

have obtained among all races in the times of all the prophets, from Moses to the Latter-Day Saints of Salt Lake City, and in the worship of all the gods from Jupiter to the latest theosophic misconception; and however much we may respect the courage implied in the expression of a sincere opinion, it is impossible not to detect the further existence of this disordered state as shown in numerous sciolistic writings, notably those of Dale Owen, Swedenborg, and the theosophists. Moreover, it needs but little observation to trace the prevalence of the same morbid influence among clairvoyants, spiritualists, and even the ardent admirers of Madame Blavatsky.

Catalepsy with somnambulism is a complication in which the phenomena of catalepsy and the symptom of somnambulism are bound one to the other, and succeed in a regular order in such a manner as to form a single attack. They are sometimes distinct, independent of each other, and separated often by long intervals.

The disease may occur with other accessories, as catalepsy with tetanus, catalepsy with epilepsy, and with chorea, the chorea happening in the daytime and the catalepsy at night during sleep. Catalepsy may also exist with permanent contraction of the feet and hands; with delirium and melancholy, with acute and chronic mania, and with dementia and idiotism. It is a frequent complication of paranoia, and is sometimes, though rarely, associated with hypochondria. We may occasionally see in the subject hysteria, catalepsy, ecstasy, and somnambulism succeed, turn by turn, and mix one with the other, with a frequency entirely out of the regular order of things and an intensity unheard of. This extraordinary mixture of cerebral neuroses was met with in its highest degree in the great convulsive epidemics of the Middle Ages, during the sixteenth, seventeenth, and eighteenth centuries; and their occurrence having become a matter of history and common hackneyed observation with writers on kindred subjects, it suffices to give them merely a passing mention. Catalepsy is met with in acute dementia, stupidity, and other non-determined cerebral affections. The cataleptic states may still be manifested in the greater part of the neuroses, and in diverse affections of the brain, and with such acute diseases as pneumonia, typhoid fever, acute articular rheumatism, intermittent fever, and worms. Verminous catalepsy has been noted and commented upon by various writers.

Epidemic catalepsy, like many of the neuroses, may become contagious by imitation under mesological circumstances favorable to its propagation. Such circumstances exist when the disease occurs in an assemblage of impressionable subjects, as a school or a convent, a camp-meeting, or a spiritualistic gathering, where a twofold predisposition is to be found in the nervous temperament and in certain questionable hygienic and moral conditions. In former epidemics, the disease seen in its most startling and complete expression exhibited a terrible spectacle and mixture of all the neuroses and all the insanias. It was common for celibate and ascetic persons to show the strangest nervous symptoms; to fall cataleptic at mass or during other religious observances, and to exhibit the complex symptoms of hysteria, demonopathy, and catalepsy.

Catalepsy and cataleptoid phenomena may be provoked artificially in hysterical or other predisposed, impressionable and nervous persons, through mental suggestion, or by intense light, the sonorous vibrations of a tuning-fork, and by pressure on the ovaries. These artificially induced conditions have been studied by various persons, who think the condition should properly be called *syggnostic*.

PATHOLOGICAL ANATOMY.—The physiological cause of this and of allied conditions is presumed to be inhibitory arrest of activity of certain tracts of the ganglion cells of the brain cortex. It is, however, impossible to say in the present state of scientific observation whether inhibitory lesions exist or not in catalepsy; but it is probable that there is, in addition to muscular inhibition, a morbid element, the essential nature of which is unknown. Such superficial alterations as considerable development

of the Pacchionian bodies and injection of the meninges found after death from catalepsy are insufficient to explain the symptoms during life; and the inflammatory exudation or alterations found in the central organs, with softening of the optic thalamus and corpus striatum, are lesions rather to be associated with other diseases than with catalepsy, since they were present as complications in the observed cases; therefore, until something more complete is known of the morbid anatomy of catalepsy, it must be regarded as a violent excitement, a sort of tension, a cerebral cramp, the result of a purely dynamic lesion of the cerebro-spinal nerve centres whose function is to preside at the determination and co-ordination of movement.

CAUSATION.—If the pathological nature of catalepsy is obscure and unknown, its causes are extremely numerous, and present a particular interest. Nervous exhaustion is the most common predisponent, and of all the etiological moments hysteria is the most prominent. Catalepsy and insanity usually march together. Many authorities declare that no catalepsy can exist unless accompanied or followed by a psychosis. Acquired or innate predispositions are found in persons of great nervous susceptibility and unsteadiness, or in those of a nervous and melancholic temperament with a previous neurosis, and rendered more susceptible by chlorosis, masturbation, or progressive spinal paralysis. Tumors, tuberculous meningitis, and other chronic cerebral diseases, may also give rise to cataleptic manifestations. Atavistic influences seem to account for some cases of catalepsy. It does not appear that the disease is ever directly transmitted, although heredity as a general cause seems to preside over its development in many observed cases.

