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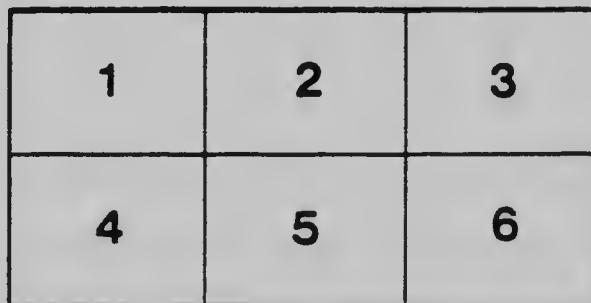
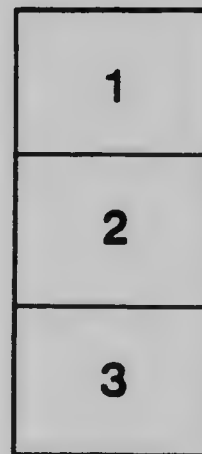
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Diseases of the Eye, Ear, Nose and Throat.

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DISEASES

OF THE

**EYE, EAR,
NOSE AND THROAT**

A MANUAL FOR UNDERGRADUATES

BY

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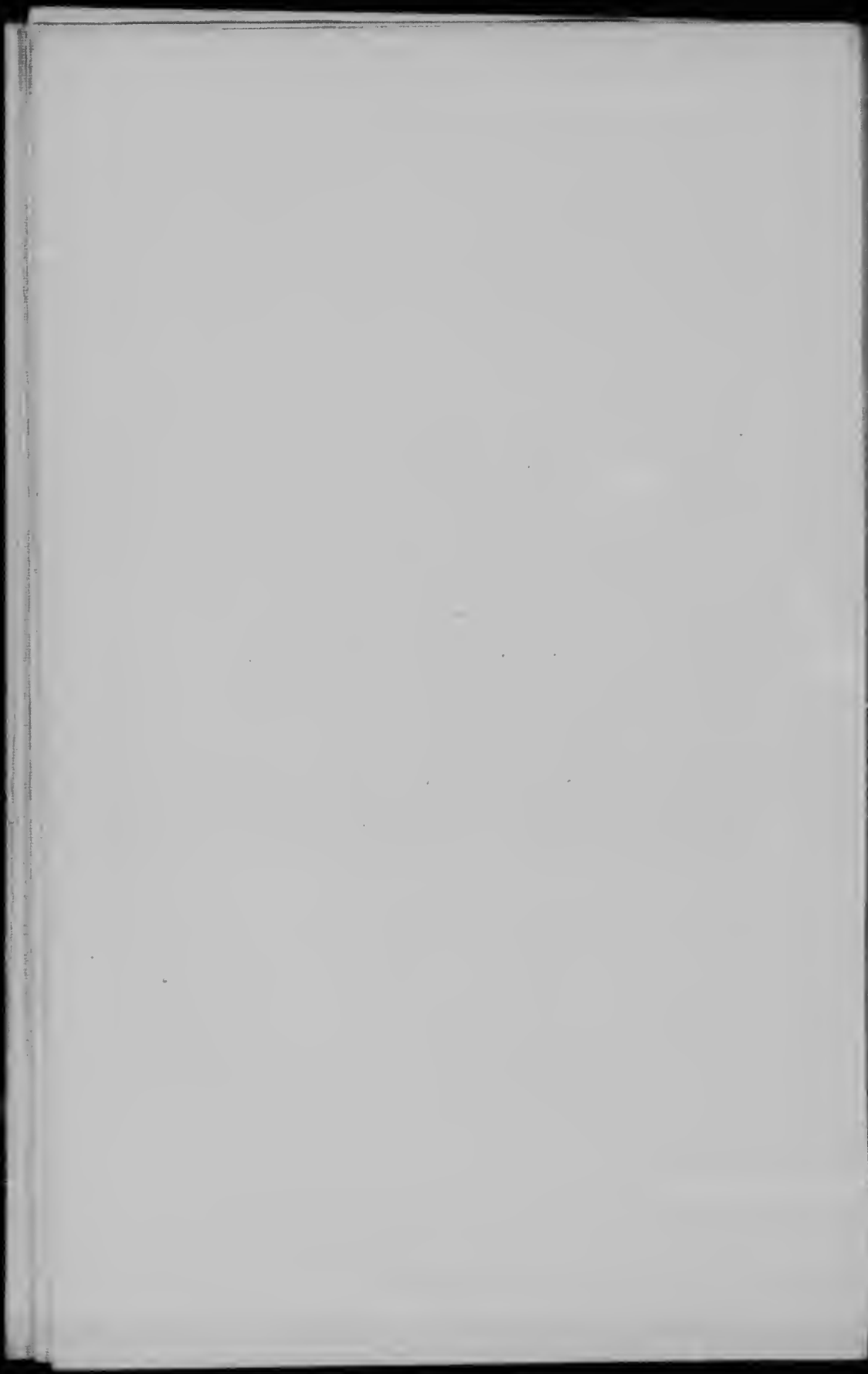
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PREFACE.

This book is published to relieve my students of the labor of taking notes and to save time for practical work. It embodies the theoretical part of lectures delivered annually to undergraduates of the Medical Faculty of Queen's University. The text is to be studied in connection with attendance on clinics, demonstrations, and operations in the General Hospital.

J. C. C.

Kingston, Nov., 1902.



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DISEASES OF THE EYE.

CHAPTER I.

