promises the best results, especially in children. It is very important to delay such operations until all danger of inflammatory reaction has passed away. The processes above described will seldom be completed in less than two or three months, and during this time the patient should be kept constantly under the care of the surgeon, and during convalescence he should wear shaded glasses. In spite of every precaution many cases of injury to the lens are not likely to end happily either for the patient or for the surgeon. Capsular inflammation is likely to block up the pupil with a dense membrane to which the iris becomes strongly fastened; pus also may show itself in the anterior chamber; and, finally, there may be panophthalmitis with complete destruction of the affected eye.

THE CHOROID.—The choroid is often ruptured as the result of sudden compression. The rent may occur at a point so far forward as not to admit of diagnosis during life, and from such accidents no doubt come many of the cases of hæmophthalmus posterior which make a fair recovery without any special mark to indicate the source of the hemorrhage. These anterior ruptures also are supposed to account for some of the hypothetical cases of commotio retinæ. Though ruptures are sometimes seen at a point anterior to the venæ vorticosæ, most of those which fall under surgical observation are near the posterior pole of the eye. They do not come at a point directly opposite the blow or pressure which causes them, but are situated on the same side of a vertical plane which passes through the centre of the globe from front to back. This seems to be in accordance with *a priori* reasoning concerning ruptures. The choroid has been known to rupture in two places at once, both ruptures being situated in the same meridian and on the same side of the eye as the compression which caused them.

Very often the perception of light becomes quantitative as soon as the accident happens, but sometimes the diminution of vision is not very great until after several days have elapsed. However this may be, the power of accommodation is at once suspended, and after recovery vision rarely reaches its normal acuteness. The wound, when first examined, will be found—if there has been no very great hemorrhage—to be filled with blood which conceals its edges. The uninjured retinal vessels may sometimes be traced over the wound; at other times the retina is broken through and separated at its edges from the choroid. The indications for treatment are the same as in other ruptures of the external tunics, except that constant recumbency is not so imperative and the patient may be allowed a little more freedom after the first few days. The inflammatory disturbance that follows rupture of the choroid, though sometimes destructive, is not usually very severe, and the amount of useful vision that is recovered is dependent very much on the seat of the lesion. Of course, if the tear has extended through the macula there will be a permanent central scotoma. The size of the final scotoma is not always commensurate with that of the original injury, it being sometimes much less than would have been thought probable.

FOREIGN BODIES.—Concerning foreign bodies in general, that have entered the eye and remained in it, a word or two is necessary. The eye is never safe so long as they remain imprisoned in its tissues. Still there is hardly any place inside its walls where, according to reported cases, foreign bodies have not remained for months and years. But in all, or nearly all, the cases so reported serious trouble eventually developed and brought the patient to the oculist. Yet it is fair to suppose that patients have sometimes carried foreign bodies in their eyes to the grave without serious trouble, but this is so exceedingly rare that in general, when a foreign body has penetrated the globe, it is good surgery to remove it as soon as the diagnosis is made; and if it is not possible to remove it from the eye, then it should be removed with the eye.

This rule admits of one or two exceptional cases, to be mentioned hereafter—cases in which foreign bodies, on account of the slight inconvenience which they cause at the time, invite delay for the purpose of escaping for a time the reaction which is sure to follow operative interference. Temporizing may be allowed only when the success of operative interference is not compromised by delay.

An investigation of the cases in which the globe of the eye has been penetrated by a foreign body and no attempt has been made to remove it, shows that in not a few instances the patient has experienced months of suffering and danger, and then finally has lost the sight of one eye, if not of both. Under these circumstances the surgeon should advise against a protracted postponement of operative interference. In a few cases only is it permissible to advocate delay. Thus, for example, if a patient presents himself having in the lens, or on the iris or retina, a small bit of copper or steel, an eyelash, or other substance which has been forced through to its position without exciting any lasting reaction, and if the eye has retained its usefulness in great measure, it is not necessary to attempt to remove it if it is so fastened in its position that any ordinary accident or change in the surrounding tissue is unlikely to make it at some future time more difficult of access. If it is so situated that to remove it is an easy and safe procedure, it would of course be the part of wisdom to do so without further delay. But if, as is often the case, it is where it can be reached only by operative interference attended with great risk of injury or failure, it is better to counsel delay, while giving the patient emphatic warning that when any change for the worse does occur operative interference will then become imperative. Ciliary injection, pain, tenderness, photophobia, or lachrymation, or any of the symptoms of beginning iridochoroiditis, should warn both surgeon and patient that further delay is dangerous.

The Use of Magnets in Removing Foreign Bodies.—Quite a large per cent. of the foreign bodies that penetrate the globe and would remain there but for surgical interference are made of iron or steel and may be removed more easily by the magnet than in any other way. Even if the magnet itself is not all-sufficient for this purpose, it may be of great assistance by adding magnetic attraction to the force applied by the surgeon to any steel instrument that he may employ.

For purposes of diagnosis the electro-magnet is especially useful. Definite sensations of pain in the eye as the circuit is made or broken furnish undoubted evidence of the presence of a magnetic metal. It must be added that the lack of such sensations does not with like certainty determine its absence.

There are three classes of magnets in use. The permanent magnet of Gruening is independent of batteries or electrical connections, and has proved to be a useful instrument. More powerful than this is the electro-magnet introduced by Hirschberg. Various forms of this are in use, most of them from five to eight inches in length and capable of developing an attractive force of considerable strength, even across the whole diameter of the eye. A giant form of this very valuable instrument has been constructed by Haab. This new instrument so enlarges its sphere of usefulness that it has become a well recognized part of the equipment of the hospital operating room. The fact that in its most desirable form it takes up a square metre of floor space, weighs nearly 200 kgm., and costs relatively a large sum, has somewhat interfered with its general adoption as an office accessory.

The methods of using the magnet are such as are naturally suggested by the situation. Various forms of tips are easily attached to the iron core; some being intended for insertion into the eye, others for placing on or near its surface. The greater the mass of the magnetic metal and the nearer the foreign body, the better. It should be remembered that although the attractive force is practically instantaneous in its action, the movement of the attracted body is not.

Viscosity and other structural conditions of the tissue are such that repeated attempts to extract a hypothetical foreign body on several successive days may give no evi-

dence of its existence, and yet, on a subsequent repetition of the attempt, the body in question will appear.

