If the hamulus be used, it must be strong, else it will probably be broken by the tough capsule. There is scarcely a more simple operation than this in the whole range of surgery: the wound heals by the first intention, and there is little to be feared from inflammation, either immediate or secondary. Instead of the spear-shaped knife, one sickle-shaped, and double the breadth, at the shoulder, of that of Mr. Scott, is more convenient for opening the cornea.

It is an old saw, that the surgeon should have a lady's hand, an eagle's eye, and a lion's heart: thus, to be a most complicated and apocryphal animal, whose classification should have puzzled Buffon himself. Without knowledge to guide his eye, how little does a light and even experienced hand, with the most fearless and intrepid determination, avail: it is as the philosopher's stone in the hands of the ignorant, who, not knowing how to manipulate it, could find in it nothing more than a common pebble. Though the science of medicine demands research and labour, success in the practice of it requires rather that the advice of Mephistopheles should be followed, than that knowledge should secure the palm. Indeed, it is a law so admirably suited to the ambition of most, that it is worthy of being

printed in letters of gold over the vestibule of each school, that each one entering may be taught that Mammon is the presiding deity of the place.

"In vain you rove through such a space
With Science for your guide or plan;
Each one you meet will only trace
And learn the parts he easiest can.
Who can the passing moment take
And of it all advantage make,
Him you will find the proper man.
You're fairly built, and seem beside
As if you had some boldness too;
If you but in yourself confide,
Then other souls will trust in you.
But above all, learn how to treat
The women—for their "Ah's" and "Oh's"
So multiform, you soon may meet;
For from one point their healing flows.
Be you but passably demure,
Command o'er all you'll soon secure;
A title first must be possest,
In you a confidence to breed:
Superior knowledge 'twill attest,
And show *your* art doth *all* exceed.
Those little favours then at once you gain,
For which another coaxes years in vain.
Adroitly learn their pulse to feel—" *

Beer's cataract knife is that most usually adopted for the operation of extraction; it is both the most convenient and the most simple. It is a triangular blade, varying slightly in length, as does the breadth of the cornea, with a straight back, an oblique cut- Beer's knife.

* Goethe's Faust, by Filmore.

ting edge, and a double-edged, lancet-shaped point, the whole being wedge-shaped, increasing gradually in substance up to the shoulder. That it should be formed as a wedge is essential, that it may fill up the wound in the cornea as this enlarges, to prevent the escape of the aqueous humour. It is seldom necessary to use the knife of the largest size, but it should ever be in proportion to the cornea to be divided. It is always better to use a long knife than a short one ; for a short blade tempts to upward pressure, and this being no part of the operation, but universally injurious, is always to be avoided. A gentle horizontal movement is that which seems most natural with a long blade, but with a short one, there is an irresistible desire to terminate the section.

Rosas' knife.

Rosas' knife differs from the former in having a double cutting edge, the centre of the knife only increasing in thickness to the shoulder, and the edge, corresponding to the back of Beer's knife, not being straight, but slightly oblique. The knife enters the cornea very easily. It is a pretty knife, but more difficult to use than Beer's. It requires that both its edges should be watched simultaneously, and consequently tends to complicate the operation ; nor do I know that it possesses any compensating advantage. It is a more elegant instrument and pleasanter to use, but more dangerous, than the old knife.

Jäger's knife.

When a young man, Jäger thought to diminish the danger of the operation by annexing a second

blade to Beer's knife. This was exceedingly thin, to lie upon and form with the other but one cutting edge. It was moved by means of a button, through which the additional blade might be thrust forward and retracted. The knife was used to traverse the chamber as the single knife; then, the eye being fixed with the one stationary blade, the other was thrust through the cornea, and with it the section was completed. Having perfectioned this instrument, Jäger laid it aside, for he found it more troublesome to use than the single blade, without being decidedly advantageous. Mr. Guthrie followed Jäger, and constructed a knife on the same principle. I should imagine, however, that the inventor himself would scarcely use it a second time. It consists of a blunt silver blade, with a lancet-shaped knife to slide along it. The cornea is first opened with Wenzel's knife, the double blade is then introduced, the lancet retracted, with the blunt silver knife against the iris; the section is then completed with the lancet. Thus, from the very commencement, destroying that which in itself alone constitutes the safety of the operation; for the aqueous humour must flow before the second knife is introduced; consequently, the cornea is rendered flaccid, so that a regularly cut flap would be impossible.

Guthrie's knife.

Mr. Scott, four or five years before his death, undertook to learn the use of a sickle-shaped knife; and by dint of practice, attained to the more perfect use of it, than he had ever been enabled to gain during his previous years, of Beer's knife. The

Scott's knife.

knife has a cutting convex edge, and its back describes the sixth part of the circumference of a circle, the diameter of which is an inch and a half, or, perhaps, more correctly, of which the radius is ten lines. Its breadth at the heel is two lines. The substance of the knife increases slightly from the point to the shoulder. The intention, with this knife, is to pass it across the chamber, to fix the point in the cornea, and to complete the flap by cutting from heel to point. The knife is not difficult to use; indeed, Mr. Scott thought it particularly applicable where the eye was fixed with difficulty. Necessarily, the character of the operation is altogether changed, with this knife, and more or less bruising of the cornea must attend its use.