The causes that may provoke a cataleptic crisis are numerous and varied, and it often follows diverse circumstances, as excess of work, religious excitement, violent fright, deep chagrin, an attack of anger or indignation, gastro-intestinal irritation, sudden cessation of the menses, unrequited love, and worms. It may result in a transitory form from diffused encephalitis, or as one of the sequels of typhus or malarial fever, of acute articular rheumatism, uremia, the puerperal state, auto-intoxication, and pneumonia. Partial catalepsy may also be in consequence of the narcotic inhalation of ether or chloroform, or poisoning by lead or carbon dioxide, hashish, or alcohol, and it may result from being struck by lightning. In fact, any toxic substance or any concomitant psychosis may put into activity the cataleptic state. The production of crises, by looking fixedly or for some time at a bright object, and vividly riveting the mind on the image is one of the proceedings of Braidism or Mesmerism. Among the hack observations of medical writers are those relating to the Franciscan friars, who became cataleptic at mass during the elevation of the host. It is known that the monks of Mount Athos go into a state of cataleptic ecstasy by looking fixedly at the umbilicus; Indian fakirs fall into catalepsy by looking a quarter of an hour at the end of their nose; Egyptian sorcerers procure sleep and insensibility by similar details; Arab sorcerers of Cairo, by looking steadfastly into the palm of the hand; and it is related of Cagliostro that he brought on somnambulant crises by similar means. Instances of psychic shock, like that of a woman who became cataleptic every time she saw a certain man who had insulted her, or that of an indignant French judge, who suddenly became cataleptic when insulted in court, incline one to the opinion that such expressions as "petrified with indignation," "motionless with surprise," and the like, though merely implied comparisons, are not always to be taken in the metaphorical sense.

DIAGNOSIS.—The marks that constitute the essential and pathognomonic character of catalepsy, as complete or partial aptitude of the limbs to preserve during a relatively long time the position given to them, and the impossibility of the patient to modify this attitude, along with unconsciousness, anaesthesia, and analgesia, should make the matter of diagnosis easy. Embarrassment is most likely to occur in cases of simulation, or when it is

a question of discriminating between hysteria, tetanus, ecstasy, coma, lethargy, syncope, congelation, and cadaveric rigidity. In the matter of simulation it is only necessary to test the sensibility, the reflex irritability, and the electrical contractility of the muscles, and to try the influence of mental suggestion. In cases associated with hysteria the distinction is a matter of no therapeutic importance. It may be well to question whether the condition is from a cerebral lesion or of toxic cause. The neuro-muscular system of animal life being alone affected during an attack, that of vegetative life is without loss, as is shown by the persistence of circulation and respiration, which distinguishes catalepsy from syncope or asphyxia. The general history of the case should cause no confusion in diagnosing catalepsy from the affections with which it may be associated.

PROGNOSIS.—Many regard catalepsy as the index of a predisposition carried to a high degree and by itself not dangerous to life, but a disease in which recoveries are rare. Some recent authorities think otherwise in regard to the prognosis, and Hammond pronounces it favorable even in severe cases, as all his patients recovered under treatment. In cases resulting from malarial infection the prognosis is better. The same may be said of acute attacks resulting from injury, from worms, or from mental shock in comparatively healthy persons. The retention of smell and taste is indicative of returning health. Cases complicated with hysteria or the psychoses are most grave. Death may be in consequence of anaemia or of inanition.

TREATMENT.—To arrest an attack of catalepsy efforts may be made to arouse the patient by peripheral irritation, as that caused by a pinch of snuff or the inhalation of a few drops of amyl nitrite. Quinine and morphine in combination are recommended in periodic cases of malarial origin, and vermifugal remedies are called for in catalepsy caused by intestinal parasites. Tonics, iron, ergot, and apomorphine hypodermically—gr. $\frac{3}{4}$ —have all been recommended. The most efficacious medical treatment yet reported consists in the administration of one of the bromides in combination with zinc oxide, and the simultaneous use of strychnine and other tonics. Acupuncture, faradic electricity, hydro-therapeutics, and change of air are useful adjuncts to the treatment. In addition to meeting symptomatic indications, moral hygiene of the most rigid kind should be enforced, and it is of prime importance that all emotional or religious excitement be avoided. The mind should be disciplined; home influences are to be broken up; and every effort should be made to establish the general conditions of health, which must prevail before the morbid action can really be effaced. *Irving C. Rosse.*

CATALPA. See *Poisonous Plants.*

CATAPHORESIS.—If two fluids of different density are separated by a membrane, the fluids diffuse through such membrane until they are of equal density. This process has been called osmosis. If the two electrodes of a galvanic battery are placed in two compartments of a fluid separated from each other by a porous septum, the fluid particles pass in the direction from the positive pole to the negative pole, so that the fluid in the one vessel increases, while it decreases in the other. The amount of fluid thus conveyed in a unit of time is larger the stronger the current and the smaller the conducting power of the fluid. This phenomenon has received many names, among which electrical osmosis, electrical diffusion, and cataphoresis are the best known, but the last one bids fair to remain in general favor. Cataphoresis, as Billings tersely puts it, is the power of the galvanic current to induce osmosis from the positive to the negative pole.