The presence of a foreign body in the eye is so serious a matter, and the immediate results of extraction by means of the magnet are so brilliant, that one may easily overestimate the average benefit to be expected. It is to be remembered that many of the cases in which a foreign body has been removed from the eye without infection or undue violence, turn out badly, ending in atrophy or other serious trouble. Notwithstanding all this the magnet is a very valuable addition to the surgical outfit.

Foreign bodies that find their way between the lids, and stick fast in the conjunctiva without deeply penetrating it, seldom give rise to any trouble after they are discovered. If they are not easily seen by everting the lids under good illumination, it may be on account of their minute size, or because they have been carried up to the fold of transition beneath the upper lid. Particles of glass are particularly apt to escape observation. Focal illumination and a careful exploration with a Daviel spoon is all that is needed for their recovery, and this is easily managed unless there is considerable spasm of the orbicularis, when it may be necessary to anæsthetize the eye with cocaine, or possibly, in children, to resort to general anæsthesia. The seat of injury should be carefully examined to see that nothing has penetrated beyond the limit of the conjunctiva and has become lodged in the orbit or sclera.

Foreign bodies most frequently encountered in practice are those which have lodged in the substance of the cornea. They are sometimes very small and difficult to see, on account of their color being such as to harmonize with that of the pupil or iris. They can be detected readily in the direct light of the window, or by focal illumination, and can be removed nearly always without the aid of a magnifying glass. The point of a discission needle, cataract knife, or any other sharp instrument will be found useful for the purpose. The patient should sit or stand before the window and fix the eye on some object which will insure its being held in the right position, while the surgeon stands wherever the substance can be most distinctly seen. Some patients will fix better by looking with both eyes, others with only the injured one.

It is not always possible to pick up a small particle of steel or emery on the point of a needle until after repeated efforts. In order to diminish the pain caused by such efforts it is a good plan to scrape off the epithelium from the very small surface (less than a millimetre in diameter) immediately surrounding the foreign body. When these small substances have penetrated deeply into the cornea, great care should be taken not to push them through into the anterior chamber. Such an accident is of a most serious nature; it is quite likely to necessitate an iridectomy for the removal of the foreign body. When the foreign body is so deeply situated that this accident seems imminent, it is best to enter the anterior chamber with a Graefe knife, which should be introduced at a point 2 or 3 mm. to one side of the foreign body and made to emerge at some distance beyond it. The flat of the knife will thus serve as a support for the foreign body, which may then be removed with safety by the usual manipulations. Care should be taken not to turn the knife so as to allow the escape of aqueous and not to encroach any more than is necessary on the pupillary area. Sometimes a splinter penetrates the layers of the cornea and seems to be placed lengthwise in its substance in such a manner that it can neither be removed by forceps nor grasped by a needle. In such a case, the upper layers of the cornea may be opened by a Graefe or a Beers knife, held with its back to the anterior chamber. In rare cases a small bit of foreign substance may be driven through the cornea in such a manner that one end of it hangs loose in the anterior chamber, while the other remains fast in the deeper layers of the cornea. When this state of affairs exists, the foreign substance may be removed by making a cut in another part and removing the offending substance from within with a pair of delicate forceps.

Foreign bodies in the anterior chamber, unattached to the iris or lens, often sink to the lower part of the sclerotic border. Very small bodies may be concealed there or behind the iris or the opaque sclera. They sometimes become partly encapsulated or surrounded with lymph before exciting destructive inflammation. In some cases they may be removed by an iridectomy. Occasionally such a foreign body has ulcerated through and has been discharged before the eye was entirely ruined. If such a process is going on when the patient first presents himself, it may be well to temporize, but never to delay operating with the hope that the substance may be gotten rid of through the establishment of such a process.

In cases in which it is otherwise impossible to diagnose or localize a foreign body it may often be seen by the aid of an "*x*-ray" apparatus and a fluorescent screen. Two pictorial reproductions from different positions are usually necessary and sufficient to determine, with some degree of exactness, the position of the foreign body. This is done by comparing its position in the picture with that of other substances, which though outside of the eye have been placed in the field in a manner suitable for comparison.

Lens and iris seem particularly tolerant of foreign bodies. If a small foreign body is attached to the iris in such a manner that it does not seem likely to fall to the bottom of the anterior chamber, it may be left *in situ* as long as it causes no disturbance, provided the chance of successful removal is not growing less. A foreign body in the lens, if the opening in the capsule is small, may be left in place until it can be successfully removed by a cataract operation. If the capsule is widely opened, the case should be treated as a traumatic cataract, and the foreign body should be removed if possible with the swollen cortical.

A foreign body in the vitreous, immediately behind the lens, will sometimes present itself at the wound and be expelled by gentle pressure, or it may be removed by a scoop or hook, after the lens has been removed by a cataract operation. Such a result, though gratifying, is hardly to be depended on. In fact, the removal of a foreign body from anywhere in the vitreous is something of a forlorn hope. An incision either equatorial or meridional, may be made back of the ciliary region, and in such a manner as not to divide entirely any of the muscles. Through this opening the foreign body may come, or may be made to come. A few cases have been recorded, but no one has had so many, or has been so successful, as to warrant us in establishing any rule or definite course of action.

When a foreign substance has been in the eye so long as to cause considerable inflammation, which has rendered the vitreous opaque and full of connective-tissue opacities, removal is out of the question as a means of preserving sight, and a constant watch should be kept over the patient, so that the globe itself may be enucleated before the establishment of severe or dangerous inflammation. Small substances (less than 2 mm. in their longest diameter) that rest on the retina, or are suspended in the vitreous, do not demand surgical interference if, when they are first seen, the symptoms of irritation have passed away, and if delay in removing them does not seem likely to render the operation more difficult.

Foreign bodies, both large and small, may pass through the conjunctiva and remain in the orbit. If their presence is not recognized at the time, the external wound is quite likely to heal. In rare cases the body then becomes encysted, but more commonly it gives rise to orbital abscess, and is discharged or removed with the contents of the abscess. Orbital abscesses are not unattended with serious danger, on account of possible pressure on the globe or extension to the cerebral cavity.

William S. Dennett.

EYE, TUMORS OF.—I. TUMORS OF THE EYELIDS. A. *Benign Tumors.*—The benign tumors of the lids are partly congenital, partly acquired later on in life. Their growth is but seldom accompanied by any inflammatory symptoms. These tumors, of course, during

their growth, are influenced by the nature of the tissue from which they spring and into which they grow, and the variety of tissues which constitute what we term the eyelids necessarily brings about a number of distinct forms of tumors, and an endless variety in their shape.