A knife double the breadth of Mr. Scott's, but otherwise retaining the shape, is useful to open the cornea for partial extraction. It appears to me preferable to the clumsy spear-shaped knife in use for this purpose.

Thus, and in many other ways, the shape of the knife has been altered to suit the fancy of the operator, each one constructing something different for his special use; but whether it be a double blade, or sickle-shaped; whether it be single, or double cutting; whether flat or convex on the surface, the same principle must be adhered to, that it be wedge-shaped. Nor is it difficult to acquire a certain facility of handling any knife, if this circumstance be attended to: but the more simple the instrument, the easier its employment, and the greater

success attendant on its use. For the other instruments necessary, they consist of needles, straight and curved, spear-shaped, trochar-shaped, and curved with a cutting edge: eye-hooks; a Daviel scoop; an elevator; an elastic lid-expander; a fine forceps, and a pair of fine curved scissors. The temper of all eye instruments should be such, that they do not break, and that the edge does not turn. Lüer, of Paris, fashions his needles so exquisitely, that they are elastic as a foil; nor is the edge of his instruments injured even by cutting ivory, but even then they are fit to use for operation.

DISCISSION.

Discission of the cataract is performed to admit the aqueous humour to the lens.* It is necessary, that the cataract be fluid, soft, cheesy, or at most

* In former days, it was usual always to depress the cataract; and no distinction, then, being made between the hard and the soft cataract, the same operation was undertaken for one and the other. It was found, however, that, on certain occasions, the needle passed through the opaque lens without removing it from the centre of the eye, but that, in the course of a few weeks, it disappeared spontaneously. Attention being drawn to the matter, different uncouth operations were practised, to the end that the capsule might be opened. By some, an opening was first made in the cornea with a knife, and the needle was then passed through the wound. Others thought it necessary to depress so

moderately firm; that the patient be healthy, that its removal may be rapid; and that he be not in advanced age; indeed, the operation is scarely admissible after the age of forty-five.

An anterior and a posterior operation may be performed, viz. through the cornea or through the

much as they could of the opaque lens, and leave the rest to be absorbed. Conradi, Stadtarzt, at Nordheim, who had already paid attention to the subject of cataract, as may be learnt by his Bemerkungen über einige Gegenstände des grauen Staares; Leipzig, 1791, first made the formal proposal of opening the cornea with a needle, to puncture the crystalline capsule, in an essay, styled, Vorschlag zu einer Einfachen Methode den Staar zu stechen; Arnemann's Magazin, vol. i., 1797. Gleize published his observations about the same time, entitled, Nouvelles Observations pratiques sur les Maladies de l'Œil, et leur Traitement; Paris. Buchhorn followed, in 1810, and proposed the term Keratonyxis, in his inaugural dissertation, De Keratonyxide, nova Cataractæ aliisque Oculorum Morbis medendi Methodo chirurgica; and again, Die Keratonyxis, Magdeburg, 1811. And at the same time, Langenbeck, Beer, and Jäger, through essays on the subject, drew the attention of the medical profession to this new operation. Nor should I imagine to detract from the merit of Pott and others, who were instrumental in causing this to be adopted as a mode of operating the removal of cataract, and who, in certain cases, proved it to be preferable to the old-standing and legitimately recognised operation of depression, by tracing, with M. Velpeau, the antiquity of this particular operation to ages long past, when the Arabs were the special cultivators of the healing art, to find there was nothing new but the name; nor yet, to indulge in the facetious remarks of Col de Vilars, who, supporting the character of his nation, insists that, to the instinct of birds, we owe the operation of keratonyxis, who, says he, when cataractous, plunge a thorn into the eye, and recover sight.

sclerotica. The former, known as Keratonyxis, may be subdivided, according to the state of the capsule, into discission proper, and dislaceration.

Keratonyxis.

For discission, that the capsule may be cut through with a needle, it is necessary that it should be transparent; for an opaque capsule is not capable of being incised as is the healthy membrane. A lance-shaped needle, the size of the shaft being equal to the width of the spear-head, that, during the necessary manœuvres, the aqueous humour may not escape, is to be held as the knife, the hand of the operator being supported in the same manner, and the patient and assistant similarly disposed as in the former operation. The needle will be passed over the cornea, and retracted, until its point arrive below the centre of the pupil, when it will be made to puncture the cornea, and, at the same time, to wound the capsule. A mere puncture of the anterior capsule would be sufficient to cause the absorption of the lens, but its more complete division will hasten the process. The capsule having been punctured, the point of the needle is then carried upwards with a lever movement, then obliquely downwards, and again directly upwards; thus, to describe a Latin N. The operation is then complete, and the needle is to be withdrawn as it was introduced. The object is to divide the capsule, without the lens; care must, therefore, be taken that the point only of the needle be brought to operate on the membrane; for, if the broadest part of the spear be made to divide the capsule, the lens must be seriously disturbed. In

