

into the stomach, there is salivation and perhaps coryza, followed by nausea, and accompanied by some diuresis and considerable diaphoresis. If free vomiting occurs, these effects will quickly pass away; but if not, they will be prolonged, and with one or more exacerbations. In the latter case, too, there is more apt to be a laxative or even a purging effect, as is also the case after hypodermic injections. The respiratory mucous membrane generally shares in the increased secretion. Ipecac is therefore a nauseating expectorant and an emetic, with a cathartic tendency. Its emetic action is characterized by its slowness. If cephaline is given, the nausea and salivation are more marked; if emetine, the nasal secretion is more in evidence. Very large doses are poisonous, the symptoms being those of emetico-cathartic irritants, but with great depression, which appears almost certainly due in part to central action. A cholagogue action is distinct. This cannot be explained on the theory of mechanical pressure upon the gall bladder from the retching, because it will occur when this is not present.

Use.—The expectorant and emetic uses of ipecac follow clearly from its action as above described, but not its antidiysenteric. As an emetic it is not suitable for use in poisoning, as it is not prompt enough, and is too apt to be irritating. This action is, however, often of great value when we wish to carry its relaxing effect to the extreme, as in acute bronchitis. Very small doses of ipecac will often exert an anti-emetic action, and will also promote appetite and digestion. The chief use of the drug is, however, as an expectorant, in which it both increases the secretion and stimulates its removal, yet acts as a sedative or anodyne when there is annoying cough without much secretion. This action is quite prolonged, and the effect is easily maintained by repeated small doses. The diaphoretic action is an important accompanying factor. As an antidiysenteric, ipecac is better adapted to the stomachs of savages than to those of most civilized persons, for the doses are so large (a drachm or more) that the treatment is heroic. De-emetized ipecac is for this reason preferred, but it has been claimed that it lacks efficiency. The mode of action is not known. It is not impossible that in the true dysentery of the tropics, in which cases it is far the more efficient, it acts as a specific rectal antiseptic, as it is known to have antiseptic powers.

The preparations are numerous. The drug is very largely employed in the powdered form. As an expectorant, the dose is 0.03 to 0.06 gm. (gr. ss. to i.), as an emetic 1 to 2 gm. (gr. xv. to xxx.), as an antidiysenteric 4 to 6 gm. (gr. lx. to xc.), or a full emetic dose followed by gram doses. The official fluid extract is given in corresponding doses of cubic centimetres or minims. The seven and one-half-per-cent. syrup and the ten-per-cent. wine are to be adjusted, in proportion to their strength, for the same requirements. The tincture of ipecac and opium, containing ten per cent. of each, is used when a specially sedative expectorant effect is desired, but not when we specially desire the clearing of the air passages. In the preparation of the last three the fluid extract of ipecac is employed. The same statement concerning selection applies to the powder of ipecac and opium (Dover's powder), having the same strength. The official troches contain, each, gr. $\frac{1}{2}$ of ipecac, and the troches of morphine and ipecac, each gr. $\frac{1}{4}$ of morphine and gr. $\frac{3}{16}$ of ipecac. The rectal injection of ipecac for the treatment of chronic constipation has been tried, and it would seem that further experiments in such use are desirable.

Henry H. Rusby.

IPECAC, NORTH AMERICAN.—FALSE IPECAC, INDIAN PHYSIC, BOWMAN'S ROOT.—The roots of *Porteranthus trifoliatum* (L.) Britton, (*Gillenia trifoliata* Moench), and *P. stipulatus* (Muhl.) Britton, (*G. stipulacea*, Nutt.) (fam. *Rosaceae*). These are pretty perennial herbs, with clustered, erect, or ascending stems, resembling the Geums, deeply three-parted leaves and white flowers. The former grows west to Missouri and south to Georgia; the second somewhat farther south and southwest. The roots grow from a hard, woody, and knotty crown about

an inch in diameter. They are numerous, much and very crookedly twisted, knotty, and interlacing, especially the second species. The roots are annulate and transversely fissured and of a deep reddish color, thus giving them an appearance very similar to that of ipecac, which they have been used to substitute and adulterate. The bark is brittle, like that of ipecac, but the wood is thicker and much tougher, and has conspicuous slender medullary rays, which extend slightly into the bark. Strangely enough, the drug possesses properties similar to those of ipecac. It was highly prized by the aborigines as a mild emetic and nauseating expectorant, purgative also in larger doses, and was much used by the settlers. It is still employed to a considerable extent, and somewhat by physicians. The emetic property appears to reside in the peculiar neutral substance gillenin, which is extracted as a white powder, soluble in water and alcohol. It is probably a glucosidal mixture. "Gillenin" of commerce is a resinous extract, containing the other, and is given in doses of gr. iv. to vi. The dose of gillenin is 1 to 2 gm. (gr. xv. to xxx.).

Henry H. Rusby.