DISEASES OF THE CONJUNCTIVA.

These form about thirty per cent. of all the affections of the eye falling under the care of the surgeon. The conjunctiva being a mucus membrane, is subject to the changes to which mucus tissues in general are liable, as well as to some which are peculiar to itself. Through the nasal duct, it may participate by continuity in the inflammatory processes of the nose. It is also implicated, to a greater or less extent, in the inflammations of the anterior part of the eyeball,—keratitis, iritis, and cyclitis. It seldom takes part in the affections of the choroid and retina. The only contagious diseases of the eye are some of those affecting the conjunctiva. The most noticeable feature in a conjunctiva in a state of inflammation is a change in the vascularization. In health the transparency of the membrane is but little affected by the number or size of the vessels, the white

selera being clearly seen through it. In hyperaemia or congestion the vessels are greatly multiplied, the veins are more tortuous and increased in diameter, and the selera may be entirely obscured, the white of the eye being of a "bloodshot" appearance. In this conjunctival congestion the vessels are freely movable over the globe, and in this way are to be distinguished from the deeper ciliary congestion, the so-called "circum-corneal" injection, in which the vessels are fine and straight. In the second stage of the inflammatory process there is an abnormal amount of secretion. In health the conjunctival glands secrete only enough mucus for the lubrication of the parts and the maintenance of the proper softness and pliability of the tissues. In hyperaemia there is often a deficiency of secretion giving rise to a feeling of dryness and stiffness in the eyelids. In the acute form of hyperaemia the discharge is almost wholly watery, due to increased secretion of tears. When the second stage of inflammation sets in, there is a hyperactivity of the glands and the quantity of mucus secreted is greater than normal. When there is no condition leading to pus formation, this secretion is mucus, or catarrhal. When there is formation of pus, the pus cells are found mixed with the mucus, and the discharge is mucus-purulent and of a yellowish color. In the severer cases pus predominates or constitutes the whole of the secretion. In an uncomplicated case of conjunctivitis there is little actual pain, because the tissues being lax, there is but slight pressure on the nerve filaments from the inflammatory exudation. The feeling is more one of annoyance and discomfort, heaviness and heat.

HYPERAEMIA OF THE CONJUNCTIVA.—This is either active or passive. In the active form it may be the initial stage of a catarrhal or a purulent conjunctivitis. In it the arterial circulation is increased, as is shown by the large number of small straight vessels running to the cornea. The eye has a suffused look, due to more or less increased secretion of tears. In this passive form there is a retarded and sluggish venous return. The veins are increased in size, are more tortuous, and often stand out prominently on the conjunctival surface. It is one of the most common of eye affections, and while not serious, is very annoying and uncomfortable and often renders any regular use of the eyes impossible. There is a sensation of heat, burning, and itching in the eyes, a heaviness of the lids, with a tendency to keep them closed, especially in artificial light. There may be a feeling of dryness and stiffness in the lids, experienced specially on awaking at night. A feeling of sand or grit in the eye is caused by the protrusion of the swollen veins above the level of the conjunctival surface, acting as a foreign body.

Causes.—The strain of ametropia, or wearing improper glasses, and local irritants, such as dust, foreign bodies, tobacco smoke, cold winds, are causes. The abuse of alcohol is a common cause. It is often associated with nasal catarrh, lacrymal obstruction, blepharitis, and hay fever.

Treatment.—The first step is to remove the cause as far as that can be determined. The ametropia is to be corrected. When the sunlight is complained of, smoked glasses may be worn for protection, and a shade may be used to soften

an artificial light. The nasal mucus membrane must be attended to. Direct medication of the conjunctiva consists in the application of some mild astringent. Boracic acid, ten grains to the ounce, can be freely used in the eye three or four times a day. Biborate of soda, ten grains to the ounce, will suit many, an alkaline solution being to them more grateful than an acid one. Chlorate of potash may be used in the same way. When a stronger astringent is needed, the acetate of zinc, one or two grains to the ounce, or the sulphate of zinc, or sulphate of copper is useful. Equal parts of tincture of opium and water is a good stimulating collyrium. Where the lids are dry, the silver preparations should not be used. Sometimes it is advisable to make a profound impression on the vascular walls, and this is best done with the solid sulphate of copper crystal. The alum stick is much milder. That which gives the greatest immediate comfort is the spraying of the lids with cold water, or water and alcohol or cologne, or the simple douching by the hands with water alone. The opening of the eyes under water is not so efficient, and may cause swelling of the epithelium.

CATARRHAL OR MUCOPURULENT CONJUNCTIVITIS.

—This is characterized by congestion of the conjunctiva, some photophobia and blepharospasm, and increased secretion, either mucus or mucopurulent. It is the condition frequently called "pink eye." The fact that it is epidemic and that it is contagious by the secretion renders the existence of a specific germ certain. This is known as the Weeks' bacillus.

The germ is often found in the healthy lacrymal sac, and becomes virulent only under some change in local conditions. The conditions of hyperaemia and congestion probably furnish a field for the activity of the germ. All the organisms found in pus are, however, not obnoxious to the conjunctiva for the pus from an orbital abscess, from a sty, or from an acute dacryocystitis, does not produce a conjunctivitis.