1. *Warts* and *epithelial horns* (not to be confounded with epithelial growths) are sometimes found on the outer dermoid surface of the lids, more frequently on the upper lid. They may be congenital, and they may keep on growing gradually until it becomes necessary to remove them on account of their unsightliness, or because their weight is felt disagreeably and has become a hindrance to the free movements of the lids; or, finally, because they actually obstruct sight by obscuring a part of the visual field in certain positions of the eyeball.

Such warts usually spring from the lid, with a broad basis. They are not easily confounded with epithelial growths, because they lack a zone of inflammation and infiltration, which, in the case of the latter, is never wanting. Furthermore, epithelial growths usually show points of ulceration. Moreover, epithelial growths of the eyelids, although observed in young subjects, are more frequently found in the declining years of life, and lie most frequently near one of the canthi or at the lid margin. Warts and horns, however, are found in all ages, and seem to be more frequent near the middle portion of the eyelids than at any other locality.

According to their superficial arrangement, such epithelial warts of the eyelids have been described as papillomata when resembling cauliflower, and as condylomata when resembling the broad or pointed condylomata observed in other regions of the body.

The histological structure of these warts has nothing that would distinguish them from other warts of the skin. They consist of hypertrophic papillary structures, covered by very thick and horny layers of epithelial cells.

Although such warts are in themselves benign tumors, we must state here that in later years epithelial growths often begin from such warts, and their removal is therefore to be recommended.

2. *Granuloma* or *chalazion* of the eyelid is, in contradistinction to the other benign tumors of the eyelids, an inflammatory tumor. In its origin it is a hordeolum, that is, an inflammatory process caused, in the more superficial or the deeper layers of the eyelid, by the stoppage of one or more secretory canals of the Meibomian glands, be this merely mechanical (by foreign substances) or due to an infection or an inflammatory process, which only secondarily involves the secretory ducts of these glands. Such a Meibomian hordeolum is originally the distended Meibomian gland, filled with its own secretion and pus,

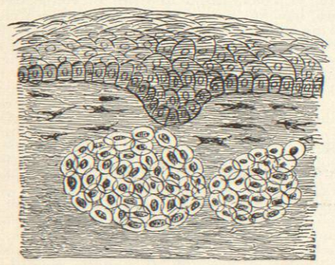

Fig. 2058.—Xanthelasma of the Eyelid.

and later on with an atheromatous detritus. This sac, so to speak, lies, as is clear from its mode of development, embedded within the tarsal tissue, and pushes out the skin of the lid in the form of a roundish elevation, the periphery of which falls off into the surrounding tissue at a more or less acute angle. These tumors vary considerably in size, and, aside from the deformity which their presence causes, they may have to be removed because they interfere with sight.

We find, then, usually, that these tumors (tarsal tumors, as they are often styled) consist, at a later period, to a great extent, or even totally, of granulation tissue, which, having sprung from the walls of the sac, has forced the semifluid contents of the original cyst to one side where they have undergone partial absorption. Later yet, we may find solid granulomata, and no vestige of the atheromatous or purulent contents of the sac. As curiosities we may mention that one author claims that chalazion is due to the tubercle bacillus, while another author has even found an enormous bacillus chalazicus.

This is undoubtedly the form of tumor most frequently met with on the eyelids.

3. *Xanthelasma* or *xanthoma* of the eyelids is not a rare affection. It seems, however, to be more frequent among females than among males. It is a roundish or lobulated elevation of the skin, of a peculiar yellowish appearance, which has given it its name. Its development has often been brought into relationship with diseases of the liver.

Very frequently these elevations occupy symmetrical positions on both eyes, especially on the upper eyelids. They are not found in early youth, and undoubtedly belong to the later years of life. In females they often develop in the catamenial years. Aside from the deformity which they cause, there is hardly any reason for their removal.

So far as their histological formation is concerned there can be no doubt that different forms of tumors which have nothing in common except their yellow aspect, may be taken for xanthelasmata. This yellow coloring is due to the presence, in the subcutaneous tissue, of a large number of stellate connective-tissue cells which contain yellow pigment granules. Aside from these, the tumor may consist of connective tissue which has undergone fatty infiltration and degeneration, or it may show plainly a hypertrophic condition of the sebaceous glands, with stoppage and perfect occlusion of their excretory canals. We find then, in these tumors, large, round sacs of connective tissue filled with the enormously swollen epithelial cells of these glands, which are undergoing retrogressive metamorphoses (see Fig. 2058). In other cases we find simply a dense connective tissue, void of even a trace of the glandular structure, but containing the pigmented, stellate cells which these tumors all have in common, and from which they derive their name. The same enlarged and degenerated epithelial cells are found in molluscum contagiosum and have been claimed to be the characteristic molluscum bodies. They are, however, also found in epithelial horns and other pathological conditions of the lids.

According to their form, these tumors have been described as xanthelasma planum or tuberosum.

4. *Angiomata* of the eyelids are almost always congenital tumors, although, from their slow development, they may become noticeable only several years after birth. They belong either to the cavernous or the arterial variety.

The cavernous angiomata cause a swelling of the lid in which they are embedded, and usually impart to it a dark-blue color. If the upper lid be the one affected, it cannot be raised freely, or else it shows the condition known as ptosis. Any impediment to the continuous flow of the venous blood (stooping down, coughing, pressure, etc.) causes the tumor to swell. These growths frequently extend backward into the tissues of the orbit, or into the tissues surrounding this cavity. From their site, color, and conformation, such cavernous angiomata may be, in rare cases, confounded with orbital cysts, which sometimes cause a very similar aspect of these regions.

The histological structure of these cavernous growths shows, of course, nothing peculiar.

The teleangiectatic tumors are usually smaller than the cavernous ones, and since they generally reach to

the cutaneous surface, they are recognized at a much earlier period. There is very often but little or no swelling, but the bright-red, enlarged blood-vessels can be seen through, or even in, the skin. This kind of angioma

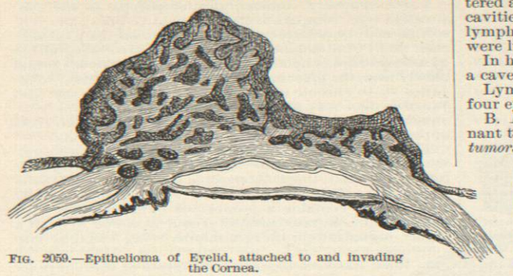

Fig. 2059.—Epithelioma of Eyelid, attached to and invading the Cornea.

is but seldom confined to the eyelid alone. Yet there are also teleangiectatic tumors of the eyelids so well defined that they can almost be enucleated like a granuloma.