IRIDECTOMY (Gr., *ίρις*, *ίριδος*, the iris, and *ἐκτομή*, a cutting; *ἐκ*, out, and *τομή*, a cutting, from *τέμνω*, to cut), the operation of cutting out a portion of the iris for the purpose of forming an artificial pupil.

The instruments needed for the operation are: A spring speculum. A pair of fixation forceps, for steadying the eyeball (Fig. 2954); this must be light and catch accurately, and the teeth must not be too sharp and pointed, otherwise they may tear through the conjunctiva. A broad lance-shaped knife, the shape of which varies with the direction in which the iridectomy is to be made—if

made outward (toward the temple), a straight knife may be used; if made inward or upward, the blade must be bent at an angle (Fig. 2955), according to the prominence of the nose or the upper margin of the orbit. If the anterior chamber is narrow, and the iris close upon the cornea, a very narrow von Graefe knife should be used in place of the lance-shaped one. The narrow knife represented in its actual size by Fig. 2956 has, in the hands of the present writer, almost entirely supplanted the lance knife in this operation; with it, it is possible to skirt the edge of the anterior chamber and make a large incision without risk of wounding the lens. The iris forceps, which should be lightly bent (Fig. 2957), should catch accurately, but when closed the arms of the forceps should come together only for a distance of 2 to 3 mm. from their end. The iris scissors; these may be bent at an angle (Fig. 2958), or curved on the flat (Fig. 2959); the blades must close tightly. Lastly, the rubber spatula, with which to replace the iris if necessary.

Before the operation, the eye and its surroundings are to be thoroughly washed with a solution of corrosive sublimate of the strength of 1 to 5,000, the lids are everted, and the conjunctiva is washed with a piece of absorbent cotton dipped in the bichloride solution.

FIG. 2954.

All instruments to be used are immersed, first in a 2.5-per-cent. solution of carbolic acid, and then in ninety-five per-cent. alcohol. The hands of the operator, as well as those of the assistant, and the parts adjacent to the eye are carefully washed with a solution of corrosive sublimate of the strength of 1 to 1,000.

OPERATION.—The patient is to be placed on a bed or operating-table, and an anæsthetic administered. In all cases of iridectomy, the patient should be brought completely under the influence of the anæsthetic before the operation is attempted. If the eye is to be operated on in the right, the surgeon places himself behind the patient; if the left, he seats himself on the bed in front of the patient, that he may make the incision with his right hand. Complete anæsthesia having been brought about, the spring speculum is introduced and locked in place. With



FIG. 2955.

the fixation forceps in his left hand, the surgeon seizes the conjunctiva on the same meridian as that in which the coloboma is to be, but at the opposite side of the cornea and close to it. Care is to be taken that the forceps exerts no pressure on the eyeball—it simply holds it or rolls it. The lance knife is now taken in the right hand, and its point entered either at the limbus or 1 mm. back from the circumference of the cornea. When the point has entered the anterior chamber, and the operator recognizes this by the sudden absence of resistance, the handle of the knife is lowered and the blade is pushed forward in the direction of the plane of the iris until an incision long enough for the purpose in view has been made. We shall see that the length of this incision varies with the size of the portion of iris that is to be removed.

The position of the point of the knife is carefully watched. The handle of the knife is still more lowered, so that its point comes almost in contact with the posterior surface of the cornea, and avoids contact with the anterior surface of the lens, which comes forward when the aqueous humor flows off. As the knife is now slowly withdrawn, its cutting edge is kept close to one or the other of the angles of the incision, and by this means the inner opening of the section is made of equal extent with the outer. We have said that the knife is to be slowly withdrawn, and this is most important. A quick withdrawal of the knife, and sudden evacuation of the aqueous, may be followed by intra-ocular hemorrhage or rupture of the suspensory ligament of the lens.

The Narrow Knife.—If in place of the lance-shaped knife the narrow one of von Graefe is used, the procedure is as follows: Let us suppose an iridectomy is to be made upward, for the relief of glaucoma of the right eye. The anterior chamber is narrow, the iris and the lens system being well pushed forward; there is slight corneal haziness. The patient is to be completely anesthetized, the speculum is introduced, and, as was described above, the eye is lightly fixed by means of the forceps. The surgeon stands behind the patient, the knife is held vertically in the right hand, and at the corneal margin its point is entered in the anterior chamber; the handle is now lowered and the point of the knife directed to the point of counter puncture, kept parallel with the plane of the iris, and made to skirt the edge of the anterior chamber. The distance between the points of entrance and of counter puncture is determined by the size which it is desired to give to the pupil. In completing the section the blade of the knife is given a slight inclination upward, so that the external and internal lips of the wound are directly over each other. The counter puncture is at the corneal margin, and the wound, when completed, lies opposite the peripheral insertion of the iris.

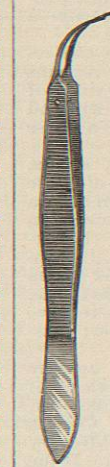


FIG. 2957.