Symptoms.—In the preliminary stage of hyperaemia there are the symptoms already described. These may last a few hours or a few days. Then the secretion from having been watery becomes mucus, or mucopurulent in character. This will gather as a slightly frothy material at the angles, or when it dries, glue the edges of the lids together. There is a slight swelling of the lids and a sense of heaviness and discomfort, though not usually any definite pain. There is some photophobia. In the severer cases the conjunctiva is deeply congested and velvety in appearance, and there is chemosis. Vision is impaired partly from the adhesion of some of the discharge to the cornea, and partly from the maceration of the epithelium of the cornea which takes place only in the severer cases. All ages are liable to it. The course varies from one to two weeks, but complete recovery takes place. Usually both eyes are affected. If neglected it may become very troublesome as in families and institutions it readily becomes epidemic.

Treatment.—Nothing should be applied to the eyes which will prevent the speedy exit of the secretion, as the retention of the secretion reacts upon

the membrane. The eyes should be cleaned frequently, from every hour to three times a day, according to the amount of the secretion. The best solution is that of boracic acid, and it may be applied by a mop of absorbent cotton, the eye dropper, or the douche. Cloths wrung out of cold water, or saturated with lead water and laudanum, may be laid upon the eyelids for their cooling and soothing properties. For some, the hot applications are better borne. To prevent gumming, the lids are to be anointed with vaseline at bed time. When the secreting stage sets in, the use of astringents may be commenced. In addition to those already mentioned, formalin, one to two thousand, every four hours may be used. If there is a decided admixture of pus, nitrate of silver, two to five grains to the ounce is to be preferred. If the cornea is implicated, atropine is to be used. As the discharge is more or less infectious, care must be taken with the towels, handkerchiefs, and other articles used about the patient's eyes. Smoked glasses may be worn for protection. No poultices or tea-leaf applications are to be permitted. The latter may produce a conjunctivitis. It may be necessary to give a laxative, and to follow this with a tonic, such as quinine.

PURULENT CONJUNCTIVITIS.—A large percentage of the blindness in the world is due to this disease. From one-third to one-half of the cases is the estimate given. It is essentially an infectious disease most frequently produced by the diplococcus of gonorrhœa. Other micro-organisms may give rise to it.

The staphylococcus pyogenes aureus and albus and the streptococcus pyogenes, and the pneumococcus are causes. In cases of gonorrhoea, infection of the eye may be brought about in a variety of ways, but generally it is by the patient's own hands. After manipulation of the genitalia with the hands, they are used to rub the eye or the face about it, and so the micro-organism finds its way to the conjunctiva. It may just as easily be carried by the handkerchief, towel or dressings. For this reason physicians, nurses, and attendants should exercise the utmost care in handling eyes in this condition, and the patients should be isolated from the other patients in the ward. A catarrhal conjunctivitis may be aggravated till quite a quantity of pus is discharged, but this is not infective, at least not to the same degree, nor is it so dangerous to the eye. Only a microscopic examination of the discharge will establish the differential diagnosis.

Symptoms.—These first appear in from twelve to forty-eight hours after inoculation, the period of incubation varying with the intensity of the poison. The lids become red and swollen and the integument smooth and hard and glistening. There is an abundant discharge of thin fluid, which may contain some flocculent material, and may be reddish in color from the presence of some blood-corpuscles. The eye feels hot and there is some local and general elevation of temperature. If the lids can be separated, the conjunctiva will be seen to be infiltrated with serum, its vascularity increased, and there may be some hæmorrhage. This soon gives way to the second stage, in which there is a free purulent dis-

charge. The pus is thick and creamy, is rapidly formed and constantly oozes from the palpebral fissure. The hardness of the lids is not so great, but the swelling of the conjunctiva is not diminished. It comes up around the base of the cornea (chemosis) and overlaps its edge, causing it to appear sunken below the surface of the swollen conjunctiva. The swelling of the upper lid is sometimes so great that it hangs down like a bag over the lower one, and it is then impossible to expose any part of the cornea. The great danger is from involvement of the cornea which may come about in one of two ways, either by direct inoculation of the cornea with the gonococcus when the epithelial layer becomes macerated and destroyed from constant contact with the pus, or the oedema around the base of the cornea may cause a strangulation of the nutrient vessels and produce a sphacelation of the cornea as a whole. The epithelium first becomes steamy and then the corneal tissue seems to melt away. The entire anterior layers are destroyed, leaving the more resistant posterior layer, or Descemet's membrane. The latter may also be destroyed, allowing the lens to be expelled, and there may be a panophthalmitis. The substance of the conjunctiva itself is not destroyed or even ulcerated. If left to itself, the inflammation runs its course in from three to six weeks, generally ending in some thickening of the membrane.

Treatment.—Prophylaxis is of the utmost importance. The patient should be isolated to some extent at least. When one eye is affected, the other should be protected by a bandage hermetically sealed, or by some device such as Buller's shield. If there is a

suspicion that some infective material has gotten into an eye it should at once be washed out with an antiseptic fluid, and a few drops of a solution of nitrate of silver, two to ten grains to the ounce, instilled. An attempt at aborting an attack in the first stage will be a failure and may do harm. Some blood may be drawn from the temple in the case of full blooded patients, but the applications of caustics and scarification of the membrane will do no good. When the stage of secretion has set in, nitrate of silver is almost specific in its action. It destroys the epithelial layer of the mucus membrane and with it the germs that are present. The strength of the solution is to be varied according to the amount of the secretion, and may range from two to forty grains to the ounce. When the strong solutions are used they must be followed by salt solution or by ice cold compresses to diminish the amount of the reaction. In place of nitrate of silver, protargol is coming into use but is not so certain in its action. It must be used in ten times the strength of the silver solution to produce the same effect. Next in importance to the silver application is the proper cleansing of the eye. The cleansing is done with a saturated boracic acid solution, sublimate solution 1 to 5,000, or formalin solution 1 to 2,000. When the lids are greatly swollen, this is not easily done. The solution may be squeezed from a pledget of cotton or introduced from a dropper, or douche, or Andrews' irrigator may be used. Great care must be taken not to injure the cornea by the manipulation. Cold applications may be used in the first stage with benefit, and some prefer to use them throughout the attack. The second