proportion to the division of the lens, so it swells; and this being considerable, and the opening in the capsule inadequate, great tension of the capsule is produced, which is followed by inflammation; the posterior chamber is obliterated, lymph is deposited on the anterior capsule, adhesions form between the iris and the lenticular capsule; iritis follows with an irregular pupil; acute inflammation is begotten, and requires to be actively treated. The harder the cataract, the more difficult its absorption. If this operation be performed on an old hard cataract, it will probably produce little or no effect; but in proportion as the individual is young, and the cataract soft, so is the power of removal. The operation is, consequently, particularly applicable, when the opacity has been produced by inflammation; where the natural consistence of the lens is reduced, or lost. If it be a fluid cataract, it immediately flows into the anterior chamber, to mix with the aqueous fluid. A few days suffice for its absorption. As its consistence increases, so does the time necessary to its removal. From fifteen days to two months may be considered as the variable periods in which the absorption of the lens will be effected. Should discission be practised on a firm cataract, it will be necessary to disturb the lens, that it may not resist too long the action of the aqueous humour; but, with a soft lens and a young subject, inflammation would certainly follow such a proceeding. As the cataract softens, it falls into the anterior chamber, whence it is rapidly absorbed; but

though it remain within the capsule, this having been opened, the removal of the soft cataract is scarcely less speedily effected: further, it is effected without that imminent danger of inflammation, which, if not necessary, so frequently attends its removal into the anterior chamber. It is unnecessary, therefore, to follow Langenbeck's advice, to remove as much as possible of the cataractous lens into the anterior chamber. It has been shown, that a deep wound of the healthy lens is followed by acute inflammation; the same occurs, though it be cataractous: in the one case and in the other, probably from the same cause. Cataract is not capable of inflammation: a deep wound, however, inflicted on a cataractous lens, is followed by the same amount of inflammation, as when the transparent lens is wounded. The aqueous humour admitted to operate on a considerable portion of the lens to its centre, causes it to swell; and if the sudden tension thus produced cannot be relieved by the escape of a portion of its substance, inflammatory action is excited; the transparent capsule becomes opaque; iritis follows, with a complete train of awkward symptoms. It was this unnecessary interference which, in the beginning, raised up opponents to the operation. As the needle passes through the cornea, the aqueous humour spirts out: if inflammation be excited, that the aqueous humour be not readily reproduced, the iris falling against the cornea may become adherent to the wound made by the needle. As the needle is made to puncture the cornea nearer to the sclero-

tica, by so much the more difficult does the operation become.

Sclerotonyxis.

The posterior operation is performed with a curved needle, which is to be passed through the sclerotica one line and a half behind the margin of the cornea, and either above or below the long ciliary artery, which courses along, from behind forwards, in the horizontal circumference of the globe. The point, being made to present in the pupil, is to be directed against the capsule, as in the anterior operation. I well remember seeing a young operator perform this operation, and his embarrassment at the result. The needle was introduced, as is customary, the capsule was pierced, and lever movements were employed to break down the lens. The next day, the patient, a young girl of fifteen years, was seen with the anterior chamber half filled with blood; iritis followed, and active antiphlogistic measures were necessary to subdue the inflammation.

Latta, in speaking of the fluid lens, says, as the result of his experience in twelve cases of this description, that the fluid is removed from the anterior chamber, and a clear pupil obtained, with the restoration of almost perfect sight, at the expiration of one month. The turbid fluid may be removed from the anterior chamber in a fortnight or even in a shorter time, but that good vision is to be obtained in a month is not to be expected. Indeed, it may be considered the exception to the rule, when good sight is permitted after fluid cataract; for this being usually a result of acute inflammation, no form of

cataract is more commonly followed, on its removal, by very defective vision, than is the fluid cataract.

If it be desirable to hasten the process of absorption, the operation may be repeated: on this second occasion, there being no further fear of the lens inordinately swelling, a portion being already removed, the needle may be used more freely to break up the remaining cataract. To divide the capsule too freely, in no degree hastens the absorption of the cataract, whilst it endangers the eye; for the cataract is liable to escape entire into the anterior chamber. As pieces only of a cataract excite inordinate inflammation when in the anterior chamber, how much rather the entire lens!

Of dislaceration.

Dislaceration of the opaque capsule, either when adherent to the iris or unbound, is performed after the following manner. With a slender lancet-shaped knife, an opening is made in the cornea, the point of the knife being entered in the median line of the eye, and one line anterior to the junction of the cornea with the sclerotica: yet, any other position, that may be judged more convenient, even though there be opacity, or cicatrix, of the part selected, may be chosen for the opening. The incision is to be made sufficiently large for the exigencies of the case, either by carrying the knife onwards into the anterior chamber, or it may be enlarged in withdrawing it. A fine hamulus is then to be passed through the wound, its point downwards, until it reach the posterior chamber; the point is then made to revolve, to describe the fourth part of a circle, seizing,

at the same time, the opaque capsule. By motion, imparted in one direction and another, its attachments will be loosened, that it may conveniently be drawn out through the wound together with the tenaculum. When the operator feels it within his power, he withdraws it from the eye, by a single, continued, and somewhat sudden movement, the point of the instrument again being directed backwards, whilst the back of the hook presses firmly on the inner edge of the corneal wound, to be withdrawn in a horizontal direction, without lever movements, through the widest part of the opening.

Inflammation may be excited both by this operation and the more simple one already detailed; but whether it follow a simple puncture of the coats of the eye, or an incised wound, the treatment which is necessary, is identical, in the one case and in the other. A wound of the sclerotica, however, is more liable to be followed by inflammation than is that of the cornea: and the posterior operation is more complicated than the anterior, by reason of the greater injury inflicted, in wounding the delicate structures behind the iris. That the operator has less power to perform the anterior, than the posterior operation, does not, in any degree, diminish the value of the former; for although the power to manœuvre the needle is unquestionably less, it being sufficient to accomplish the object, more is unnecessary, and, therefore, useless, or dangerous, in tempting to more than is expedient.