Whether the lance-shaped or narrow knife is used, it may happen now that the iris is spontaneously prolapsed in the wound and may be excised *in situ*. Ordinarily the next step of the operation is as follows: The fixation forceps is given over to an assistant, and the bent iris forceps entered, closed, through the incision; when the point of the forceps is opposite the sphincter of the pupil the blades are opened as widely as may be, and the iris is seized and drawn out through the corneal incision. The operator, now holding the iris thus secured and drawn out of the corneal wound to the requisite extent with the forceps in the left hand, takes the scissors in the right, and, holding them parallel with the corneal wound, cuts the exposed portion of iris. After the excision it is of great importance to see that the edges of cut iris are not entangled in the wound. There are different degrees of this entanglement—the edge of the cut sphincter may be drawn into the corneo-scleral section, or the ciliary portion of the iris may be thus entangled. In either case, care should be taken to replace the iris. This may be often accomplished by simply stroking the region of the incision with

the rubber spatula, or it may be necessary to enter the wound again with the spatula and gently replace the iris. Should neither of these measures succeed, it may be necessary to use the iris forceps again and excise the portion thus entangled with the scissors. After the operation it sometimes happens that hemorrhage into the anterior chamber takes place. In such an event the edges of the wound are gently separated by a Daviel spoon or by the india-rubber spatula, and the blood slowly runs out; or the eye is closed for a few minutes, and, waiting until the aqueous humor is secreted, the same attempt with the spatula is made again. If the hemorrhage is considerable and is continuous, sponges wrung out in ice water may be held for a few minutes against the eye until all sign of active bleeding has ceased. Any coagulum lying in the wound should be removed by means of the iris forceps.



FIG. 2956.

A bandage is now applied to the eye as after cataract extraction (see *Cataract*), and within six hours the bandage is renewed. On the following day, if there has been no accident, the patient may be allowed to leave his bed, but he should still remain for forty-eight hours in a moderately dark room. A few drops of a two-per-cent. solution of atropine should be instilled in the eye the second day, and this may be repeated twice daily so long as the patient remains under treatment. The length of the after-treatment will depend on the circumstances under which the operation has been performed, and when the iridectomy has been made merely for optical purposes, the confinement of the patient need be very brief. It sometimes happens that after the operation the sclero-corneal wound fails to unite, and that this condition of things lasts for days and even weeks. In cases of simple glaucoma, immediately after the operation there may remain a marked increase of intra-ocular tension, and the anterior chamber is not at once restored. Indeed, the intra-ocular tension may increase, the iris and lens be pressed against the cornea, and the eye become painful and congested. In such a case as this the bandage can no longer be tolerated—indeed, it does harm. Occasional warm compresses may be used, and the pain quieted by injections of morphine, until the inflammatory symptoms have subsided.

In conclusion, it is proper to consider the care that must be exercised in performing an iridectomy, both for the accomplishment of our object and that no harm may ensue to the eye from the operation. It may happen that an inexperienced operator does not succeed in the excision of a piece of the iris, that he tears the iris from the ciliary body, that he causes a rupture of the hyaloid membrane, or that he wounds the anterior capsule of the lens. More than this, the operation, when performed *secundum artem*, is not absolutely free from danger. Occasionally, if rarely, such an eye is lost by purulent iridochoroiditis. When, after the operation has been performed, there ensues cystoid cicatrization of the iris in the wound, increased intra-ocular pressure may take place, or the eye may be lost by purulent irido-cyclitis. Mooren² found among two hundred and forty iridectomies one corneal suppuration, and von Graefe³ saw two suppurations of the cornea after simple iridectomy.

HISTORY.—Before speaking of the uses of an iridectomy a brief reference to the history of the operation is in place. As early as 1711 the operation was performed by Woolhouse, and again in 1728 by Cheselden. The method of operation was modified and improved by Beer, in 1796. The new pupil, in these earlier operations, was made to enable

the rays of light again to enter the eye; it was done for optical purposes. Scarcely thirty years have passed since the applicability of iridectomy has been vastly increased. It was left for Albrecht von Graefe, in 1855,

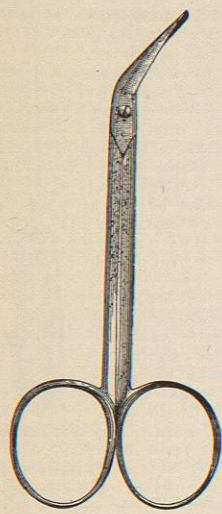


FIG. 2358.

most advantageous position for such a pupil is either opposite the inner side, or at the lower and inner side of the cornea.

The pupil may be either free or adherent to the cornea at a single point, or its entire margin may be fast to the corneal cicatrix. In cases in which the iris is completely adherent to the cornea an iridectomy is impossible.⁴ If the anterior chamber is no longer present, and the cornea is flattened, opaque, and its curvature gone, iridectomy is useless, if not an actual impossibility.