stage is, however, better controlled by periodical applications of heat. Hot borated compresses are generally used, but it is best made by immersing the eye in a cup or tumbler filled to the brim with water as hot as can be borne. The cup is held in the hand and the head bent forward so as to bring the eye and surrounding parts into the water gradually. This is cleanly and convenient. The bath should be continued for a few minutes, and repeated every one, two, three, or four hours according to the severity of the symptoms. When the pressure on the cornea becomes dangerous, we may lighten it and at the same time secure the benefit of a bloodletting, by a division of the outer canthus, termed canthotomy, or cantholysis. The incision may be made with a heavy pair of scissors, and should extend through the orbicularis muscle. Vaseline is usually put into the eye freely after each dressing. Atropine or eserine may be used when the cornea is threatened.

OPHTHALMIA NEONATORUM.—A separate consideration is necessary for the ophthalmia of the newborn infant. The cause is the introduction into the eye of some infective material from some portion of the genito-urinary tract at the time of, or shortly after birth. The infection usually takes place while the head is in the parturient canal, and is more likely to occur in face presentations. The idea that any severe conjunctivitis can be caused by exposure to bright light, catching cold, or washing with strong soap, cannot now be entertained. Of course every case of ophthalmia neonatorum is not gonorrhœal, but the

case should be regarded as such till proved by the microscope to be otherwise. Any discharge from the vagina of the mother may set up a purulent inflammation.

Symptoms.—It usually begins on the third day, though it may set in as early as twelve hours after birth, or may be delayed for a week or more. The longer after birth the disease commences the less severe is the attack likely to be. There is first a slight redness of the conjunctiva with a trifling discharge, succeeded by great cushion-like swelling of the lids, intense chemosis and congestion, severe pain and free discharge. The symptoms increase with great rapidity till there is an almost continuous stream of pus. The surface of the swollen lid is hot, dusky red, and tense, and the upper lid overhangs the lower and can only with difficulty be raised. The risk to the cornea is very great.

Treatment.—Prophylaxis is of the greatest importance and is very satisfactory in its results. Cautious vaginal antiseptics may be secured during labor, but more important than this is Crede's plan of prevention, which consists in the use of a few drops of a two grain solution of nitrate of silver immediately after birth. The value of this was first demonstrated by Prof. Crede at Leipsic in 1882. Previous to this the percentage of cases of ophthalmia was as high as 19. In the same lying-in hospitals it had dropped to 0.24 in 1890. Crede recommends that as soon as the head has passed the vulva, the face of the child should be wiped clean, the eyelids opened with the fingers, and a few drops of the solution let fall into the eye from a glass rod. More recently it has been

considered advisable to use a stronger solution, as much as a ten grain solution being preferred by many. For the active treatment of a case the same principles hold as have been detailed for the ordinary purulent conjunctivitis. Cold applications and blood-letting are not suitable for infants. Otherwise the treatment will be the same.

MEMBRANOUS CONJUNCTIVITIS.—In this there is the formation of a distinct membrane in which the bacillus of diphtheria is often present. Some describe a croupous form due to some other organism than that of diphtheria. In either case the symptoms are much the same as in a severe purulent conjunctivitis, and the treatment locally is the same. Antitoxin should be used.

PHLYCTENULAR CONJUNCTIVITIS.—This is also termed Herpes Conjunctivae, Scrofulus, Lymphatic, or Strumous Conjunctivitis. It is not infectious, but the condition of the general system and the state of nutrition are important factors. In a simple typical case there is a little red eminence, of about the size of a millet seed, which develops at some point on the limbus of the cornea. In the beginning it is conical, its apex being covered by the epithelium of the conjunctiva. In a short time the epithelium at the apex of the elevation, or efflorescence, as it is often called, separates, and the tissue that lay beneath it breaks down, so that the cone bears on its top a small gray ulcer which lies above the level of the neighboring

healthy conjunctiva. As the breaking down continues the ulcer sinks to the level of the conjunctiva, then becomes clean and gradually is covered with epithelium. No visible mark is left on the conjunctiva. The process is ordinarily completed in eight to fourteen days. While this is going on the adjacent part of the conjunctiva is hyperaemie, the injected vessels being directed from all sides toward the nodule. The remainder of the conjunctiva is perfectly free from congestion. There are many modifications of this simple type, so that cases differ widely from each other. These modifications concern—

(1). The number of the efflorescences or phlyctens. It is rare to find but one of these ; generally there are several, and often a good many present at the same time. Then the conjunctiva appears reddened all over so that the focal nature of the disease is obscured.

(2). The site of the phlyctens. They may not be limited to the limbus, but either exterior to it, on the bulbar conjunctiva, or interior to it on the cornea itself. In the latter case the condition is properly termed phlyctenular keratitis.

There is usually an abundant lachrymation, but no mucus or mucopurulent secretion. The subjective symptoms are photophobia and blepharospasm. The intensity of these symptoms bears no relation to the severity of the disease. Children seek the darkest corner of the room, and bury the whole face in a pillow, the least ray of light seeming to cause them agony. These symptoms are worse in the morning than in the afternoon and evening.