Secondary cataract.

Secondary cataract, whether it be of extraction,

discission, or reclination, is, or ought to be, a circumstance so rare, as scarcely to require distinct consideration ; but, whether the produce of nature or the surgeon, it is equally a hinderance to sight, it equally requires removal. One form alone the operator is not answerable for, namely, opacity of the posterior surface of the capsule. Should this be found opaque, immediately on the removal of the lens, it will not be interfered with, else the vitreous humour must be voided: but the necessary operation will be postponed, until the corneal wound shall have closed, and the eye shall have resumed that state, when an operation may be undertaken with safety.

After the operation, the iris is to be kept under the influence of belladonna, more particularly when keratonyxis has been performed.

Absorption of the cataractous lens is hastened by some slight stimulus. I know none more effective than the following form, of which, a drop, or two, may occasionally be allowed to fall between the lids.

℞. Iodinii	. . . .	gr. i.
Potassii Iodidi	. . . .	gr. ij.
Aquæ destillatæ	. . .	ʒij.
Liqua	. . . .	

As performed on children.

Keratonyxis is the peculiar operation adapted to children, it being attended with very slight pain, and the motions of the eye being more easily restrained, and the globe less liable to escape from the needle, than when the posterior operation is per-

formed. It is more difficult than in the adult, the space being less, in which to manœuvre, and all the parts being more minute: but the result of this operation in children is particularly satisfactory. As in the adult, the needle having passed through the cornea, the pupil may be spasmodically closed, so that the operation cannot be proceeded with. Patiently, the needle must be held, without further movement, until, the pupil expanding, the operation may be continued.

The infant is most conveniently held in its nurse's arms, with its head beyond her elbow; the operator behind the child, and his assistant opposite to him to steady its head, one hand being placed on either side of its face. The surgeon will himself raise the upper lid, and that most conveniently by means of a narrow open-work elevator, with which he may also make such pressure, as he may require, on the globe of the eye. The lower lid will be depressed by the index finger of the assistant, covered with a piece of muslin. Then the operation will be proceeded with as in the adult, or, it may be deemed more convenient, to place the child on a pillow to rest on a table. In the infant, it is scarcely possible to manipulate too gently or too little with the needle; for the cataract is readily absorbed, and inflammation scarcely less easily induced. The operation is capable of being repeated at intervals, as may seem necessary, nor is there any disadvantage in repeating the operation three, or four, times; indeed, this is to be commended, rather than the freer

use of the needle with a single operation. A single operation, however, will frequently be found sufficient, nor should it be repeated, unless absolutely necessary ; neither is it to be done, until a fortnight at least shall have elapsed from the date of the last operation. If a clear pupil be obtained in the space of two, or even three months, it is all that may be desired. Vomiting frequently occurs after discission, and less frequently in the adult. It will be necessary to attend to the general health of the child. Local applications need not be insisted on : cold produces discomfort, and is likely rather to be injurious than beneficial, it occasions fretfulness and restlessness.

RECLINATION.

Reclination of the cataract is a modification of the old operation termed depression or couching. The term depression, as applied to cataract, might, with much advantage, be expunged from the medical nomenclature ; for, not expressing the operation to be practised on the eye, and used synonymously with reclination, it might conduce to error.

When the cataract is simply lenticular, or alone capsular, and so firm that it will resist the pressure of the needle, so as not to be broken in the attempt

at removal, it may be reclined beneath the axis of vision.

When the eye is small, the cornea flattened and the anterior chamber shallow; or, when, on the contrary, it is large, firm, and protruding; when its elasticity is diminished, through previous inflammation; when the palpebral fissure is small, being so narrow that the globe may not be uncovered; or when the pupil is small and fixed, and there be synechia anterior, or posterior, this operation may be preferable to extraction. Further, when the patient is very old and feeble, when, through infirmity of body or mind, he is disturbed and intractable, so that doubt may reasonably be entertained of the healing of the corneal flap, this operation is to be preferred. Should there be any marked dyscrasia, or any concomitant affection of the globe or lids, which is difficult of removal, or likely to be reproduced by an incised wound of the cornea; or if there be a long-standing pterygium, trichiasis, entropium, ectropium, or, indeed, where the globe, being altered by disease, is no longer in a healthy state, that extraction may be performed with an adequate probability of success, the operation for reclination will not be prevented by the presence of any of these to a limited extent. If it be possible, however, to restore the eye, by remedial measures and time, and the lapse of time, necessary to the re-establishment of healthy action in those parts morbidly affected, be not too serious, then all the pains essential to the restoration of the organ are worth the

adoption of such measures : but inasmuch as no part of the body resumes less easily or less quickly a healthy state, or a state so completely free from unhealthy action as to render extraction admissible, and as the restoration of sight is of great importance to the patient's welfare, and is earnestly desired, and practicable, although the eye may not be said to be free from disease, then reclination must be performed, there being no other course to adopt.