In cases of keratoconus an iridectomy has been of service. Here the object of the operation is twofold—first, to offer to the rays of light a portion of the cornea relatively of normal curvature, and secondly, to secure a permanent reduction of the intra-ocular pressure.

Again, an iridectomy is often indicated when the region of the pupil is occupied by a membrane, the remains of an exudation. We shall speak later of the value of iridectomy when there are adhesions between iris and lens capsule, and when these adhesions furnish a cause for relapse in iritis.

When a fragment of metal has penetrated the cornea and lodged on or in the iris, an iridectomy must often be made in order to remove the foreign body, and in such a case a small wound is to be made at the limbus, and then with the iris forceps a fold of the iris, including the foreign body, is to be gently seized and excised. It happens in such cases, sometimes, that a piece of steel lies on the surface of the iris, or is lightly embedded in its tissue, and we are enabled by the use of the magnet to remove the foreign body through a corneal wound without causing prolapse of the iris.

An iridectomy is indicated in certain cases of opacity of the lens. Especially does it benefit certain cases of zonular cataract, in which the centre of the lens is clear, while around it is a cataractous layer or zone. Certain of these cases are progressive. It is for the stationary form that the operation is indicated (see *Cataract*). If the central opacity is not extensive, and if, upon dilating the pupil with a mydriatic, the patient secures a reasonable vision and can read, a new pupil can be made inward. Von Graefe⁵ advised in such cases that the incision be made with the lance knife inward, not at the margin of the cornea, but a line within the limbus; then with the

forceps the pupillary margin of the iris is seized and a small piece excised. The new pupil should be as small as possible, on account of the dispersion of light through the lens, and on account of the irregular astigmatism that is usually found in the periphery of the lens.

Iridodesis, or displacement of the pupil, has been recommended in these cases, and the form of the pupil secured by this operation is most desirable; but experience has shown that it is not without its dangers, and the anterior synechia which it entails may be a source of lasting injury to the eye.

Anterior polar cataract, in which the peripheral portions of the lens are transparent, furnishes sometimes an indication for iridectomy. In such a case the condition of the lens and the vision must be carefully examined after artificial dilatation of the pupil.

So, too, in cases of secondary cataract, either after an extraction or when a traumatic cataract has undergone spontaneous absorption, an iridectomy may be of benefit. In the majority of such cases, however, either a discission of the membrane or its removal from the region of the pupil is necessary.

We have thus far considered the operation of making a new pupil in the light of its serving an optical purpose. There is an equal, if not larger, application for it in combating inflammations of the eye. One well-recognized effect of an iridectomy is the consequent reduction of intra-ocular tension.

In cases of chronic iritis⁶ and irido-choroiditis iridectomy holds a foremost place in treatment. The most frequent cause of recurrence in iritis is found in the adhesion that takes place between the posterior surface of the iris and the anterior capsule. The broader these adhesions are the more frequent is the recurrence, and with complete fixation of the pupil, further complications occur in the form of chronic choroiditis, and this may go on to atrophy of the eyeball and loss of sight. The period at which the iridectomy is made in these cases is of great importance. It should not be made when the eye is in a condition of acute inflammation. Cases of irido-choroiditis, in which a certain degree of atrophy of the eye has taken place, have been arrested by the performance of iridectomy. Von Graefe, in the article we have cited, shows how here the stasis and congestion in the choroidal vessels are relieved, and the nutrition of the vitreous humor is improved by the operation.

In cases of exclusion of the pupil, that is, where there is complete adhesion between the edge of the pupil and the capsule of the lens, and consequently no communication between the anterior and posterior chambers, an iridectomy is indicated. As the object of the operation in such cases is the re-establishment of connection between the anterior and posterior chambers of the eye, success will depend on the condition of things back of the iris. If there is firm membranous exudation there the operation will be difficult, and may have to be repeated again and again.

Another class of cases in which iridectomy may be practised to ward off inflammation is that in which there are local changes in the iris, as in the case of small cysts, usually following a penetrating wound and situated at the sclero-corneal junction; or, again, that in which a foreign body has penetrated the cornea and lies in the iris tissue, when its removal may be impossible without iridectomy.

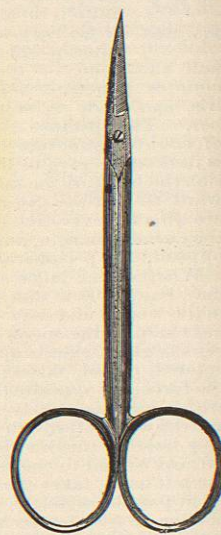


FIG. 2359.