While cavernous angiomata are apt to grow with advancing years, the teleangiectatic angiomata do not seem to have this tendency to a very marked degree.

5. *Fibromata.*—*a. Hard fibromata* of the eyelids are of very rare occurrence, and may possibly take their origin from a granuloma formed in the cystic distention of a Meibomian gland (hordeolum). The writer has seen and examined only two such cases. In both, the round tumor was implanted in the tarsal tissue, and raised the skin of the lid just as a chalazion does. In both, the tumor was situated in the upper lid and was harder to the touch than a chalazion usually is. The size of the tumors was about that of a cherry pit, and they consisted altogether of a dense connective tissue with short spindle cells.

β. The *soft fibroma* (fibroma molluscum) of the eyelids is also of very rare occurrence, and is usually found at the same time on other parts of the body.

These tumors, which appear always in large numbers, vary in size from that of a pea to that of a large pear, and even much larger ones have been observed. As they grow they usually become pedunculated, and hang pouch-like by this pedicle.

Their histological structure has not as yet been satisfactorily studied. Some authors have found only soft connective tissue, while others report the presence of peculiar cells undergoing retrogressive metamorphoses—probably epithelial cells of the sebaceous glands, resembling closely those found in xanthelasma.

γ. A third form of *fibroma* of the eyelid has been described as *plexiform neuro-fibroma*. This rare kind of growth is said to be congenital, and to consist of a series of swellings and cords which lie in the subcutaneous tissue, and which in parts are extremely painful to the touch.

The histological examination has not cleared up the nature of these fibromata very materially. They are said to consist of dense connective tissue, rich in nuclei, and surrounding simply atrophic nerve bands, or nerve fibres undergoing fatty degeneration.

6. *Lipomata* of the eyelids are of rare occurrence. They may be congenital, or they may appear in very obese people in advanced life. In the latter case they are apt to grow, and may have to be removed because they interfere with the sight, and this is especially apt to be the case when they develop in the upper lids and hang over the lid margin.

No further importance is attached to this kind of growth.

7. *Lymphangiomata* and *lymphomata* have also been found in the eyelids.

The case reported as lymphangioma seems to be unique. It is said to have been situated at the lid margin, the size being that of a split pea. It consisted of fibrous connective tissue, throughout which were scattered a large number of cavities of different sizes. These cavities contained a fine, granular substance in which lymph cells were suspended. The walls of the cavities were lined with an endothelium.

In harmony with this description the tumor was styled a cavernous lymphangioma.

Lymphomata of a very large size were found in all the four eyelids of a man suffering from leukæmia.

B. *Malignant Tumors of the Eyelids.*—1. Of the malignant tumors of the eyelids the most frequent are *epithelial tumors*, and among them especially the flat epithelioma.

The epithelioma of the eyelid begins almost always at the lid margin, especially on the lower lid, and it seems to grow with preference near the inner or outer canthus.

In the beginning we usually find a small, roundish, reddish nodule, which is quite hard. Sometimes this hardness and some redness around the original nodule are the only symptoms by which we may distinguish it from a common wart. After a while, either spontaneously or because the patient keeps irritating it with his fingers, the surface of this nodule becomes slightly ulcerated, and a crust is formed. Now this one nodule may keep on growing and spreading, and become excoriated at its surface, or new nodules may spring up around it and share the same fate. Thus there is finally developed a flat ulcer, with a hard base, and hard, ragged edges, which frequently bleed profusely when but slightly injured. As the ulcer creeps along some parts may heal, and the tough white bands of scar tissue give the affection then an aspect very similar to that of scirrhous cancer in other parts of the body. The infiltration of the tissues, the breaking down of the lid margin, and the development of bands of cicatricial tissue—all these alterations, singly or combined, may cause very annoying and unsightly deformities of the eyelids. The lower lid, as a rule, becomes everted, and to all other afflictions is added a continuous flow of tears. The growth of this kind of epithelioma is but slow and, *quoad vitam*, very much less to be dreaded than another form of this growth which eats rapidly into the tissues and breaks them down in a very short period. In the latter variety the rapid progress of the primary disease is soon followed by infiltration of the lymphatic glands and of the parotid, or the disease may spread over the conjunctiva bulbi into the cornea, and, eating its way through it, may enter the eyeball, or grow around it and invade the tissue of the orbit. This form is, luckily, observed rarely, and the prevalent form is the one which we first described.

Epithelioma of the lid is a disease which is found in individuals of advanced age only.

When this form of tumor involves the eyelid the histological elements found are precisely the same as those observed in the growth when it involves some other part of the body. The pre-existing epithelial cells of the cutis, as well as those of the sebaceous glands, become hypertrophic, and grow in the typical way into the under lying and surrounding tissues, in the shape of cylinders. Frequently the rapid increase in number of the epithelial cells causes the formation of pearl nodules. The periphery of the growth shows the usual zone of infiltration and inflammation.

2. *Adenoma* and *adeno-carcinoma*, especially of the Meibomian glands, but also of other glands in the tissues of the lids, have been found in a number of instances. When seen at the proper time it has been found that what originally was an adenoma had developed, later on, to a carcinomatous character.

3. *Sarcomata* of the eyelids, at least those of primary nature, have been observed in small numbers (about fifty in literature). The eyelids are more frequently invaded by sarcomatous growths from the orbit and the surrounding tissues.

In the cases of primary sarcoma of the lid which have been observed, the patients were nearly all children. The tumors grew rapidly and soon infiltrated the whole tissue of the lid. The neoplasms were mostly of the round-cell type; in some instances, however, the growth belonged to the melanotic variety, and in still others it was composed of spindle cells, of cells of a myxomatous type, or of cells arranged in alveoli.

Of course, the danger to life due to sarcomatous growths makes their removal as urgent when they originate in the eyelid as when they develop in any other region of the body.