Cataphoresis, which, scientifically speaking, means merely the action of the galvanic current, has in medical language acquired the meaning of introducing medical substances into the body through the unbroken skin, and is now almost exclusively used in this sense. If a definite quantity of medicine in solution is placed on a disc or sponge electrode at the positive pole of a battery, and

applied to a certain spot of the body, while the negative pole is placed anywhere in contact with the body, a local anaesthesia is produced around the positive pole if the substance experimented with is cocaine, while the entrance of quinine, strychnine, and many other drugs into the body by this method can be demonstrated by their presence in the urine or the saliva. Mention of attempts made in this direction date back as far as 1747, but not until 1853 do we find scientific demonstrations of the fact. From that date until to-day the matter has been investigated by physicists, physiologists, and physicians, in both Europe and America. Electrodes have been invented suitable to the different purposes of administering the drugs, but while cataphoresis is beautifully simple in theory and to the physicist, its practical application to every-day medicine is almost exclusively confined to members of the dental profession, who use it most successfully to anaesthetize sensitive dentine and gums with cocaine, and for the bleaching of teeth.

In medical practice cataphoresis has found but scant favor. Neurologists have produced deep local anaesthesia with cocaine cataphoresis where before large doses of morphine were needed to produce the same effect. The substitution of the former drug for the latter has been advocated enthusiastically in cases in which a possible morphine habit loomed up threateningly; but whether a cocaine habit is preferable to a morphine habit is a subject open for discussion. The discovery of cocaine and the ease with which local anaesthesia can be produced by its hypodermic use have undoubtedly reduced the importance of further investigations of cataphoresis for such purposes, and to the busy general practitioner the subject remains more or less a medical curiosity.

How far the action of the cataphoric current in itself can induce or produce nutritive changes in the living cells is a question which opens an unlimited field for research. The so-called Porret's phenomenon shows that its action on living protoplasm closely resembles that on fluids outside of the body, for if applied to muscular fibres the current induces a streaming movement from the positive to the negative pole in the protoplasmic contents of the fibres, so that they swell at the negative and decrease in size at the positive pole; and if the electrodes are changed, the action is reversed. Only a very arbitrary opinion may be ventured in deciding whether such compulsory rearrangement of the protoplasm can be looked upon as beneficial or harmful, and until we have more definite knowledge of the subject, the application of the cataphoric current as a mere stimulus to any part of the human body, aside from its electrolytic action, must remain, from a scientific standpoint, mere guesswork. Whatever beneficial results are reported must be accepted as due to chance, or perhaps to the imagination of the patient. It is, however, safe to predict that when medicine becomes a science, and we know the specific medication necessary to stimulate or rebuild certain definite organs or parts of organs, cataphoresis will receive its due share of attention and assume its proper place. Attempts to force iodine into goitres and lithium salts into gouty joints are crude experiments in the right direction. While we know that such medicine can be forced into a definite part by cataphoresis, we must wait until further investigations demonstrate that the cells of that part will and do assimilate the medicines driven into their substance; for unless such assimilation and subsequent excretion do take place, which change the worn-out or diseased cells into healthy ones, the medical substances introduced will act as foreign bodies and produce irritation instead of improvement. *Julius Pohlman.*

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CATARACT is the morbid impairment of the transparency of the crystalline lens, or of its enclosing capsule, and is lenticular or capsular, according to its situa-

tion. A less important division is that into true and false cataract, the latter being caused by deposits on the capsule, the result of disease.

Cataract may be stationary or progressive, partial or total. It may be cortical or nuclear, according as it affects the cortical substance or the nucleus of the lens. When confined to the vicinity of either pole it is denominated anterior polar or posterior polar, in conformity with its position. The old division into hard and soft is rarely used at the present day, the consistence of the cataract largely depending on the age of the individual. Cataracts are moreover divided, according to the stage of development in which they are encountered, into incipient, mature, and hypermature. Finally, they may be classed as simple or complicated; as simple when dependent on or associated with no known disease, either local or general; as complicated when proceeding from an affection of the system at large, such as diabetes; or, from an impairment of the eye itself, like glaucoma or separation of the retina.

DIAGNOSIS.—Objective Symptoms.—The modern methods of investigation render the diagnosis of cataract a matter of certainty. By their aid the slightest opacity of the crystalline lens can be detected and correctly located, and they have wholly superseded the old "catoptric test," which depended on the reflected images from the anterior and posterior capsules, and the disappearance of the latter when an opaque substance intervened before it. Recourse is now had to the concentration of light on the eye by means of a convex lens, and to the illumination of its interior by means of the ophthalmoscopic mirror. In either case the pupil should ordinarily be dilated by the application of one of the usual mydriatics, duboisine, homatropine, or atropine. The first of these acts with the most rapidity, the second produces the most temporary effect, while the third is the one most generally accessible. Previous to using the mydriatic the tension of the eye should be carefully noted. Should it be found to be excessive, no attempt to dilate the pupil is admissible.