In cases of extensive ulcerations of the cornea, or suppurative keratitis with tendency to hypopyon, iridectomy often renders service. The operation would not be indicated if the corneal affection were likely to heal and ultimately leave the centre of the cornea clear, nor in cases in which the corneal disease was dependent on purulent or diphtheritic conjunctivitis. The operation is rather for cases of idiopathic keratitis in which there has been a considerable loss of corneal surface, and here, as von Graefe pointed out, the reduction of the intra-ocular tension relieves the strain upon the cornea and allows the process of repair to go on.⁷

In cases of beginning staphyloma of the cornea, and cases in which there has been corneal ulceration with entanglement and prolapse of the iris, with staphylocomatous tendency, an iridectomy is necessary. In these cases the power of resistance of the cornea, even to the normal intra-ocular pressure, is reduced, and the operation should be made even before there is an increase of the tension, with a view to averting it. More than this, the operation is of value in combating the severe pain that is present even if the eye is blind, and in warding off sympathetic affection of the fellow-eye.

Partial staphyloma is often relieved by an iridectomy. We come now to a consideration of the value of an iridectomy in cases of glaucoma. For the relief of this disease the operation was first performed by von Graefe, in 1855.⁸ The incision is to be made at the sclero-corneal junction, and of sufficient extent to remove a segment of the iris from pupillary to ciliary margin, and at least 3 mm. in width. The results attained by the operation will depend on the period of the disease at which it is undertaken. It may be said in general that the sooner the operation is made after the disease has declared itself, and before serious changes have occurred in the structures of the eye, the better. In the ordinary history of a case of glaucoma there are so-called premonitory symptoms. These are of periodic occurrence, leaving the eye in the interval apparently perfectly well. Among these symptoms are increase in the tension of the eyeball and a rapid increase in the amount of the presbyopia, compelling the patient to make frequent change in the strength of the reading-glass; there is periodic dimness of sight; on looking at a light the patient sees a rainbow or halo around it; there is pain in the forehead and temples; there is contraction of the visual field, and generally this limitation begins at the inner or nasal side. With these symptoms, some or all of which may be present, there may be cloudiness of the aqueous or vitreous humor, and the pupil is sluggish and moderately dilated. On the optic disc we see arterial pulsation. So soon as these periodic symptoms leave no longer a normal pupil, and so soon as a lasting impairment of the vision takes place, we can no longer speak of the premonitory stage; the disease of glaucoma is established, and iridectomy can no longer with safety be delayed. The prognosis is most favorable when the iridectomy has been performed during the premonitory stage.

In acute inflammatory glaucoma the iridectomy may accomplish good results, if it is made at a sufficiently early period. Even if the sight is reduced to a mere quantitative perception of light, the operation may restore vision, provided that the sight was good before the attack. At this period of the disease the operation is attended often with peculiar difficulty. The increased intra-ocular tension causes the lens and iris to be pressed forward and the anterior chamber to be narrowed. Here the narrow von Graefe knife can be, with great advantage, substituted for the lance knife in making the section. The iridectomy in glaucoma should be large and peripheral. Indeed, we have seen cases in which the iridectomy could be accomplished with no other instrument.

Von Graefe gave the name *glaucoma fulminans* to a class of cases in which blindness ensues in apparently healthy eyes within a few hours. He explains the process as one in which the sudden increase of intra-ocular tension shuts off the supply of arterial blood to the retina.

Here, if the iridectomy is to bring any relief, it must be made within two or three days of the beginning of the attack.

In chronic inflammatory glaucoma the iridectomy will often arrest the disease and preserve such vision as the patient has at the time of the operation. The prognosis in these cases should be guarded, however, and the result will largely depend upon the extent of the limitation of the visual field, and upon the degree of the excavation of the optic disc. The greater the intra-ocular tension at the time of the operation, the better are the chances from the iridectomy. If, after the operation, there should still be increased tension, von Graefe has recommended that another iridectomy should be made, diametrically opposite the first, so as to cut off the two halves of the iris from each other. There are cases, however, of chronic inflammatory glaucoma in which, notwithstanding all treatment, blindness ensues in consequence of progressive atrophy of the optic nerve, and not through a recurrence of the glaucomatous inflammatory symptoms with increased tension.

In cases of glaucoma in which there are no evident inflammatory symptoms, iridectomy often proves of service. This class of cases has received the name of *glaucoma simplex*, or amaurosis with excavation of the optic nerve. Von Graefe pointed out that in most of these cases an iridectomy reduces the tension of the eyeball to its normal condition and keeps it there. In some cases the tension is reduced and the vision remains for a time as it was directly before the operation, and then fails; the tension is later on again increased, and only after a second iridectomy is the process brought to a standstill. In a certain number of cases von Graefe⁹ found that the iridectomy actually increased the tension instead of diminishing it, and the sight was suddenly lost as if by an acute attack of glaucoma; in other words, the operation precipitated the fatal issue.