II. Tumors of the Conjunctiva.—A. *Benign Tumors of the Conjunctiva.*—1. *Lymphangiectasia* of the conjunctiva appears usually as a conglomeration of small, roundish elevations, filled with a watery fluid, and often strung together like beads. These little tumors give rise only very rarely to an inflammatory condition of the surrounding conjunctiva, and, as a rule, cause the patient no annoyance to speak of. When punctured they collapse, but are generally soon refilled. Their usual seat is the bulbar conjunctiva.

From the appearances presented under the microscope these tumors consist, undoubtedly, of distended lymph vessels. The little tumor is composed of a system of canals and cavities, which are in no way connected with the blood vessels. The latter show the more plainly, as they are usually hyperæmic. The cavities and canals just spoken of are separated from each other by trabeculæ of dense connective tissue, but they intercommunicate. The surrounding conjunctival tissue appears condensed and pressed aside. This system of canals contains a perfectly translucent serous fluid in which are suspended a number of lymphatic cells. The walls show, now and then, some traces of an endothelial coat (see Fig. 2060). The writer has had occasion to report a case of acute formation of hemorrhagic lymphangiectasia in an idiotic girl.

2. *Serous cysts* of the conjunctiva may undoutedly result from what was originally simply a lymphangiectasia; the septa existing between the canals and cavities of such a tumor having gradually yielded to the pressure, and all the cavities having thus become united into one. But serous cysts have also been found in the conjunctiva at birth, and they may develop without being preceded by a typical lymphangiectasia, especially after injuries, or they may be due to the cystic degeneration of small glandular lobules situated in the fornix.

They appear as round or oblong or oval swellings in the conjunctiva, and, owing to the nature of their contents, they usually present a somewhat yellow tinge.

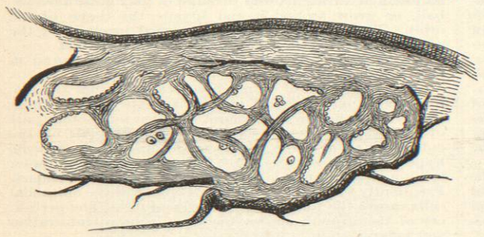

Fig. 2060.—Lymphangiectasia of the Bulbar Conjunctiva.

They are not, as a rule, movable under the conjunctiva, but they may become large enough to annoy the patient, and must then be removed.

They have a well-defined cyst wall, consisting of connective tissue, and are usually lined with one or two layers of endothelial cells.

3. *Teleangiectatic* tumors are also occasionally found in the conjunctiva of the lids and eyeball, and usually there is then, at the same time, a teleangiectatic tumor in the lid. The seat of these tumors seems to be mostly in the region of the lachrymal caruncle.

Their histological structure is the same as that of other teleangiectatic tumors.

4. *Granulomata*, commonly called polyps, of the conjunctiva are comparatively frequent. They are red, softish nodules which project into the conjunctival sac; their mode of attachment to the conjunctiva being either by a broad base or by a slender peduncle. They are found chiefly near the inner canthus. They are due either to injuries or to chronic inflammatory affections of the conjunctiva, and may attain a considerable size, especially on phthisical eyeballs. Now and then they make their appearance at the site of a tenotomy for strabismus.

Their structure is that of all granulomata. They consist mainly of newly formed round cells and small spindle cells, here and there intersected by connective-tissue trabeculæ. This tissue is often full of blood-vessels, and usually contains a number of cavities filled with serous fluid. In rare cases the tissue is found to be of a higher organization, the granuloma being changed into a fibroma.

5. What has been described as *lipoma* of the conjunctiva is a subconjunctival growth of fat tissue. In the few cases which have been described this kind of tumor was congenital, in some it increased in size in later life. The subconjunctival lipoma appears as a yellow, roundish, and soft swelling, usually consisting of several lobules. They seem to be generally situated between the external and the superior rectus muscles.

According to the descriptions given of their histological structure these tumors are very closely allied to the dermoid tumors; it even seems as if they were dermoid growths with an excess of subcutaneous fat tissue. In one or two cases bone and fibrous tissue have been found in connection with such a fatty growth.

6. *Papilloma* of the conjunctiva has been found in a number of instances. The tumor, when seen, usually encroached upon the cornea, thus simulating a pterygium. Its histological examination alone revealed the true character. In one case reported by the writer, almost symmetrical papillomata developed in both eyes and, growing over the cornea, rendered the patient blind.

7. *Dermoid* tumors of the conjunctiva are always congenital tumors. Their seat is at the corneo-scleral juncture, and very frequently they lie partly in the corneal and partly in the conjunctival tissue.

The tumor appears as a grayish or yellowish round elevation, about the size of a pea—sometimes, however, much larger. Where it ends in the corneal tissue it is usually surrounded by a zone of gray corneal tissue, not unlike an arcus senilis. Conjunctival blood-vessels may enter it. Its surface is usually smooth and shining, and it may be partially or totally covered with fine hair. Sometimes one or more of these hairs grow very long and protrude through the palpebral fissure. Such a tumor may remain stationary a whole lifetime and cause no greater annoyance than what may be due to the growth of the hair. In other cases some irritation causes the tumor and its surroundings to become inflamed, and then the tumor may begin to grow and invade the thus far healthy tissue of the cornea. In such a case, or from cosmetic reasons, the removal of a dermoid tumor may become necessary, and is, as will be seen from the histological conditions, easily accomplished.

The dermoid tumor, as its name indicates, consists essentially of the elements of the skin. It is covered by epithelium, the outer flattened cells of which are, however, not always horny, but often undergoing a retrogressive metamorphosis. This is probably due to the moisture in which the surface of the tumor is continuously bathed. There are also usually a number of mucous cells to be found in this layer. This epithelial coat is uneven, like the surface of the skin, and numerous offsets are sent into the depth surrounding the papillæ of the tumor. From almost all of these indentations one or two fine hairs spring forth, and here lie also the orifices of the

acinous glands, which are usually found in these growths. The connective tissue under the epithelium is very dense and fibrous. It contains elastic fibrillæ, and, as a rule, but few cellular elements, unless the tumor be in an inflammatory condition. The basis of the tumor, which is only very loosely connected with the episcleral tissue, is made up of fat tissue. Where the tumor lies on the corneal tissue, the union is usually a very firm one. These tumors contain a moderate number of blood-vessels, but it seems that they are but scantily supplied with nerves.