The appetite is always poor, and very frequently depraved, there being a craving for indigestible and unwholesome food. The constant wetting of the lids by the tears may lead to blepharitis, to eczema of the skin covering the lids, and in time to ectropion of the lower lid.

Treatment.—The local treatment consists in the application of antiseptic irritants, of which calomel and Pagenstecher's ointment of the yellow oxide of mercury, are most in use. The calomel in a fine powder is dusted lightly over the affected area; the ointment, one to five grains to the ounce, is put into the conjunctival sac, and is then rubbed about with the lids so as to distribute it over the whole conjunctiva. These are to be employed only once a day. They are contraindicated in recent infiltrates and progressive ulcers of the cornea. Boracic acid solution may be used freely by the patient himself. Much irritation calls for the use of atropine and cocaine. Bad cases should be cauterized with the actual or the galvano cautery, or with carbolic acid. The general treatment is of great importance. The child should never be kept in a dark room, but should be out in the open air as much as possible, in spite of any photophobia that may exist. Attention to the diet, to bathing, and to exercise is of great importance. The medicinal treatment consists in the use of cod-liver oil, and preparations of iron, arsenic, iodine and quinine.

GRANULAR CONJUNCTIVITIS. — There are two forms of this.

- (1). Simple granular or follicular conjunctivitis.
- (2). Trachoma.

In follicular conjunctivitis the surface of the palpebral conjunctiva is covered with granules, varying in size from a rape seed to the point of a pin, evenly distributed, and usually in rows parallel to the edge of the lid. They are reddish or yellowish in color, and the conjunctiva beneath may be thickened, but is soft and pliable. They are sometimes the result of long-continued, though it may be low and mild, inflammation or simple congestion of the parts. In its simplest form it may be a manifestation of adenoid activity. The symptoms are those of chronic congestion. There is a feeling of discomfort about the eyes, especially by artificial light, and the secretion may gum the lids together in the morning. The main part of the treatment is to use the various irritant astringents. Sulphate of copper in crystal is the best. Acetate of zinc, one grain to the ounce, is useful. If there is much secretion then the nitrate of silver may be used. The nasal mucus membrane should be examined and any fault found there corrected. If there is ametropia, properly fitted glasses must be worn.

Trachoma is a much more serious and important condition. It is the most important of the diseases of the conjunctiva, on account of its wide-spread diffusion, its chronic course, and serious results. No micro-organism has yet been discovered which is generally accepted as peculiar to it, but the clinical picture, especially in advanced cases is clear and unmistakable. There is a morbid deposit or change in the tissue which in time causes a destruction of the

parts surrounding it. The trachoma granule is best seen in the early stages, before the inflammatory changes have set in. It appears as a small, round, greyish elevation, embedded in, but rising above the level of the conjunctiva. These are confined to the palpebral conjunctiva, particularly that of the upper lid, and to the retro-tarsal folds. They are usually in irregular masses, not unlike frog-spawn, or grains of sago.

Symptoms.—The symptoms are those of conjunctivitis. The lids are often thickened, and there is a partial ptosis. When the lid is everted, the inside is seen to be roughened or granulated. In the stage of cicatrization the inside of the upper lid assumes a hard, gristly appearance, and there are bands of cicatrization running lengthways. The subjective symptoms are the usual discomfort and inability to use the eyes, especially by artificial light, and the sensations of burning and itching, and heaviness of the lids. Sometimes the disease is far advanced before the subjective symptoms appear. When the cornea becomes involved, there are lachrymation, photophobia and pain of a neuralgic character. The keratitis is a mechanical one, due to constant friction of the rough conjunctiva over the surface of the cornea. This form of keratitis is termed pannus. A serious complication or result of trachoma is the incurving of the tarsus of the upper lid, caused by the contraction of the cicatrix. This is known as entropion, and will be discussed under diseases of the lids. One characteristic of the disease is its tendency to remissions and exacerbations, and it may continue with periodical attacks from childhood to

old age. It is held by most authorities that the disease is contagious, but there is some difference of opinion on the subject. It has been called a disease of filth, poverty, and overcrowding, and without doubt these conditions hasten its development in those predisposed to it. The predisposition is not confined to individuals, but includes races. The Jews, Irish, and Orientals generally are subject to it, while the negroes of America are exempt.

Treatment.—This is medicinal and surgical. The medicinal treatment is limited to the application to the diseased surface of some kind of astringent or caustic substance which will temporarily increase the hyperaemia of the part and in this way hasten the absorption of the morbid material. Almost every known astringent has been recommended and used at some time as a local application in trachoma, and no doubt all with a show of some success. In the ordinary chronic form the crystal of sulphate of copper is the safest and most satisfactory application that can be made. The effect is easily regulated. It can be made light or severe, according as it is applied lightly or heavily and repeatedly. It may be repeated every day, every other day, or once or twice a week. Nitrate of silver may be used if there is much secretion. Boroglyceride and the glycerole of tannin are useful in the later stages of the condition. The surgical treatment aims at the removal of the granulations in some way. Excision has been practised for a long time, but it removes the normal tissues as well and causes too much retraction of the conjunctiva. Expression or squeezing is the treatment in vogue at present. It removes the morbid tissue with

less injury to the normal structures than the others, but it is not suitable when there is much thickening of the conjunctiva. It may be combined with scarification, and requires a special forceps such as that of Knapp or Noyes. For the pannus it is advised to excise a narrow band from around the base of the cornea, this operation being termed peritomy. A remedy which is used for the pannus is jequirity, the *abras precatorius*, in powder or watery extract. This has the power of exciting a violent purulent inflammation, which as it subsides leaves the pannus either much thinner or completely absent. Inoculation with gonorrhoeal matter was also practised for the same end in Belgium some years ago. The general condition of the patient and the hygienic surroundings must be attended to.