As we owe to von Graefe the discovery of the fact that iridectomy alone permanently reduces the abnormally increased intra-ocular tension, so do we owe to him a knowledge of the class of cases in which the operation may be employed. According to von Graefe,¹⁰ there is hardly any inflammatory disease of the eye which may not lead in its course to secondary glaucoma. That we may enumerate the cases in which an iridectomy may be called for, we will briefly allude to the diseases in which secondary glaucoma most frequently supervenes. Of the affections of the cornea, diffuse keratitis comes first in order, then chronic keratitis, associated with the so-called sclerotic-choroiditis anterior, pannus, cicatrices of the cornea, and especially cicatricial ectasia of the cornea. In this last class of cases the iridectomy is to be made, not alone when there are signs of increase of tension, but at an earlier period, and with a view to protecting the eye against an attack of secondary glaucoma.

Von Graefe has described a peculiar affection of the cornea which is prone to develop secondary glaucoma, and calls for an iridectomy for its relief. This is the so-called "band-shaped" keratitis, which occupies the centre of the cornea, the rest of the cornea being transparent. The opacity extends over that portion of the cornea which would be exposed when the lids are but slightly open. When this affection is recognized, an iridectomy should be made as early as possible. Secondary glaucoma supervenes on plastic iritis, when numerous posterior synechia have formed, and in iritis serosa. In both classes of cases an iridectomy is the only measure which offers a hope of permanent relief.

Traumatic cataract leads sometimes to secondary glaucoma, and an iridectomy may, under certain circumstances, afford relief. With rupture of the anterior capsule and rapid swelling of the lens substance, the iris is pushed forward, and increased tension is the result. Von Graefe has here pointed out that, if the signs of secondary glaucoma are present, either simple iridectomy or extraction of the lens is indicated. The eyes of young children withstand the deleterious effects of an increased tension much better than do the eyes of adults.

In cases of dislocation of the lens, if symptoms of glaucoma arise, von Graefe advises that an iridectomy should be made, especially if the dislocation is moderate, and the iris pushed forward to a limited extent. The incision should be as near the periphery as possible, on account of the danger of the vitreous humor entering the anterior chamber and pushing back the iris in such a way that its excision becomes difficult. The operation should not be undertaken in these cases until the patient is completely under the influence of an anæsthetic and the muscles are completely relaxed, otherwise there is great danger of escape of vitreous, and consequent intra-ocular hemorrhage.

Secondary glaucoma supervenes on serous choroiditis, and if repeated paracentesis fails permanently to reduce the increased tension, and the disease resists other treatment, an iridectomy should be made.

In posterior staphyloma, or sclerectasia posterior, secondary glaucoma may, and often does, supervene.¹¹ Von Graefe states that the disease here always attacks both eyes sooner or later, and that it assumes the character of glaucoma simplex, or that of the inflammatory form. The secondary affection, if its character is not early recognized and an iridectomy made, leads to grave impairment, or even to total loss, of sight.

Richard H. Derby.

¹ Graefe-Saemisch, iii., pp. 359, 360.
² Ophth. Beobacht., Berlin, 1867.
³ Archiv f. Ophth., Bd. xii., 1, p. 214.
⁴ Graefe-Saemisch, Bd. iii., S. 340.
⁵ Archiv f. Oph., l., Band ii., p. 243.
⁶ Ibid., ii., p. 245.
⁷ Ibid., iii., p. 456.
⁸ Ibid., iii., p. 202.
⁹ Ibid., iv., p. 153, and *ibid.*, xv., iii., 173.
¹⁰ Ibid., xv., iii., 121.

IRIDOTOMY.—Iridotomy and iritomy are the names which have been given to the operation of cutting the iris, thus making a distinction between that operation in which the iris is simply cut, and the *iridectomy* in which a portion of it is removed.

In a normal eye it is not difficult to make a cut in the iris, either radial or tangential, with a Graefe knife, and that too without wounding the lens or its capsule; but iridotomies are usually done on eyes in which the conditions are far from normal, in which the lens has been removed, and in which the pupil is so blocked by iris, or thickened capsule, or both, that neither iridotomy nor capsulotomy can be considered exclusively descriptive of the necessary operation. In such cases the method of de Wecker is usually followed. A small cut is made with a lance knife or a Graefe knife as for a cataract operation, the points of de Wecker's scissors (Fig. 2960) are introduced closed and nearly on the flat, and are then allowed to open so that the sharp point shall pierce the iris and pass below it until the limit of the proposed incision has been reached. Now the cut is made by closing the scissors, after which the instrument is withdrawn and the operation is complete. A single slash in the iris is not always sufficient to secure an open pupil, so the operation is sometimes varied by making a second cut before the scissors are removed, this being made in such a manner as to leave a slender tongue of iris the point of which will roll up on itself leaving a triangular pupil. The after-treatment is the same as that following iridectomy.

Fig. 2960.—De Wecker's Scissors.

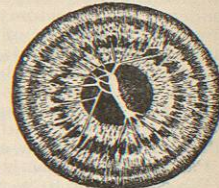
William S. Dennett.