8. *True osteomata* of the conjunctiva have been observed in a small number of cases. The formation of bony tissue seems not to have been congenital. There appeared, in one case, a small tumor on the eyeball near the outer canthus, and it was removed on account of the annoyance which it caused. In another case the tumor had attained the size of a bean. The histological examination revealed true bone tissue.

9. The writer, on one occasion, removed from the eye of an infant a tumor which must be styled a *chondro-adenoma* of the conjunctiva. This tumor sat on the bulbar conjunctiva with a broad base, was whitish in color, and presented a perfectly smooth surface. The parents had observed it at the time of the child's birth, and thought that it had been gradually growing since that time. Its size was about that of a split pea when the writer saw it. The histological examination revealed the fact that it consisted of a large cluster of glandular tubules, resembling somewhat in their arrangement those of the lachrymal gland, and a large, roundish piece of embryonic cartilage. These two kinds of tissue were separated from each other, and together they were surrounded by a dense connective tissue.

B. *Malignant Tumors of the Conjunctiva.*—1. *Sarcomata* of the conjunctiva are of rare occurrence. They are either unpigmented, or, what is more frequently the case, pigmented. These tumors take their origin almost invariably from the region where the conjunctiva bulbi joins the cornea, that is, from the episcleral tissue at the corneo-scleral juncture, in rare cases from the loose tissue of the fornix. Their development has, in a number of cases, been ascribed to an injury.

The sarcomatous tumors of this region usually form roundish, sometimes lobulated swellings, which soon encroach upon the corneal tissue. They are very vascular, and bleed easily. They are usually of a rusty brown color, or they may even be almost black, at least in parts. Their surface appears smooth and shining, which is due to the fact that the growth for a long period remains covered by the conjunctival and corneal epithelium. Sometimes new nodules appear at some other point of the corneo-scleral margin, occasionally at a point diametrically opposite the original tumor. In their further development these tumors may spread into the interior of the eye, and, from the dissemination of their elements, death may ultimately result.

Histologically, the sarcomata of the conjunctiva are usually of the small round-celled variety. The original nodule, when growing on to the cornea, spreads for a time between the corneal epithelium and Bowman's layer, in the way pannus tissue is known to spread. Later on, Bowman's layer is destroyed at the periphery, and the sarcomatous elements invade the corneal tissue proper (see Fig. 2061). Yet the resistance of Bowman's layer is so great that the tumor will now spread underneath this layer into the cornea. In rarer cases the elements of the sarcoma are spindle cells. The pigmentation of the cells varies considerably in one and the same tumor. The more superficial parts are, however, usually the least pigmented ones. There is but very little intercellular substance. The large quantity of blood-vessels which these tumors usually contain has already been mentioned. There are always signs of former hemorrhages, and usually evidences of recent ones are to be found. In the propagation of these tumors the blood-vessels seem to play an important rôle, as they are sometimes found to be filled with pigmented molecules and pigmented cells. The periphery of these tumors is formed by a well-pronounced zone of inflammation.

2. *Epitheliomata* of the conjunctiva are more often observed than any other kind of conjunctival tumors. Although they are seen more frequently in persons of an advanced age, they make their appearance also in young individuals. They are generally situated on the bulbar conjunctiva, and, like the sarcomatous tumors, they most frequently start from a point near the corneo-scleral juncture.

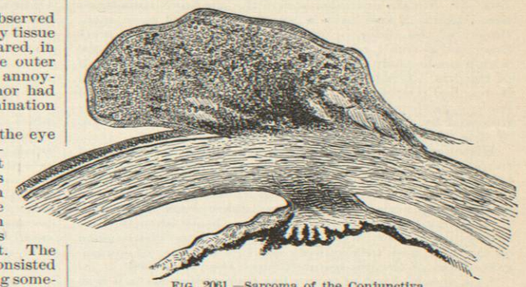

Fig. 2061.—Sarcoma of the Conjunctiva.

Their formation may begin with the development of a small phlyctenula-like nodule covered with hyperæmic blood-vessels; usually a number of larger and distended blood-vessels going to this nodule may be seen in the scleral conjunctiva. The growth may for a long period remain stationary, or it may keep on increasing gradually in size, or upon some special irritation it may start to develop rapidly, and be accompanied by inflammatory symptoms, and sometimes by considerable pain. The tumor usually spreads upon the cornea, which it may gradually penetrate, and thus find an entrance into the interior of the eyeball. The pain and suffering usually force the patient to submit to the removal of the eyeball before any further spreading of the elements of the tumor has taken place. In its early stages the new formation may be removed from the eyeball without much difficulty, as this has been stated of the sarcomatous new formations. Such epithelial growths of the conjunctiva have sometimes been found to be pigmented, and have then been described as *melanocancroids*.

The epitheliomata of the conjunctiva, like those found in other parts of the body, originate in a hyperplasia of the pre-existing epithelium. Thus we find in the beginning the epithelial layer considerably thickened, the serrated cells very numerous and well pronounced. In some cases we find a layer of horny cells of considerable thickness. This original tumor is usually surrounded by a tissue which is hyperæmic and infiltrated with round cells. When the tumor grows, epithelial-cell cylinders begin to dip into the underlying tissue and send off new branches. Gradually the new formation invades the cornea, this invasion being always preceded by the new formation of blood-vessels and by round-cell infiltration. Bowman's layer gives way, and the epithelial-cell cylinders spread into the corneal tissue proper. In the same way the epithelioma spreads into the sclerotic. Sometimes the surface of the tumor is ulcerated.

The epithelioma may spread into the interior of the eyeball. Thus it has been seen to invade the ciliary body and the choroid along an anterior ciliary artery, or the iris, after perforation of the cornea and anterior synechia had taken place. In some cases the conditions seemed to warrant the assumption that the external tumor had spread to the interior of the eyeball by metastasis.

The earlier the operation is resorted to, the easier is the removal of such tumors. This may be done successfully by means of either the knife or the galvano-cautery.

III. Tumors of the Cornea.—The cornea proper does not seem to be the seat of primary tumors. What has been described as such is to be found in section II. (Tumors of the Conjunctiva).

IV. Tumors of the Sclerotic.—The sclerotic, like the cornea, does not seem to be a field for primary new formations. Those which have been described as such probably belong to the conjunctival (episcleral) tumors, and have, therefore, been treated under II.