A slight degree of synchysis does not forbid the performance of this operation, though it is most desirable to perform it on an otherwise healthy eye. It will readily be understood, that the more fluid the vitreous humour, the less resistance it can oppose to the rising of the cataract. Even though it retain its normal consistence, the cataract is very apt to rise so soon as the needle is raised from its surface.*

The disturbance of the vitreous humour—the rupture of the cells of this medium, necessary to the reclination of the cataract, is that particular part of the operation, which is most injurious, — is that upon which the greatest evil of the operation, perhaps, mainly depends, and through which the results of this operation are so frequently unfavourable. The violence done to the humour, the lacera-

* M. Bretonneau invariably broke up the cells of the vitreous humour, before he depressed the cataract. The reason for this unwonted practice may possibly not occur to the English reader. I have laboured for an excuse for this mischievous interference, but have been unable to stumble on any other than, that M. Bretonneau was ignorant of the structure and use of the vitreous humour, or careless of the result of his operations.

tion of the hyaloid membrane, is followed by a slow form of inflammation, through which the use of the organ is eventually lost.

Although, then, this operation does not demand a perfectly healthy eye, it is not admissible, when disease is present in the interior eye : and as disease is easily excited where its remains exist, reclination of the cataract requires equal care with any other operation. It is easier of performance than is extraction, though the results of the operation are less favourable, it being performed on that class of cases least adapted to operation.

Kerato-nyxis.

The cataract may be reclined through keratonyxis, or sclerotonyxis. Everything being disposed as in the former operations, the surgeon will select a lance-shaped needle, its head being slightly bent, with which he will puncture the cornea at its centre ; he will pass the needle directly into the posterior chamber, present its point to the cataract, rather above the centre of the pupil, and, by force gradually applied, will remove it from its position ; at the same time, turning its superior edge downwards and backwards, he will carry the entire body beneath the axis of vision. By a gentle rotatory motion of the handle, he will disengage the point of the needle, and raising it slightly from the cataract, will observe whether this retain the position he has given it. Should such be the case, he will withdraw the instrument. But, when the cornea is punctured, the aqueous humour flows ; the iris falls forward, and the pupil closes. The iris is easily wounded, but the capsule almost always on entering the

needle; the operator is embarrassed in his movements, he wounds the capsule only without dividing it, and he has but little power to recline the lens: moreover, the iris is apt to become adherent to the corneal wound. The operation is followed by inflammation not less than that per scleroticam, and not possessing the advantages of the latter, it yields to it desirably.

Sclerotonyxis.

The posterior operation is performed as follows: with a straight spear-pointed needle, the sclerotica is to be punctured at one line from its junction with the cornea, and half a line below its greatest anterior diameter. The needle, being held as the knife, is to be passed through the sclerotica in the course of its fibre, one cutting surface backwards, the other forwards: having traversed the membrane, it is to be rotated, that its flat surface may be almost parallel with the sclerotica, the handle being, at the same time, depressed towards the ear; so that the least onward movement shall thrust the point into the posterior chamber. In its passage to the pupil, it will wound the capsule and lens. It is to be passed on so far that the point of the needle may cover the inner edge of the cataract: the needle is then to be directed against the lens, and by gentle pressure rather above its centre, the lance is to be so planted that, by a quick lever movement, its attachments being separated, the cataract may be laid down between the external and the inferior straight muscles of the eye; in such a manner, that its anterior surface shall become superior, and its supe-

rior border posterior; and so deep that, without coming into contact with the retina, it shall lie beneath the axis of vision. To this end, the needle must never be allowed to describe a larger angle than a right angle with the sclerotica. The cataract is to be held in its new position for an instant, or two; when, by a gentle rotatory motion, the point of the needle will be disengaged, and raised: if it continue motionless, the needle may be withdrawn, care being taken to withdraw it in the same direction in which it was introduced. Thus, by reclining the lens before depression, more space is gained to bury it in the vitreous humour and with less danger to the retina: it is, also, less liable again to rise into its old seat, its whole anterior surface being now pressed upon by the vitreous humour, which closes around it. In the old operation of depression, the lens was sunk edgeways into the vitreous; consequently, there was scarcely more than sufficient space to sink it beneath the axis of vision, without bringing it into contact with the retina. For this reason it was, that amaurosis so frequently followed the operation of depression. Every author teems with such cases. Beer, in his *Lehre*, mentions an instructive instance of this kind, where two hard cataracts had been depressed and the patient immediately became amaurotic, and so continued, until one night, being intoxicated, he rolled off his bed and struck his head against the floor. Both cataracts rose to their places, and amaurosis was removed. Beer extracted the cataracts, and restored sight after eight years of blindness.

The capsule is not reclined together with the lens: pressure is insufficient to effect this purpose ; or, as Professor Hyrtl says, it could only be effected by the revolution (umwälzung) of the entire vitreous humour. One of the greatest advantages of the posterior operation is, that a free division of the capsule is necessary to its performance ; whilst, with the anterior, this is difficult, and almost impossible, without endangering the re-ascent of the lens : consequently, with the latter, a second operation is generally necessary to remove the opaque capsule ; for, being simply wounded, it cannot retract, and whereas, it was, perhaps, transparent, it has been rendered, through the operation, opaque.