The pupil being dilated, and the rays of a lamp, placed 30 to 50 cm. from the patient's head, concentrated obliquely on the crystalline by means of a convex lens of short focus, 18 D. to 15 D. ($\frac{2}{3}$ to $2\frac{1}{4}$ in. focal length), any capsular and many lenticular opacities are rendered plainly visible. A second lens, held before the observed eye, may be used to magnify their distinctness. But it is necessary to bear in mind that, with advancing years, the outlines of even a normal crystalline lens assume increased distinctness. Its anterior surface takes on a silky lustre, the fibrous structure becomes more and more visible, while age gives the nucleus additional density and a yellowish reflex that may often prove deceptive. No absolute diagnosis of cataract must be based on the appearance of a grayish cloudiness in the centre of the pupil until the ophthalmoscope has been brought to bear on the spot. In this method of examination the mirror is alone used, being held at about the reading distance of the observer from the patient's eye. The vivid red of the illuminated pupil remains unbroken when the media are clear, and the returning light traverses a transparent crystalline. When, however, this is not the case, the smallest opacities are distinctly seen as dots, shadows, or stripes against the bright background. Their precise situation is made out when the observer moves his own head to one side, opacities situated in the front of the lens moving in the same, those at its back in a reverse direction. The differential diagnosis between lenticular and other opacities of the transparent media is easily made, corneal spots being distinguished by oblique illumination, floating bodies in the vitreous by their mobility.

So great is the danger of mistaking the reflex from the pupil, due to advancing age, for cataract, when the examination is made by day and with the unassisted eye, that a diagnosis should rarely be made until both methods here described have been employed.

Subjective Symptoms.—When an individual who has passed middle life begins suddenly to grow near-sighted,

to see distant objects better through a concave glass, and to lay aside his usual reading-glasses, or even to require a weak concave for this purpose, commencing cataract may be suspected, and this even when no opacity of the crystalline is as yet visible. This state of the refraction is by no means invariable, but happens with tolerable frequency, and explains some of the cases of "second sight," or the returning vision of the aged, a popular belief in which is so widely spread. Much more general is the occurrence of multiple vision with a single eye. The patient sees several new moons in the sky instead of one, and the flames of the street lamps are no longer clearly defined, but seem to shoot out long rays in all directions, or else several lights are seen in the place of one. The lens, in these cases, seems to undergo a separation into sectors, possessing different powers of refraction, prior to becoming the seat of actual cataract. As the disease advances the acuteness of vision falls off. At first near, and later distant, objects are distinguished with increasing difficulty. Points of light loom up as if seen through a fog. A characteristic symptom is the change produced in the appearance of objects by varying degrees of illumination. In the majority of cases the cataract patient sees best before sunrise, after sunset, when the sky is overcast, or on a dull day. He is confused and blinded by a sudden increase in the amount of light around him, such as would be caused by the sun emerging from behind a cloud. The use of a mydriatic renders him to some extent again independent, and atropine may thus often be employed with advantage to eke out and prolong vision that is being reduced from this cause, and where the opacity of the lens will be found to be mainly central. In the rarer cases, in which obscuration commences at the periphery, enlargement of the pupil exposes the imperfect portions of the crystalline and causes a disturbance of sight. Such patients see best through a contracted pupil, and instinctively crave an excess of light.

DIAGNOSIS OF MATURITY.—As the success of the operation for cataract is always greatest in cases in which the disease is fully formed, the question of ripeness becomes an important one, and may easily be settled. Oblique illumination should show the lens to be opaque up to its front. No layer of transparent substance is to intervene immediately behind the pupil. When the cataract is mature the iris is seen to be in direct contact with the opaque lens, and the edge of the pupil throws no shadow when the source of illumination is moved a little more to one side. In addition to all this, however, it is important to ascertain that each anterior chamber is of equal depth, that the iris of the eye affected with cataract is not bulged forward beyond the plane occupied by its fellow. For such bulging indicates the lens to be in what is called the "period of swelling." Just before the opacity of the cortical substance becomes entire, its fibres often appear to swell and separate, the lens grows apparently larger and presses forward, frequently restricting the motions of the pupil. In time this process recedes, the lens loses in volume, and its mass becomes more compact, thus offering a more favorable opportunity for the operation of extraction. The period of swelling should therefore ordinarily be allowed to subside.