V. Tumors of the Iris.—A. *Benign Tumors of the Iris.*—1. *Simple granulomata* of the iris have sometimes been observed, and have a number of times been mentioned in the older ophthalmic literature. They were described as small, round, yellowish, or grayish swellings, which made their appearance usually in the lower half of the iris. Gradually such a tumor would grow until it reached Descemet's membrane, and finally it would lead to perforation of the cornea. This generally was followed by shrinkage of the eyeball and the formation of scar tissue.

Histologically, these tumors are found to consist of round cells, and to contain numerous giant cells ("myeloplaxes"). Such a structure is so similar to that of tubercles that some recent authors have described the simple granuloma of the iris as tuberculosis of the iris. It is certainly strange that, since we have learned what tumors may grow in the tissue of the iris in consequence of syphilis and tuberculosis, no further case of simple granuloma of the iris seems to have been observed.

2. A special kind of tumor has been observed, in a few instances, to spring from the iris; it is generally mentioned among the cases of granuloma. This is a very vascular swelling, from which on slight provocation the anterior chamber would be filled with arterial blood. I should suppose that in such a case we would have to deal with a *teleangiectatic* tumor, rather than with a granuloma. The writer has had occasion to report the histological results of the examination of two cases of iris tumor which had been diagnosed as sarcomata, but which proved to be vascular tumors. The one had the character of a capillary, the other of a venous angioma. The cases reported as granulomata of the iris, accompanied by more or less periodical hemorrhages, have probably been of a similar character. A case described as a "papilloma of the subepithelial tissue of the iris" undoubtedly also belonged to this class of nævi.

3. *Traumatic granuloma* of the iris is occasionally met with,—in some cases after the corneal wound is perfectly healed, but in most cases after the iris has undergone a prolapse and is exposed to the air. In the former cases the granulation tissue was found to perforate the cornea, and cause perfect loss of sight in the same way as do malignant intra-ocular tumors. In the latter cases the tissue of the granuloma gradually becomes organized and forms scar tissue, and may thus bring about a spontaneous cure.

Such granulomata also consist of round cells and small spindle cells, and contain but little connective tissue and new-formed blood-vessels. Later on, the round cells gradually are changed into spindle cells, and finally we find a dense connective tissue containing but few cellular elements. The granulomata which start from a prolapsed portion of the iris are usually covered with epithelium.

4. *Melanoma* of the iris has occasionally been observed. It appears as a darker raised spot in the tissue of the iris, and it is, to say the least, as yet questionable whether what has been called melanoma was not in reality a melano-sarcoma. The authors usually state that a benign melanoma may at any time assume a malignant sarcomatous character.

Such a melanoma is said to consist of a circumscribed accumulation of "stroma cells of the iris, the larger part of which are pigmented, have many offsets, and anastomose with each other. They pass without a sharp boundary into the neighboring tissue, and the remainder of the iris is normal."

5. *Cysts* of the iris have been observed in a large number of cases. They are either serous cysts or cysts filled with epithelial material—epidermoid (atheromatous) cysts.

Cystic formations in the iris, as a rule, develop only after an injury. They begin as small, round, yellowish, or grayish tumors. The yellowish color is more characteristic of the epidermoid character, while the grayish or grayish-white color seems to be that of the serous cysts. Such cysts gradually grow until they reach Descemet's membrane, and then may become firmly adherent to it. Oblique illumination will usually show at once whether the cyst contains serum or some other material, for in the former case the tumor will be plainly translucent. In some cases the presence and the growth of such a cyst seem to cause but little discomfort; in others, however, severe inflammatory symptoms make their appearance, and sight may be destroyed.

The manner in which the formation of such cysts takes place is as yet not absolutely settled. But from recent experiments it seems that these cysts usually develop in small portions of epithelial tissue which have been forced into the iris by some previous injury; these parts enclosing organs which are apt to retain their contents and secretion. There can be no doubt, however, that in some cases serous cysts are formed, provided a fold of the iris becomes adherent to Descemet's membrane or to a wound canal in the cornea. The closure and subsequent expansion of iris crypts has also been mentioned as a possible cause for cystic formations.

The cyst walls have usually been found to consist of atrophied and attenuated iris tissue, lined with a layer of endothelial cells, and usually firmly adherent to the cornea. There is scarcely any pigment found in the cyst walls. The contents of the serous cyst are a perfectly transparent fluid, while the contents of the epidermoid cysts correspond with those of other atheromatous cysts and sometimes contain hair.

B. *Malignant Tumors of the Iris.—Sarcomata* of the iris have been met with in comparatively few cases. They have been mostly pigmented, but in a few cases they were unpigmented, or at least only slightly pigmented.

These tumors of the iris seem to have originated mostly in the parenchyma of this membrane, and near its sphincter edge. When allowed to grow, the tumor slowly spreads over the iris, and at the same time presses against the cornea, which it finally perforates. During its development it causes increase of intra-ocular pressure and inflammatory attacks, with subsequent destruction of sight. Later on, it leads to metastases. The rule is, undoubtedly, that these tumors grow on the anterior surface of the iris. The writer has in one instance seen a darkly pigmented sarcoma spring from the posterior surface of the iris near the pupillary margin, and, pressing the lens backward, spread into the interior of the eyeball. In its early stages sarcoma of the iris has been successfully removed by iridectomy; later on, the eyeball has to be sacrificed.

In the few cases which have been histologically examined the tumors were either pigmented round-cell sarcomata or sarcomata of the pigmented and unpigmented spindle-cell variety. They seem to take their origin from the parenchyma of the iris.

VI. Tumors of the Ciliary Body.—A. *Benign Tumors of the Ciliary Body.*—1. Up to the present time the writer has examined nine instances of *adenoma* of the ciliary body. These small tumors, which sprang from the pars ciliaris retinæ, were usually confined to one ciliary process, and seemed to cause no symptoms during life. Histologically, they consist of the cells of the pars ciliaris retinæ, arranged in double rows like glandular ducts, and these tubules form numerous convolutions. Between these tubules lies a coagulated amorphous substance. The tumors are surrounded by pigment epithelium. It is as yet not clear whether these adenomata are congenital or develop later in life.

2. *Myoma* of the ciliary body has only once been observed and described. In this case a brownish-red tumor was found to press part of the iris against the posterior

surface of the cornea and to protrude for some distance into the pupillary space. The tumor showed smooth elevations. There was increase of intraocular tension, and attacks of severe pain were complained of. The tumor grew slowly but continuously, and was considered to be a sarcoma. Finally, the patient consented to the enucleation of the eyeball. The tumor was found to have the size of a filbert, and to be firmly attached to the ciliary muscle. When divided it presented a cut surface of a roseate color, and it was only slightly pigmented in the peripheral parts. On microscopical examination it was found to consist almost exclusively of non-striated muscular fibres.