XEROSIS OF THE CONJUNCTIVA.—This is also called Xerophthalmia. It consists of a dry, shrunken, and lustreless condition of the conjunctiva and cornea. In all pronounced cases the lacrymal flow is entirely stopped. The conjunctiva is more or less anaesthetic, and becomes so shrunken that it looks like skin. The disease is one of malnutrition, and the worst cases are seen in marasmic infants. Locally, antiseptic emollients are to be used, and generally attention given to the nutrition.

PINGUICULA.—This is a small round, yellowish elevation often seen on the nasal side of the conjunctiva over the insertion of the rectus internus near the cornea. It is most common in mature persons and

in those exposed to influences irritating to the conjunctiva. It does not give rise to any trouble, but it may be advisable to remove it when it produces the sensation of a foreign body.

PTERYGIUM.—This is a peculiar fleshy growth of hypertrophied conjunctiva and subconjunctival tissue, its apex resting on the cornea, its base spreading out over the conjunctiva. It is usually at the nasal side of the cornea, but is sometimes found on the temporal side and rarely on both. The apex may lie on the corneal surface anywhere from the sclero-corneal margin to the centre, beyond which it does not pass. Its growth is usually slow, taking years to reach its maximum size. They are not painful, but they render the eye liable to attacks of conjunctivitis, and they only interfere with vision when the apex comes in front of the pupil. They may possibly produce astigmatism by dragging on the cornea. Removal is the only treatment, and this is to be done by excision.

INJURIES TO THE CONJUNCTIVA.—One of the most common is burns from chemicals or explosives. The most frequent and dangerous of these is from lime. If unslaked, it rapidly absorbs the water of the tissues and gives out an immense amount of heat, leading to a rapid destruction of the part. The cornea may be involved as well. As both the bulbar and palpebral conjunctiva are affected, there is great danger of union of the two opposing surfaces as they are healing, causing a symblepharon. In the im-

mediate treatment of a burn from lime it is best to avoid all watery solutions. An oil or fat of some kind, or milk arrests the action of the lime. Usually, however, all the lime has been oxidized by the flow of tears long before the patient is seen by the doctor. Still the oil treatment is the best that can be followed, as it affords good protection to the burned surfaces. Castor oil, on account of its viscosity, makes the best dressing. Cocaine or atropine may be mixed with it.

Acids may get into the eye and cause burns of the conjunctiva of greater or less severity according to the strength of the solution. The mineral acids, nitric, sulphuric, and hydrochloric, are the most dangerous. The eye should be washed out with water, or a mild alkaline solution. Burns from carbonic acid, even when the acid is pure, are not very serious, as only the epithelium is affected.

Hot water, hot ashes, molten metal, and similar things, sometimes find their way into the eye. The injury is to be treated on general principles. Incised or lacerated wounds do not require much interference. It may be necessary to bring the edges together with fine sutures.

FOREIGN BODIES in the conjunctiva are very common. Bits of coal cinders, large particles of dust, etc., may find lodgement on the conjunctiva, especially under the lids. In all cases of rather sudden pain and irritation of the eye, careful examination should be made for a foreign body. This can generally be wiped off with a bit of cotton. Only occasionally it is embedded so deeply as to require digging out with a needle or spud.

Conjunctivitis from strong light is distinguished by swelling of the lids, hyperaemia of the conjunctiva, and lacrymation, and is attended by a good deal of pain. Snow-blindness is of the same nature so far as the conjunctiva is concerned. In addition to the exhaustion of the retina there is a sunburn of the conjunctiva from the reflected heat of the sun, showing as a hyperaemia. These are to be treated the same as any other case of hyperaemia.

CHAPTER II.

DISEASES OF THE EYELIDS.

There are a number of affections of the skin of the eyelids but they do not call for special consideration. These are Erythema, Eczema, Erysipelas, Herpes Zoster Ophthalmicus, Rhus Poisoning, Chromidrosis, Xanthelasma or Xanthoma, Miliun, Malignant Pustule, Gangrene, Phlebitis, Lupus, Chanere, Epithelioma or Rodent Ulcer, Vaccinal Eruption, Warts, Horny Growths, Angioma, and several others.

ECCHYMOSIS is frequently seen. The common cause is a direct contusion, as in the case of "black eye" from a blow of the fist. Spontaneous ecchymosis is often seen, and occurs from weakening of the vessels from old age or other causes, or may be induced by violent coughing or straining. It is one of the well-known symptoms in scurvy.

EMPHYSEMA of the lids is produced by a communication between the subcutaneous tissue and one of neighboring air-cavities, the lacrymal, nasal, frontal, or maxillary. In any case air is forced into the tissues by the expiratory effort in blowing the nose. The avoidance of this is the only treatment.