When the capsule, having been loosened by one cause, or another, is depressed with the lens, the latter remains unaltered, or it undergoes so slight a decrease, that it may be said to remain unaltered. It is, consequently, always liable to re-appear. It may remain sunk in the vitreous for any number of years, where it must ever be considered as a foreign body and liable to excite inflammatory action. Beer saw and extracted a cataract, which floated from chamber to chamber through the pupil, diminished in size and angular, which had lain during thirty years in the vitreous humour. It is said, that the lens, being of a greater specific gravity than the vitreous, does not rise, until, being partially absorbed, air is generated within the capsule.

When, as in ordinary cases, it is reclined without

its capsule, it requires a space of time varying from two to three years, before it is entirely removed from the eye, and even a longer time, when its substance is hard and the patient old. When it rises again to view, it is apt to produce great irritation, not unfrequently most unfortunate inflammation, and it requires again to be depressed, or it may be necessary, at last, to open the cornea. Hey mentions a case, where he depressed the cataract thirteen times before it became stationary. Necessarily, a second operation, be it depression or extraction, is less favourable than the first ; each operation increasing the disorganization of the vitreous humour, each being attended by some degree of inflammation ; and more especially is it unfortunate and hazardous to be obliged to have recourse to extraction after reclination : the flow of the vitreous humour must be expected, and that as one of the least evils attendant on this secondary operation.

Reclination can never be performed with any degree of certainty, nor is it a desirable operation ; but one only to be undertaken when others are impracticable. It is never performed that the operator does not feel that it may require to be repeated : it is at best a trial, the success of which scarcely depends on the manner in which it is performed : it is the most unsatisfactory of all the operations on the globe of the eye, being followed by more untoward events than any other, and the cataract being hidden only and not removed, lies concealed to breed disease, and that, not only immediate, but, also, at a time so

remote as the body itself may continue to last. Should there be latent disease in the eye, when the operation is performed, it will surely be developed to the probable destruction of the organ. Iritis is common after the operation; whether it be induced by wound of the membrane itself, or through the forcible separation of adhesions, contracted, probably, during the formation of the cataract, or perhaps communicated from the ciliary processes; but whether it be directly traumatic or symptomatic, it is an unfortunate complication, and requires to be carefully watched and actively treated. After extraction, inflammation usually supervenes in three days, or is not excited: not so, however, after the lens has been reclined: here, inflammation may arise at any time, nor is the eye ever to be considered safe from it, so long as the lens remains unabsorbed.

When the cataract, having been reclined, again rises to view, its diminished size allows it considerable motion; so that, either it will be as a tremulous cataract behind the iris or it will float backwards and forwards through the pupil. Its softer circumference having been removed, it becomes a source of great irritation to the hitherto insensible iris, to produce, perhaps, a kind of tic-douloureux. This neuralgic pain, for neuralgic it must be esteemed, is increased as the irritation is increased: with an ossified cataract, it may be so exquisite as to oblige the patient to observe constant rest with his head on the pillow. The two following cases will exemplify this distressing affection.

Clinique of M. Sichel, Paris, 1846.—A female, aged forty-seven, attended as an out-patient with a moveable cataract, which had been depressed six years previously. The cataract was small, dark-coloured, and flattened; it passed readily through the pupil, so that, it was seen, at times, in the anterior chamber, and again behind the iris. Now, it was almost hidden from view, or it would lie in the pupil. When in the anterior chamber, it did not cause pain, but when behind the iris, so as to press upon the membrane, or in the pupil, it excited excruciating pain; pain resembling neuralgic pains in general, and although strictly limited to the orbit, was not unlike that particular kind where the superior maxillary branch of the fifth pair is affected. There was lachrymation, with slight spasm of the eyelids, and intolerance of light, though insufficient to constitute this a primary feature. Belladonna and rest alone brought relief. Through these means, irritation was removed, and there being no contra-indicating circumstances present, the operation of partial extraction was performed and the cataract removed. Dr. Monteath relates the following case:—An individual was struck on the eye with a golf club, and a cataract resulted. Ten years after its formation, an attempt was made to depress it, which failed. In 1818, or sixteen years after the accident, Dr. Monteath first became acquainted with his patient. The cataract was, at this time, tremulous, and occasioned such excruciating pain in the head and eye, upon the least

motion of the body, that the head became, as it were, locked to the pillow and incapable of being raised. Such treatment being adopted as was most calculated to afford relief, the pain was mitigated. In November of the same year, Dr. Monteath extracted the cataract, having made a section of the cornea ; the lens was removed with a tenaculum, and was found to be a complete bony shell.

But not only may pain be produced by the moveable cataract, but also iritis and inflammation of the membrane of the aqueous humour. To open the cornea during the existence of this inflammation is, necessarily, to jeopard the eye. It is essential, first to return the cataract behind the iris, thus to prevent all pressure on the membrane by observing constantly the dorsal decubitus ; that by withholding the source of irritation, at the same time that inflammation is combated, the organ may be restored to a condition so favourable to operation, that its safety may not be compromised by opening the cornea. If the attempt be made to reduce the inflammation, the lens remaining the while in the anterior chamber, it will, probably, there become encysted.

After the operation of reclination has been performed, perfect quiet in bed is to be observed for some days ; that, as is probable, some slight adhesions may form around the lens, and that the vitreous, closing upon it, may not be disturbed. To this end, it is obvious that the eyes should remain closed ; but not only for the sake of avoiding movements of

the globe, but also that light may not be admitted to the eye. The after-treatment will, consequently, not materially differ from that already detailed as appropriate to extraction.