3. A *cyst* of the ciliary body has also been observed and described in a few instances, but these cases have not yet come to be examined microscopically. The cystoid formation followed an injury to the lid and eyeball. The cysts are described as oval bodies lying just behind the lens, springing from the ciliary region, and reaching with the larger end half-way across the eye into the vitreous. By oblique illumination the edge of such a cyst looks white, and can be clearly defined. Its surface is dotted, here and there, with pigment deposits. By direct examination with the ophthalmoscope the cyst walls are found to be transparent, and the details of the background of the eye may be dimly recognized through them unless they contain blood. These cysts have been observed to grow slowly, and to cause attacks of increased intra-ocular tension.

B. *Malignant Tumors of the Ciliary Body.*—Primary leuco-sarcoma and melano-sarcoma undoubtedly occur in the ciliary body, but are comparatively rarely seen, and yet more rarely examined microscopically. Moreover, these forms of tumors have nothing which would distinguish them from the sarcomatous growths of the choroid, and they are, therefore, best considered under that head (VII., B). Of late, in a number of instances, carcinomata of the ciliary body have been reported. They are described as having sprung from the pigment layer, more especially from the so-called glands of the ciliary body (Collins). This matter, however, needs further investigation.

VII. Tumors of the Choroid.—A. *Benign Tumors of the Choroid.*—1. *Granuloma* of the choroid is sometimes found in the course of histological examinations. Whether it has ever been clinically diagnosticated the writer does not know. In literature no mention is made of such a diagnosis.

In eyes in which the choroid has been injured (through the sclerotic), or in which round-cell accumulations have, after the manner of abscesses, perforated the lamina vitrea of the choroid, we find occasionally a small tumor consisting of granulation tissue, *i.e.*, of free nuclei, round cells and small spindle cells, and newly formed blood-vessels. These tumors may either lift the retina from the choroid and thus cause a circumscribed detachment of the former membrane, or they may pierce the retina also and protrude into the vitreous body. Later on, these granulation tumors are changed into connective tissue, and ultimately, after contraction has taken place, they form a simple scar.

There is one observation on record of the presence of small granulomata of the choroid in the eye of an individual who had long been suffering from "granular lids."

2. So far as I can learn, *cystoid* formations in the choroid have been seen only once, viz., by the writer, and then only in the course of the microscopical examination of an eye. They were found situated in the peripheral portions of this membrane, and formed a small number of round and oval cavities embedded in the parenchyma of the choroid. They had a membrana propria and were lined with endothelium. As regards their structure they were probably composed of dilated lymph vessels. The tissue of the choroid, which was displaced by these cystoid formations, was infiltrated with round cells and hyperæmic.

B. *Malignant Tumors of the Choroid.*—The only form of primary malignant tumor found in the choroid (and ciliary body) is that of the sarcoma in some one of its numerous varieties.

Since sarcoma of the choroid (and ciliary body) is undoubtedly the kind of intra-ocular tumor most frequently met with, we will give it a more extensive consideration, the more so as its clinical development is typical for that of all malignant intra-ocular tumors. It happens but comparatively seldom that we have occasion to see and diagnosticate a choroidal sarcoma, and afterward to verify our diagnosis by a microscopical examination at the period which is usually described as the first one in its development. At this stage the patient usually complains only of a diminution of sight. If the tumor springs from the ciliary region it can usually be recognized by the protrusion of the iris, and be seen under oblique light. The diagnosis is more difficult when the tumor is situated more centrally, or, as is frequently the case, near the optic-nerve entrance. The difficulty may be considerably increased if the retina at the site of the choroidal tumor has become detached. This seems, however, to be less frequently the case than was formerly stated by the authors. At this stage the ophthalmoscope may reveal one larger-sized, roundish elevation in some part of the background of the eye, or a flat elevation with a smooth or undulating surface covered by the retina, whose blood-vessels appear accordingly distorted in their course. The pigment of the sarcoma may perhaps be seen through the retina; even in cases in which the retina at the site of the tumor is detached it may be possible to recognize the latter through the retina with the aid of strong illumination and a high magnifying power. In most cases, however, it will be necessary to make repeated examinations of the fundus throughout a considerable period of time, in order to be able to determine whether there is any change in the picture and whether the supposed tumor increases in size. If an apparent detachment of the retina lying in the upper half of the eyeball, or to one side, remains confined to its original seat, and if the lower half of the retina does not become involved, the condition should be considered very suspicious of the presence of a choroidal sarcoma.

The growth of a choroidal sarcoma may vary considerably as to rapidity. While some reach the second period in, say, one year, others may take a number of years to reach the same stage.

The second period in the development of a choroidal sarcoma is characterized usually by an increase of the intra-ocular tension to a varying degree (glaucomatous stage), combined with inflammatory attacks and often severe pain. In some cases glaucomatous symptoms are wanting. In this period the tumor fills the vitreous chamber more and more, and pushes the retina, the condensed vitreous body, the usually cataractous crystalline lens, and the iris toward the cornea. Or it spreads through the whole uveal tract, forming, so to speak, a sarcomatous shell which encloses the retina, the condensed vitreous body, and the cataractous crystalline lens. In this period the eye usually shows, externally, the signs of a chronic inflammation.

The third period in the development of a choroidal sarcoma is usually called that of perforation and the spreading of the tumor outside of the eyeball. Thus the elements of the tumor usually grow through the sclerotic, along, or even by way of, a blood-vessel (venæ vorticosæ, anterior ciliary arteries, etc.), or through the channel of a ciliary nerve, or, what is quite often the case, when the tumor originates near the optic nerve, by way of this nerve or its sheaths, or by way of the intravaginal space. In other cases, the tumor will cause a staphyloma-like distention of the anterior parts of the sclerotic or of the cornea, and cause a rupture there. In this case the lens is usually expelled from the eye, and the tumor, no longer restrained in its growth by a resistant capsule, grows rapidly outward until the lids can no longer be closed over it.

At the same time dissemination of the elements of the tumor has usually taken place. Such elements taken up into blood-vessels are carried away by the current of the blood, and, wherever they are deposited, new (metastatic)