OEDEMA of the lids is a symptom and not a primary condition, but it is so frequent and so conspicuous that it may well be considered in detail. It may be either inflammatory or non-inflammatory. As long as oedema is on the increase, the skin of the lid is tense and smooth; but as soon as it begins to decrease, there are minute wrinkles in the skin of the lid. Oedema often causes more alarm than the lesion which lies at the bottom of it, because the patient cannot open the eye, and so cannot see with it. In every case the lids should be opened, using Desmarre's lid elevators if necessary to inspect the eyeball. The affections producing oedema may be classified as follows:

(1). Oedema as a superficial condition.

1. Hordeolum. In this there is one spot in the lid of greater induration and painfulness.
2. Dacryocystitis. In this there is tenderness over the inner angle and pus is evacuated from the puncta by pressure, and there is epiphora.
3. Erysipelas. In this the redness and swelling are uniform.
4. Furuncle, malignant pustule, and abscess of the lid. There is a circumscribed, indurated and painful nodule in the skin.
5. Periostitis. The margin of the orbit is thickened, enlarged and tender.
6. Traumatism. This is accompanied by haemorrhagic effusion into the lid.
7. A non-inflammatory oedema is met with as one of the signs of general oedema, as in heart disease, hydraemia, and nephritis.

Sometimes the lid oedema is the first sign of the disease. In such cases the oedema of the lid appears under the guise of flying oedema (*oedema fugax*) i.e., it comes suddenly and disappears again in a few hours or a few days, only to return after a short time.

- (2). Oedema due to deeper affections.
1. Conjunctivitis. The purulent, muco-purulent, and diphtheritic forms may produce an oedema.
 2. Inflammations of the interior of the eyeball. Irido-cyclitis, acute glaucoma, and pan-ophthalmitis may cause it.
 3. Tenonitis, phlegmon of the orbit, and thrombosis of the cavernous sinus. In these the eyeball itself is normal, but there is protrusion, immobility and chemosis. In thrombosis there is also oedema behind the ear and serious cerebral complications.
 4. Tumor of the orbit. This is non-inflammatory.

HORDEOLUM OR STYE.—This is a small furuncle on the margin of the lid and consists of a localized inflammation of the connective tissue, or of the gland, usually going on to suppuration. It tends to become multiple or to recur. A series may be kept up for months. Certain occupations, driving in the cold, working in dust, and the strain of ametropia, predispose to this trouble. Frequent attacks indicate some derangement of health and are often associated with constipation and menstrual disorders.

Treatment.—Hot fomentations hasten the process of suppuration and rupture. When the swelling points it should be punctured to evacuate the pus. An ointment of mercury will assist the suppurative process, and is also useful in preventing the tendency to recurrence.

CHALAZION.—This is often called a meibomian cyst, but it is not a true cyst. It originates in a meibomian gland, and seems to consist of hyperplasia of epithelium, proliferation of connective tissue, and retention of secretion. A mass of granulation tissue is thus formed which Virchow termed granuloma. This tissue undergoes degeneration and breaks down. The cause is not known. The tumor grows slowly and forms a firm swelling attached to the tarsus, the skin being freely movable over it. Chalazion may be taken for a sty, from which it is to be distinguished by the circumscribed character of the swelling, the absence of inflammation, and the fact that a sty points in the edge of the lid. Applications are of no value in this condition. The tumor should be incised through the conjunctiva and the contents removed through the opening by a small curet.

BLEPHARITIS.—This is applied to the various grades of subacute and chronic inflammation of the edges of the eyelid. Hyperaemia of the margin of the lid manifests itself by reddening so that the eyes look as if they had a red fringe. It occurs in many

people as a result of insignificant causes of injury, such as prolonged weeping, great straining of the eyes, being in a vitiated atmosphere, a wakeful night, and similar causes. There is a feeling of heat, followed by burning and lachrymation. There are no scales or crusts on the lid margin.

Blepharitis appears under the two forms of, (1) blepharitis squamosa, and (2) blepharitis ulcerosa. In the squamous form the skin between the cilia and in their vicinity is covered with small white or gray scales which are easily removed by washing, leaving the skin underneath shining and red but not abraded. The lashes come out easily. The scales are from an abnormal secretion from the sebaceous glands. There is a slight conjunctivitis. Both eyelids are affected. Patients complain of burning, photophobia and inability to continue close work. Exposure to cold and dust, and the use of the eyes increase the congestion.

Blepharitis ulcerosa appears in various degrees of severity. In this form also the border of the lid is covered with yellow crusts; but after washing them off, we find an ulcerative process as well. Small yellow spots are seen here and there around the cilia. These are abscesses which have formed by suppuration of a hair follicle and of the sebaceous gland belonging to it. An ulcer is formed at this spot and the hair follicle is destroyed. If the process goes on for any length of time the row of cilia becomes very much thinned out, those that remain being in groups glued together into tufts by the dried secretion. The subjective symptoms mentioned in connection with the squamous form are present to a greater degree.

Blepharitis is always very chronic. In young patients it may disappear, but in many it continues throughout life. If the condition is severe and continues for any length of time a series of sequelae may be looked for. These are as follows :

1. Chronic catarrhal conjunctivitis.
2. Permanent destruction of the cilia, termed madarosis.
3. The lashes become stunted, curled, and misplaced. Some of them take a false direction and come in contact with the cornea, and this is termed trichiasis.
4. The lower lid may become everted. This is ectropion. There is at the same time a displacement of the punctum which produces epiphora.