FUNCTIONAL EXAMINATION.—It is hardly necessary to dwell on the fallacy of the popular notion that, in a case of cataract, blindness must occur before the operation becomes admissible. Many a patient, misled by this belief, has waited until the last perception of light had died away, and then presented himself to the surgeon for treatment, to be met with the announcement that the disease was not a cataract, and that treatment had only been possible while some vision remained. An opaque lens merely interposes a screen, more or less translucent, to the passage of light, an appreciable amount of which still filters through. Where no perception of light remains, therefore, no restoration of sight is possible. The patient must be able to make out not only the presence, but the position, of a luminous object. Having ascertained, by covering the other eye, that the one affected has a general

perception of light, that the pupil expands and contracts in accordance with the degree of illumination, and that the position of a window can be pointed out, it is well to test more carefully the sensitiveness of both the central and the lateral portions of the retina. The patient is taken into a dark room, the good eye carefully covered, and the gaze of the other fixed in a given direction. This may be brought about by desiring the patient to hold up one of his own hands, at arm's length, on a level with his eye and straight before him, and directing him to look persistently toward the spot where he knows this hand to be. A lighted candle is first held as close as possible to the hand he is fixing, and then moved in the same plane up, down, and to either side successively; the patient being required to indicate each new position of the candle, without removing his eye from the direction of his own hand. If he sees the light each time its position is changed, it is certain that the whole extent of the retina retains its normal sensitiveness; if he fails to observe it in one direction, the powers of the retina are correspondingly impaired. When the light, on being moved upward, can no longer be located, the lower portion of the retina is destitute of perception, and it must be borne in mind that here is the usual position of a retinal separation. When he sees the light laterally, but not straight before him, the region of the macula lutea is generally diseased, and the power of reading is unlikely to be regained, even after a successful operation.

CAUSATION OF CATARACT.—Our knowledge on this point is extremely limited. Becker's¹ researches go to show that senile cataract originates in an interruption of the progressive sclerosis of the lens. Attacked with this disease it shows in the outset a decided contraction of volume. The cortical substance is thus, as it were, split up. The intervals thus left are at first filled with the normal fluid, the index of refraction of which subsequently changes, thus making the divisions more plainly visible by transmitted light. Actual opacity now begins to occur, the fluid constituents of the lens increase, and its volume augments. The microscope shows changes in the fluid, molecular opacity, and swelling in the fibres; the places of which later in the cortical are subsequently occupied by the products of degeneration.²

But all this brings us no nearer the cause of cataract. It is broadly stated that it is due to an impaired nutrition of the lens. This merely gives the difficulty another name. How is this nutrition effected? The crystalline body possesses neither nerves nor vessels, is suspended between two fluids, the aqueous humor on one side and the vitreous on the other, each similarly devoid of vessels, and probably in some way receives its nourishment through them. That substances introduced into the general circulation may ultimately be detected in the lens has been shown by experiment, although a considerable interval must elapse before their arrival occurs. They are supplied to the aqueous and vitreous by the vessels of the surrounding parts, and through them to the lens itself. Impaired nutrition of these two humors may therefore indirectly be the cause of cataract.

It is certain, on the one hand, that there must be some predisposition in the system at large, as senile cataract almost invariably attacks both eyes, although at different periods. It is equally certain that there must exist some local, modifying factor, inasmuch as the most diseased eye is always first attacked. This statement is based on the well-known fact that the prognosis in the second eye is usually better than that in the first.

VARIETIES OF CATARACT.—Congenital.—These are either partial or total, more generally the former, occurring in the shape of sharply defined opacities. It may in general be said of cataracts of this class that they are the result of defective formation, and are accompanied by a certain amount of amblyopia or imperfect perception; which not only persists after the mechanical obstruction to the entrance of light is removed, but is apt to increase with advancing years, if the eye be left alone, thus rendering advisable the early performance of the operation. Very different in this respect is senile cata-

ract, which may last without impairing the functions of the retina behind it.

1. **Zonular Cataract.**—This may be either congenital or met with in the earliest years of life, and is, according to Graefe, the most frequent of all the forms occurring in childhood. A central zone or shell of the crystalline is affected, circular in shape, surrounding and surrounded by entirely transparent lens substance. Seen from the front, by oblique light, or through the ophthalmoscopic mirror, it appears like an opaque or partially opaque nucleus to an otherwise transparent lens; and closer examination reveals its own centre to be transparent. Its diameter ordinarily varies between 5 and 8 mm. Sometimes this layer is surrounded externally by a second, equally opaque; sometimes, instead of a complete layer, groups of opaque points or striæ are irregularly distributed, with large intervals of clear lens periphery between them. In many cases the whole volume of the lens has suffered diminution. Zonular cataract is invariably met with in both eyes. It is frequently found that the children in whom it occurs have been the subjects of convulsions. They are, also, sometimes the victims of rachitis. This disease of the lens, when congenital, generally occupies a lesser area at birth than subsequently, and is hence often overlooked in very early life. Its subjects may be recognized by the way in which they shade their eyes to get the advantage of a dilated pupil, going into dark corners to thread a needle or perform some task requiring more than usual eyesight. In this connection it is desirable to refer to the proper treatment of zonular cataract. Its object being the admission of more light to the eye, two methods at once suggest themselves, the one being the formation of an artificial pupil opposite a clear space in the lens periphery, the other the removal of the lens itself, by discission in the young, by extraction in the case of one advanced in years. Each of these methods has its advantages and disadvantages. A successful iridectomy relieves the patient from the necessity of the life-long use of heavy lenses for all purposes, but is of no value if the cataract subsequently becomes total, as is sometimes the case. A full dilatation of the pupil is therefore to be brought about and the effect on vision noted. If much improvement follows iridectomy is indicated, particularly if the cataract has the appearance of being non-progressive and if the history of the case shows that vision has not materially changed for some time. But if vision does not improve under mydriasis, or if there is a history of diminishing vision, the lens should be removed.