IRIS, CONGENITAL ANOMALIES OF.—Congenital anomalies of the iris are usually associated with malformations of other ocular structures and frequently with congenital defects elsewhere, such as harelip, cleft pal-

ate, etc. They are dependent in great part upon hereditary influences, although it seems highly probable that in certain cases they may be due to inflammatory processes occurring in the eye during fetal life. Poor vision is the rule, but it is usually to be attributed to the insufficient development of the eye as a whole rather than to the defects in the iris. Not infrequently there is microphthalmos of one or of both eyes. Errors of refraction of high degree are common and add to the general impairment of vision. In addition to this, such congenitally defective eyes are especially subject to diseases, particularly choroiditis and cataract.

Membrana Pupillaris Perseverans (persistent pupillary membrane, Fig. 2961). In the fetus the entire lens is surrounded by a vascular membrane, the *tunica vasculosa lentis*, the blood supply of which is derived chiefly from branches of the *arteria centralis* that pass around the edge of the lens and anastomose on its anterior surface. The network of vessels is particularly free at the equator of the lens and least marked at its anterior pole. The portion of the membrane occupying what is to be the pupillary area is known as the pupillary membrane, and as the iris is developed an anastomosis takes place between its vessels and those of the membrane. Usually at birth all of these vessels and the membrane itself have disappeared, but exceptionally portions of them persist throughout life. When this is the case there is rarely found anything that resembles a true membrane, but simply a number of strands of tissue, often highly pigmented, which arise from the anterior surface of the iris and project into the pupil. The strands may hang freely in the pupil, they may be adherent to the capsule of the lens, or they may extend entirely across the pupil forming a network in front of the latter. Not uncommonly there remains only a single fine thread passing across the pupil. In rare instances the strands have been seen united with the cornea. That these strands really represent vessels has been proven by microscopic examination. Blood corpuscles have been seen in them and they have been artificially injected shortly after birth. They usually take origin from the small circle of the iris, but they may be given off farther toward the periphery. Rarely a portion of the pupillary membrane itself remains on the lens capsule and may be mistaken for an anterior polar cataract.

Fig. 2961.—Persistent Pupillary Membrane. (After von Hippel.)



This is one of the commonest anomalies of the eyes. Fuchs says it is frequent in new-born infants, but usually disappears. It is more common in the right eye than in the left, and in one eye than in both. It occurs more frequently in females than in males. As a rule the strands do not interfere with vision, but in a few cases the sight has been so much impaired as to necessitate their removal by operation. They are sometimes mistaken for synechie, although they can readily be distinguished from the latter by their distensibility and by their arising from the anterior surface of the iris.

Corectopia (displacement of the pupil). A slight degree of corectopia must be regarded as normal, since the pupil is usually not exactly central but situated a little to the nasal side. In marked cases of the anomaly the pupillary margin may lie within 1 to 2 mm. of the corneal limbus. The displacement is usually upward and outward and the pupil is apt to be small and to present irregularities in its contour. The iris may be perfectly normal and react normally to light, and in such cases the condition is commonly unilateral and not associated with other ocular defects. Often, however, corectopia occurs in conjunction with other congenital anomalies such as buphthalmos, albinism, coloboma of the lid or iris, and microphthalmos. Not infrequently it is accompanied by ectopia of the lens, both eyes as a rule being affected. In

such cases the lens and pupil are most often displaced in opposite directions and there is apt to be iridodonesis. The lens is usually clear but noticeably small and may present a greater or less degree of coloboma. It is noteworthy that in cases of corectopia coloboma of the choroid or retina has never been observed. Remains of the pupillary membrane are sometimes seen. In some cases the iris may be discolored and atrophied, and the radial striae run in such directions as to produce the appearance left by an iridectomy when the root of the iris has been incarcerated in the wound. For this reason it has been suggested that the condition here is due to an adhesion of the growing iris to the periphery of the cornea as the result of an intra-uterine iritis.

The vision may be normal or greatly impaired, the impairment in these cases being dependent upon the optical defects rather than upon changes in the fundus. When the edge of the lens is opposite the pupil, monocular diplopia may occur.

Dyscoria (irregularity in the shape of the pupil). It is very common to find a number of pigmented tags extending from the pupillary margin into the pupil. These are due to a proliferation of the pigmented epithelium lining the posterior surface of the iris. In some cases they are quite large and they have been known to break away and lie free in the anterior chamber. They are to be distinguished from posterior synechie due to iritis by the fact that they are never adherent to the capsule of the lens. Sometimes they are regarded as remains of the pupillary membrane, but differ from the latter in arising from the margin of the pupil. Very similar projections are normally present and highly developed in the eyes of horses. Dyscoria may also be the result of posterior synechie following fetal iritis.