But, although the operation be excellently well performed, and Nature contribute her share to the completion of the whole, the result may not be satisfactory. A very limited or feeble vision may be restored; objects may be seen double, indistinctly, or confusedly; and, as time wears on, no improvement, or that very inadequate, may take place. When one eye alone has been operated on, through the removal of the lens the power of the two eyes can no longer be the same; when the refractive system is so dissimilar, unity of action can scarcely be expected. It requires a long time to produce concurrence of the two eyes, and this may indeed never be gained. Habit, however, renders double vision less disagreeable, until forgotten it does not offend. This effect varies considerably according to the individual. In one, an object will be seen very faintly by the side of another which is distinct: this is generally the case after traumatic cataract. A person may accustom himself to this appearance, so as no longer to be conscious of the presence of two objects, until he analyze his sensations. When the cataract has been

produced by a blow, a wound, or inflammation, objects may not be distinguished for many months after the complete removal of the lens: on the other hand, when it is the result of deficient nutrition, the retina remaining perfect, there will always be power to distinguish objects, features, or even to read a large print, the moment the operation is completed. Vision improves in both cases, as the consent of both eyes is gained, but it long remains imperfect; perfect vision requiring the combined use of the two eyes, and that they differ but slightly in power. The refractive power of the two eyes no longer according, the same object is painted on the two retinæ unequally; on one, faintly and indistinctly, without exact outline or precision; on the other, as in the natural state of the organ: and since it is impossible that a faint and undefined image shall be transmitted to produce upon the sensorium an equal effect with that more concentrated and exact, so, it is necessary that, so long as the refracting media remain unequal, there must be produced a double image. Sometimes, objects seen double are perceived as one on the top of the other; as two heads, instead of one, one beneath the other: and so on with every object seen. A young man, with traumatic cataract, travelled down from Berlin to Vienna to consult Jäger; for many had seen his eye, but none held out hope of the recovery of sight. Besides, the cataract was an eye-sore—unquestionably, a disfigurement, which, for its own sake, he was anxious to lose. None, however, were willing to interfere with it, for all

augured ill of the result. The cataract was large, white and capsular, and the pupil widely dilated. The sense of light was present. During his boyhood, an arrow had wounded the eye. The manner of its production, together with the exceedingly dilated pupil, deterred others from removing the cataract. Jäger, however, consented to operate, and performed the operation of partial extraction; through which the capsule was removed. The case seemed to terminate most happily, and objects were distinctly perceived: but, when both eyes were used, everything was seen as though double, one upon the other. This annoyed the patient excessively, so that he became, in turn, an annoyance to the operator. Jäger explained how the eyes required time and training to act in concert, and assured him that nothing more was necessary: he directed him to practise before a mirror, that he should endeavour to see objects singly. In this, he was indefatigable, but gained nothing; and despairing of ever being able to conquer this annoyance, in a rage, he placed himself before the mirror, and staring forcibly with both eyes, suddenly, one image alone was seen. He returned delighted to the Professor. He was amaurotic.

Nor let it be supposed that this is a solitary instance; far otherwise, indeed, is it. Amaurosis, however, is generally produced, when it occurs, by the immoderate use of the eye; by the early use of it, or by straining, for one purpose or another. Chronic inflammation is begotten, through which,

sight is so gradually extinguished, that the diminution of power is scarcely perceived, until the alteration is irremediable: more powerful glasses are used, and amaurosis becomes complete, and is unalterable.

But, although the patient be healthy, and the cataract be removed through operation, there being no contra-indicating circumstance, sight may not be restored.

University ophthalmic wards, Vienna, Dec. 1846, —K. D., aged thirteen, a healthy light-haired boy, with capsulo-lenticular cataract. Six months before his admission, he had been struck on the eye with a stone, and cataract resulted. The eye in question was harder than the other, but sensible to light; the iris was free, and capable of being fully influenced by belladonna. Discission was performed, and the cataract was rapidly absorbed: but, when the lens was now greatly diminished, so that more light was admitted to the eye, no increased effect was allowed; the lad constantly denying any benefit that had arisen to him from the operation. As, however, it was evident that the impediment was less, and light perceived when it was greater, Rosas did not hesitate loudly to tax him with deceit. He was considered a black sheep, and worthy to be punished. The cataract now being entirely removed, however, the mystery was resolved. A white fond de l'œil, from lymph deposited on the retina, was to be seen, so far as the eye could reach, above and below, and from side to side.

Jacobus Zakowski, aged fifteen, a dark, strong lad. Six years ago, he was kicked by a horse, when the right orbital arch of the frontal bone was fractured. The accident was soon followed by cataract, which formed in the corresponding eye. The depression of the bone was considerable, and marked even to sight : it extended from the situation of the supra-orbital notch, downwards and outwards. The cataract was capsulo-lenticular ; light was distinguished, and the pupil was free. Discission was performed, November 21st, 1846. The cataract was quickly absorbed ; but as it was removed, light was appreciated no better. Belladonna was used, and a large portion of the pupil was now perfectly clear and black, and, still, objects could not be distinguished, and light no better than at first. There was no apparent cause why this should be so, and, consequently, the lad's affirmation was not believed. The cataract entirely disappeared, without a vestige ; the pupil was black and regular ; the iris healthy in appearance ; and the consistence and shape of the eye normal ; and, notwithstanding, nothing could be perceived.