2. **Punctated Cataract** consists in a large number of extremely small points of opacity, scattered throughout the lens. At the anterior and posterior poles they are often grouped into a triangular figure composed of short lines, meeting at an angle of 120°. The figure at the anterior pole has not the same direction as that at the posterior. Under strong illumination the opacity takes on a bluish tint. Examined under a high magnifying power, these opaque points present the appearance of small round or oval drops. Their form and position encourage the belief that they are situated, not in the lens fibres, but in the interfibrillar substance. According to Liebreich,³ from whom the above account is borrowed, this form of cataract is frequently, perhaps, indeed, generally, overlooked.

3. **Anterior Polar Cataract.**—A small, round, brilliant, white point, sometimes attaining a diameter of 2 to 2.5 mm., may occupy the centre of the anterior pole of the lens. At times it projects forward into the anterior chamber, and is then known as pyramidal cataract. Often there is a faint central corneal opacity in these cases, and then, according to Arlt, the rationale of the formation of this kind of opacity becomes evident. An intra-uterine central ulcer of the cornea is followed by perforation, the aqueous escapes, the lens comes forward into contact with the cornea, and a portion of the exudation, caused by the ulcer, adheres to the anterior capsule. When the ulcer heals and the anterior chamber is re-established, the lens recedes to its original position, car-

ring with it the acquired opacity. It is contended by some observers that simple corneal inflammation, unattended by perforation, may also act as a cause.

4. *Posterior Polar Cataract.*—This is a stationary opacity, rarely as small as the smallest examples of the kind just described, situated at the posterior pole of the lens. Its outline may be round and defined; or it may send out striae of opacity in different directions. It will generally be found to be associated with a persisting hyaloid artery.

5. *Total Congenital Cataract.*—This may differ in no respect from the soft cataract of the young, which is next to be described. But it is more frequently liquid, or else shrunken, and is very apt to be adherent to the iris. The capsule in such cases may be abnormally thickened. These cataracts are always double, and very frequently hereditary.

Soft Cataract of the Young.—The nucleus of the lens is rarely defined before the thirtieth year. Between thirty and forty there is, in the majority of cases, a small nucleus. After forty it is seldom absent. Cataract occurring in a lens devoid of nucleus is always soft. It commences sometimes in the shape of a general grayish opacity, at other times in the form of points or long striae, in the external cortical layers, and advances with comparative rapidity until the whole lens becomes clouded. It is in this form of cataract that the swelling of the crystalline, already alluded to, is most marked; the iris during this stage being thrown well in advance of its normal plane, and the movements of the pupil becoming restricted in comparison with those of the other eye. An operation at this time is apt to be followed by iritis, and should hence be avoided. Entire liquefaction may subsequently take place, the whole of the lens taking on the color of milk, or of milk mixed with water. As has been said, soft cataract may develop very rapidly. It may, moreover, be confined to one eye, and depend on either a general or a local cause, the nature of which may readily be determined. An example of the first is the

Diabetic Cataract.—As the soft cataract of early life is so often confined to one eye, the simultaneous affection of both lenses at this period would lead us to suspect a constitutional origin, particularly the existence of diabetes mellitus, and to examine the urine for sugar. This form of cataract may occur at any age, and, in the case of the young, progress with great rapidity. It resembles other cases of soft cataract in all respects, except that, according to some observers, traces of sugar are to be found in the lens. The prognosis of the operation is, of course, somewhat modified by the presence of so serious a disease, but need not necessarily be regarded as unfavorable, many cases making a rapid and uncomplicated recovery of sight. It has been claimed⁴ that the use of the waters of Carlsbad has been observed to arrest diabetic cataract, and even to cause its complete disappearance.

Cataract Occurring in Connection with Separation of the Retina, Retinitis Pigmentosa, or Disease of the Choroid.—Here we have undoubtedly to do with a local impairment of nutrition; and, of all these causes, the former is the most frequent. The cataract exhibits no peculiarity of appearance. Its cause must be inferred from the fact that it is monocular, that the vision of this eye had been considerably impaired before its appearance, and from the functional examination which reveals a diminished or extinct perception of light in one part of the field, generally the upper. In retinitis pigmentosa the opacity commences as a round spot at the posterior pole of the lens, from which radii shoot out toward the periphery. The anterior portion of the lens subsequently becomes similarly affected, but total opacity does not occur.