Polycoria.—Strictly, this condition does not exist, since no authenticated case has been described in which an iris contained more than one pupil surrounded by a sphincter muscle. Cases have occurred, however, in which there were a number of openings in the iris in addition to the single normal pupil. They usually appear as radial clefts in the iris tissue surrounding the pupil and may be as high as sixteen in number. Less often the defects occur at the root of the iris and are sometimes regarded as instances of iridodialysis. The appearance of polycoria may also be produced by a bridge coloboma of the iris or by a persistent pupillary membrane.

Irideremia, Aniridia (congenital absence of the iris). From a clinical standpoint this may be either complete or, less often, incomplete. If a microscopical examination could be made in every case, however, it is probable that some remains of the iris would always be found. When the irideremia is complete, both eyes usually show the defect. The incomplete form may closely simulate a coloboma, in fact it is impossible to draw a sharp distinction between the two conditions. The influence of heredity is more apparent in irideremia than in any other congenital anomaly of the eye.

The pupil ordinarily appears a little less dark than normal, and by artificial light under suitable conditions it may appear luminous to the observer. The ciliary processes usually are not visible, probably because they are not well developed. The accommodation, however, is perfectly normal. In most cases a strong light is not borne well by the patient, but this is not always true. The vision is as a rule very defective, due in most instances to other complications rather than to the mere absence of the iris, and there is frequently nystagmus and sometimes strabismus. Other congenital anomalies, such as persistent hyaloid artery, ptosis, and microphthalmos, may be present. Corneal and vitreous opacities, choroidal atrophy, and detachment of the retina occur, but the most frequent complication is cataract, most often of the anterior or posterior polar variety. Luxation of the lens, usually upward, may be present at birth or take place later in life.

A not infrequent and particularly interesting complication is glaucoma. This fact has been brought forward as an objection to the theory that glaucoma is due to a

blocking of the filtration angle by the iris, but is really in favor of such a view because anatomical investigations have shown that in irideremia there is always a small stump of iris either free or firmly adherent to the periphery of the cornea.

A number of theories have been advanced to explain the occurrence of the anomaly, none of them very satisfactory. The best explanation seems to be that of Manz. According to this observer, the proper development of the iris is mechanically prevented by a delayed separation of the lens and cornea. The frequent occurrence of corneal opacities and of anterior polar cataract certainly supports this explanation. A highly theoretical view is that an intra-uterine glaucoma causes the iris to be pressed against the cornea, thus preventing its further development.

Coloboma of the Iris.—In typical cases this consists of a cleft in the iris which extends into the pupil and with the latter forms a pear-shaped opening (Fig. 2962). Less often the edges of the gap are nearly parallel so that the appearance of a keyhole is produced, and in rare instances the edges of the coloboma may converge toward the pupil. The coloboma may be complete, the opening extending to the ciliary margin, or incomplete, a bridge of iris tissue remaining at the apex of the gap. Usually it involves from one-sixth to one-fourth the circumference of the iris and is placed downward or downward and inward. In the lowest grade of the anomaly there is simply a slight notching of the pupillary margin. The pigmented posterior layer of the iris is usually visible along the edges of the opening and may send irregular projections into the latter, or, in the form of a black membrane, it may more or less completely close in the gap. Sometimes a band of tissue unites the edges, forming the *bridge coloboma* (Fig. 2963). The bridge usually arises mainly from the anterior surface of the iris and possibly represents the remains of the pupillary membrane, but it may arise directly from the edges of the opening. In some instances a strand of tissue has been found connecting the apex of the coloboma with the optic disc.

Fig. 2962.—Coloboma of the Iris. (After Seggel.)

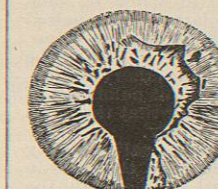


Fig. 2963.—Bridge Coloboma. (After Saemisch.)

The sphincter muscle passes along the edges of the coloboma and in the incomplete type may encircle the apex. The pupil reacts in the usual way both to light and to myotics and mydriatics. A mydriatic may cause a small coloboma to become evident which was previously invisible. The pupil is usually displaced downward, less often upward. The appearance of a coloboma may be simulated by a highly pigmented streak that has the shape and position of a typical coloboma, by a localized thinning of the iris, or by a streak in which the pigment is scantily present—*pseudo-colobomata*.

Coloboma of the iris is among the most common congenital anomalies of the eye. It usually occurs in one eye only, most commonly the left, and in most cases it is associated with a coloboma of the choroid or ciliary body. Two colobomata have been met with in the same iris. While in typical cases the defect is directed downward, cases have been observed in which it was directed inward, outward, or even directly upward. Sometimes the defect is so great that it becomes a question whether it should not be regarded as an example of incomplete irideremia. In more than half the cases of atypically directed coloboma the shape of the coloboma is typical. Bridge coloboma has been observed in these cases. In most of them there is no coloboma of the

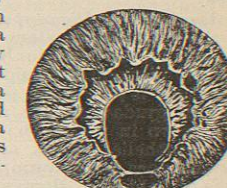


Fig. 2963.—Bridge Coloboma. (After Saemisch.)