Dec. 31st.—At the early visit of Dr. Blodig, the professor's assistant, a singular luminous appearance of the eye was observed. The bottom of the eye was thickly studded as with glistening, gold-like crystals : this was more especially to be observed at the bottom of the eye, though they were distributed throughout the vitreous humour, upon the iris, and sparingly through the aqueous humour.

The appearance was so remarkable, that it was caught at the first glance : it was most apparent on looking directly into the eye, but was visible in every direction, though principally posterior to the iris. This singular state did not increase, nor was it removed; neither was vision in any degree improved, even after the expiration of some months. Professor Rosas considered this to be dependent on some change of the vitreous humour. It is worthy of remark, that the crystal-like appearance never changed, as light was thrown upon the eye, nor did it increase, or become more generally distributed, but always retained the appearance, as when first observed, like fine gold-dust.

It is still an open question, whether amaurosis is indeed produced by division of the frontal nerve. Many cases are on record, where the division of this nerve is said to have produced amaurosis, both immediately on its division, and, also, on the formation of the cicatrix : and to have been again relieved by a further division. Thus, Beer particularly states that injury to this nerve is followed by amaurosis ; and he recommends a free division of the nerve, having frequently found this treatment successful in restoring sight. Others, who have followed this advice, however, do not agree with Beer, but report the proceeding as utterly useless. Magendie has shown that, on division of the fifth pair of nerves, not only sight is destroyed, but the whole eye, through destructive ulceration. He was consequently led to consider this the nerve upon which the

nutrition of the eye depends. Almost every case of amaurosis recorded, as following the division of the frontal nerve, is accompanied by violence. It is either a contused wound from a blow, or a lacerated wound, probably produced by a fall. If every injury to the frontal nerve, in such an exposed situation as the supra-orbital arch, were to be followed by amaurosis, it would, indeed, be an unfortunate circumstance. Happily, although these accidents are of daily occurrence, the more serious injury is comparatively rare. Nor is this result found, when the nerve is simply divided, as in surgical operations. It must, therefore, depend on other cause than division alone of the nerve, and that cause will be found in the accompanying violence. When, with the blow, there be division of the integument, perhaps fracture of the arch itself, it cannot appear wonderful, that there should be, at the same time, produced concussion of the retina : and this more probably, when the bony arch, resisting the force of the blow, transmits it : or, instead of concussion simply, there may be laceration of the retina ; blood extravasated upon the membrane, &c. Nor is this view of the production of amaurosis opposed by considering that the same results are produced, though the wound be not in the situation of the frontal nerve—though the violence be applied to the outer extremity of the arch, where the nerve can receive no injury ; or though it be applied to the globe itself. Therefore, although the frontal nerve, included in a cicatrix, may transmit the irritation thus produced

and amaurosis result, I hold it to be perfectly incompatible with that we know of the functions of the fifth pair of nerves, and its relation to the retina, that division of the frontal nerve shall in itself produce amaurosis. In the case before us, the violent succussion, probably, separated, in part, the attachments of the capsule, upon which cataract resulted; and, as is by no means infrequent, the force of the blow being yet produced, laceration of the retina occurred, giving rise to amblyopia; whilst the phenomenon, to illustrate which I have recorded this case, was produced by the disturbance of the vitreous humour, together, probably, with some vascular excitation, induced by the performance of the operation. Again, to attribute the formation of the cataract to defective nutrition, the frontal nerve being divided, would be far from logical. Amaurosis, as the result of injury where the frontal nerve is injured, is rare; cataract, together with amaurosis, is still more rare: if the division of the nerve should in any degree alter the nutrient functions of the eye, to render the retina incapable of receiving to transmit an impression; and in the same manner, by diminishing the nutritive influence permitted to the lens, cause its death or opacity; then, as it may occur once, it should occur always, in a greater or less degree: but, inasmuch as amaurosis is produced without cataract, the two influences are distinct; and further, as the frontal nerve may be divided without either cataract or amaurosis being pro-

duced, its simple division is never the cause of either.

Without alluding to every case that might prove an impediment to the happy termination of the operation, or without further dwelling upon that is to be done, or avoided, one consideration alone shall again be insisted on, namely, simplicity in the performance of operations. The employment of the curette, to remove particles of lens from the anterior chamber, has already been objected to: consequently, and by a much greater reason, is the mode of effecting this purpose as proposed by Forlenze to be discountenanced. This was no other than to inject tepid water into the anterior chamber after the removal of the lens. The proceeding seems so strange and gross that, had not M. Velpeau expressed his opinion in favour of this use of the syringe of Anel, as likely to be truly beneficial in every case of extraction of the cataract, the subject would not now have been noticed. But, although M. Velpeau has thus expressed himself, I am not aware that he ever practises that he would seem to encourage. I imagine his acute observation must soon have taught him the absurdity of the precept.

The operation, let it be which it may, should be entered on with the conviction, that it is better to leave undone rather than to do too much; and that neatness and accuracy of finish are unnecessary, and should never be practised. Nature is quickly excited to jealousy, when the surgeon takes too much

upon himself; and she is rightly jealous, for, when capable, she does her work quickly and well, so that it may safely be confided to her.

THE END.

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