Traumatic Cataract.—The transparency of the lens depends on the integrity of its investing capsule. This may be ruptured by a contusion of the eye, or wounded by the penetration of a foreign body or of a sharp instrument. The aqueous humor then comes into immediate contact with the lens, which imbibes it, swells, and becomes opaque. When the capsular wound is very small it may again close, and the opacity remain confined to

the contiguous portion of the lens. But more frequently the swollen cortical substance protrudes from and itself widens the capsular wound, thus exposing fresh portions of the lens and ending in its general obscuration. As they protrude into the anterior chamber these masses may be absorbed, and finally the whole cataract thus be removed. But more generally, unless the pupil be at once artificially dilated, the pressure takes place against the iris, which inflames and renders necessary the operative removal of the opaque body.

Senile Cataract.—Under this form we understand the opacity of the cortical substance of a lens, the nucleus of which with advancing years has both separated and hardened. It is necessary to a proper understanding of the subject to bear in mind the probability that only the cortical layers become actually opaque, and that there is no essential difference, in the transparency of the nucleus, between the eye of an aged person who has always had good sight, and the eye of one who has become blind from senile cataract.⁵ No precise age can be assigned as that at which this form properly begins, so much variation is there in different individuals as regards the separation and hardening of the nucleus. In general it may be stated that senile cataract is most apt to occur after the fiftieth year. Testing the transparency of the crystalline, in people who have passed this age, the observer is often struck by the appearance of a series of short bifurcating linear opacities, ranged around the periphery of the lens. They may be the most numerous in either the upper or the lower segment, or even extend around its entire periphery. The practical point concerning them is that, though their appearance is always to be regarded as suspicious, they are not necessarily an indication of advancing cataract. They may either remain unaltered for years, or they may increase at once in number and extent. In the former case they are simply a senile change, analogous to the arcus senilis of the cornea; in the latter they justify the diagnosis of incipient cataract. They must be carefully observed, and the patient is not to be alarmed with a positive diagnosis of disease unless they are found to be increasing.

Becker⁶ gives the *résumé* of the various stages of senile cataract and their proper nomenclature. As long as there are a few opaque striae discernible in the periphery only, or in exceptional cases before or behind the nucleus, we speak of incipient cataract. If the opacity of the cortical substance has advanced, the expression unripe cataract is used. There is no absolute line to be drawn between these two, save that the cataract is to be regarded as incipient so long as the greater part of the cortical substance is transparent; as unripe when opaque cortical substance prevails. When the opacity of the cortical is complete the cataract is designated ripe. Oblique illumination then reveals no transparent portion, and no red reflex appears when the ophthalmoscopic mirror is used. The posterior portion of the lens is now, of course, invisible, but it ordinarily keeps pace in these changes with the anterior, and may be assumed to be in the same state.

Senile cataract generally affects both eyes, but is developed later in one than in the other. The fact that the eye last affected furnishes the better result has already been alluded to. That the tendency to this disease is hereditary has been abundantly demonstrated. The popular notions that the left eye is more apt to be first affected than the right, and that more men than women are the subjects of cataract, rest on no reliable foundation.

Absolute maturity of the senile cataract is not always to be waited for, or indeed invariably expected. In certain cases the complete affection of the cortical progresses with extreme slowness; vision in each eye may have fallen off to such an extent that reading and writing are no longer practicable, and the patient even finds it impossible to go about alone in strange localities, or those with which he is imperfectly familiar. Failure of sight continues to progress, but can be made out with certainty only by comparing the vision at long intervals of time. Meanwhile age creeps on and the general health,

affected, perhaps, by both moral and physical causes, commences to give way. In other cases progress in the formation of the cataract comes to an absolute standstill. The sclerosis of the nucleus may be complete, the cortical substance partially opaque, admitting a considerable red reflex, or perhaps even an imperfect view of the fundus to the ophthalmoscope, and months and perhaps years elapse without any change in this condition of things. Ripeness is here evidently not to be expected, and surgical interference, either directly or after the operative production of maturity, is wholly justifiable.

Black Cataract.—This name is applied to those rare cases in which the sclerosis of the nucleus goes on uninterruptedly and extends up to the capsule. Although occupied by a ripe cataract, the pupil appears black, even when oblique illumination is used. Cortical substance is completely wanting, and the whole lens is converted into one hypertrophied nucleus. This condition is of most infrequent occurrence.

Capsular Cataract.—Deposits on the capsule from without have already been alluded to. Primary affections of the capsule itself, the formation of opacities in its proper substance, are extremely rare. As careful an observer as Fuchs states that all so-called capsular opacities are deposits externally. The capsule itself invariably retaining its transparency, capsular cataract ordinarily occurs as one of the changes consequent on hypermaturity of an ordinary cataract.

Final Changes in an Over-ripe Cataract.—Inflammation in the lens, caused by this state of things, may bring about the formation of capsular opacities. The cortical substance may undergo partial absorption, this producing some improvement in vision and leading to a diminution in size of the lens. It may become liquid, and the nucleus, no longer supported, may sink to the bottom of the intracapsular space. The capsule sometimes thickens and becomes studded with crystals of cholesterolin. The whole cataract may become cretaceous, or, under very exceptional circumstances, even osseous. In the former case extensive adhesions with the iris may exist.

TREATMENT OF CATARACT.—Medical Treatment.—In view of the great advances made in the diagnosis and treatment of diseases of the eye during the present generation, as well as of the earnest efforts that are still being made in all directions to further ophthalmological science, it would indeed be hazardous to assume that no local application or general medication to affect the progress of cataract will ever be discovered. None the less must it be firmly asserted that, at the present day, we possess no means whatever of preventing the formation of the disease. Numberless remedies have been tried in the past, but have all proved inefficacious, and at the present day none but charlatans assert their ability to cure cataract without an operation. Some administer nostrums, others make topical applications, while others again extol the virtues of electricity; the result in every instance being the same. If the cases of reported cure be thoroughly sifted, it will be found that by far the larger proportion are based on a mistaken diagnosis; that in many instances the process has simply come to a standstill; while in a small number of eyes the lens has either undergone spontaneous dislocation, or else the swelling of the crystalline has been so unusually great as to rupture its capsule and lead to total absorption. Opacities of the layer of intracapsular cells may wholly disappear, and traumatic cloudiness of a portion of the lens may regain some degree of transparency. It is also a well-known fact that diabetic cataract may vary directly with the progress of the disease.

2. *Surgical Treatment.*—This consists in reopening a path for the rays of light to reach the retina, either by the side of the existing obstruction (iridectomy) or by its absolute removal. The latter may be effected in one of three ways: The cataract may be left in the eye, but be pushed aside from the axis of vision (reclination, depression); it may be caused to undergo absorption by being brought in direct contact with the aqueous humor

(discission); or it may be bodily removed from the eye through an opening made for the purpose (extraction).

General Considerations.—The indication for an operation for cataract is a probable improvement in vision, combined with safety to the general health of the individual. The two preliminary questions, therefore, to be settled are, first, as to whether a careful examination of the condition and functions of the eye renders it likely that the cataract can be successfully removed; and second, whether the general health is likely to be injuriously affected by the excitement attending the operation, or the subsequent confinement that may be necessary.

As a rule it is undesirable to operate on a teething child, a pregnant woman, or one who is menstruating or about to do so. The general condition of the patient should be carefully inquired into and the prognosis modified if any general disease like diabetes or Bright's disease be present, and it is yet deemed desirable to proceed with the operation. If the patient is fresh from a journey, a day or two's rest should be allowed. If the operation takes place away from home, a sufficient time should be afforded the individual to familiarize himself with his new surroundings. On the continent of Europe there is quite a general agreement among ophthalmic surgeons that serious operations, like the extraction of cataract, which entail a lengthened convalescence, should be performed away from home; generally in the private rooms attached to the hospital with which the surgeon happens to be connected. An establishment especially arranged for the purpose offers advantages of light, ventilation, quiet, and skilled attendance, with which no ordinary private house can compete. There is, moreover, a freedom from care and anxiety that can rarely be secured at home. For the first day or two, relations and friends being excluded, there can be no allusion to exciting topics or consultation on household cares. Distance from the latter is found to induce, with the head of a family, a feeling of repose that close proximity would go far to destroy.

The long-received notion that the spring and fall are the best seasons for cataract operations was undoubtedly based on the fact that these were the times of year which the peripatetic oculists, who formerly infested the community, found most convenient for travelling. In the United States the extreme heat that may prevail during the months of July, August, and September might exert an unfavorable effect on a protracted convalescence, and therefore renders these months less eligible than those in which the weather is generally cooler.

Should one eye be operated on when the other is entirely normal? Assuming the cataract to have been successfully removed, there are certain undeniable advantages in the association of such an eye with a normal one. Although the lens is wanting and the refraction of the two eyes thus radically different, binocular vision is often enjoyed. When this is not possible, double vision does not necessarily arise, as the patient learns to abstract from the image furnished by the imperfect eye, and to rely on the sound one for accurate perception. Even then he has a larger visual field than if he had only one eye, a better estimation of distance, and appreciation of solidity. He is no longer blind on one side, and, when moving about, avoids accidents to which he would otherwise be liable. With the young, therefore, such an operation is always to be encouraged, both for these reasons and, in the case of females, for those of a cosmetic nature. But with the aged different considerations must prevail. The operation, with them, is neither as simple nor as safe, and the after-treatment is much more prolonged. The interruption in the usual habits of an elderly person, the shutting him up in a dark room, changing his diet, and depriving him for a fortnight of the air and exercise on which he is dependent, may exert a serious influence on his health. While in youth it is, therefore, advisable to operate on a single eye, the maxim in age should be never to touch a cataract on one eye until the other begins to be affected, and then to delay as little as possible, bearing in mind the fact that the longer the