Treatment.—It is of the first importance to remove all sources of irritation. Errors of refraction should be corrected, as the proper glasses not only relieve the strain but serve for protection against wind and dust. Close work should be restricted and early hours enjoined. In the local treatment ointments are most useful. The basis of the ointment may be vaseline or cold cream (unguentum aq. rosae,—almond oil, 50 parts, white wax and spermaceti, of each ten parts, rose water, thirty parts). For the additional ingredient, one of the mercurial precipitates is usually selected, the white, yellow, or red, from one to five grains to the ounce. The patient applies the ointment by rubbing into the edge of the eyelid at bedtime. All scales and crusts must be removed before this application is made, and to do this without injury to the lid it is often necessary to use an alkaline solution, the best being bicarbonate

of soda, five grains to the ounce, in warm water. In the ulcerative form, the small abscesses should be opened every day, and the cilia removed, the ulcerating surface being touched with nitrate of silver. Panas recommends the iodide of mercury in olive oil, two to one thousand.

TRICHIASIS AND DISTICHIASIS.—Trichiasis is an affection in which the eyelashes are misplaced and turn inward against the eyeball so as to be a source of irritation instead of a protection. In distichiasis there are two distinct rows of cilia, the posterior row being a new growth, and turning in to touch the eyeball. Some authors deny the existence of distichiasis except as a congenital condition. It is very doubtful if a new growth of cilia can be produced by any disease, though cases are seen where there is an excessive growth. The essential in either condition is contact with the eyeball. This produces photophobia, lacrymation, and a constant sense of something in the eye. The cornea may suffer great injury. Superficial opacities are developed by a callous thickening of the epithelial layer, and small ulcers of the cornea are also formed. Trachoma is the most common cause, but it also comes from blepharitis, hordeolum, burns, and operations on the border of the lids.

Treatment.—If not numerous the lashes may be pulled out, and this repeated as often as they grow. The hair follicle may be destroyed by electrolysis, but this is only suitable where a few large hairs are at fault. If the whole border of the lid is affected

some operation must be done to change the direction of the whole lid margin.

ENTROPION.—This is an inversion of the lid. The distinction between entropion and trichiasis is one of degree. In entropion the edge of the lid is rolled in so that it cannot be seen at all from in front. The result is the same in each case. Two forms of entropion are seen, (1) spastic entropion, and (2) cicatricial entropion. The spastic form is that which is produced by contraction of the orbicularis. Two conditions are necessary for its development; defective support of the free border of the lid, and an abundant amount of extensible skin upon the lid. Hence it develops when the eyeball is absent, when it is diminished in size, and when it is situated deeply in the orbit. So it is most frequently seen in old people with flabby lids, and it is favored by blepharospasm, or by the wearing of a bandage. It is sometimes an unpleasant complication during the after treatment of cataract operations. It is almost without exception seen affecting the lower lid.

The cicatricial form is caused by contraction of the conjunctiva drawing the free border of the lid inward. Trachoma is the common cause, but it may follow a diphtheritic conjunctivitis, or a burn.

Treatment.—The spastic form may be managed without an operation. If caused by a bandage and we are compelled to continue its use, we place upon the lower lid in the neighborhood of the margin of the orbit a roll of adhesive plaster, which is kept pressed against the lid by the bandage. For the other form some operation is necessary.

ECTROPION.—This is eversion of the lid, usually the lower, and the consequent exposure of the conjunctiva. There are different degrees of ectropion. The lowest is that in which the internal margin stands off a little from the eyeball. Even this tends to increase by its own condition. The displacement of the punctum produces epiphora and this leads to a contraction of the skin of the lower lid, and hence an increase in the ectropion is produced. Ectropion may present all degrees up to complete eversion of the entire lid. Redness and thickening of the conjunctiva result from the exposure to the air. According to the etiology of ectropion the following classification is made :

1. Spastic ectropion. If the lid becomes everted from any cause the action of the orbicularis is likely to keep it in that condition.

2. Paralytic ectropion. This arises as a result of paralysis of the orbicularis, the lid falling away from the eyeball by its own weight. So this affects only the lower lid. The palpebral fissure cannot be closed completely, and this is termed lagophthalmos.

3. Senile ectropion is also found only in the lower lid, and arises from a relaxed condition of the parts.

4. Cicatricial ectropion. This is the result of the destruction of some part of the skin and its renewal by cicatrices which contract the lid. Injuries, burns, ulcers, the excision of skin in operations and caries of the orbit, are causes.

Treatment.—The spastic form is usually relieved by replacing the lid and applying a bandage. In the paralytic form the bandage may be used also, but the improvement will depend on the facial paralysis.

The higher degrees of ectropion, and all the cicatricial cases can only be treated by operation.

ANKYLOBLEPHARON.—This is an adhesion of the borders of the lids. It is either partial or total, and is often combined with symblepharon. As a result of burns or ulcers the edges of the lids become raw at opposed points and so become adherent. Ankyloblepharon diminishes the size of the palpebral fissure and restricts the movements of the lids. The treatment consists in separating the adherent surfaces by an operation, and keeping them apart.

LAGOPHTHALMOS.—This is an inability to close the eyelids. In the lesser degrees it is possible to close the fissure by an effort in squeezing the lids together; but in sleep there is no such effort, and these patients sleep with their eyes open. The harm comes from the eyeball being insufficiently covered. The cornea either dries up and becomes necrotic, or the epithelium becomes thicker and epidermoid, and of course opaque. In any case vision is in danger. Epiphora always accompanies the condition. The possible causes are as follows :

1. Shortening of the lids.
2. Ectropion.
3. Paralysis of the orbicularis.
4. The state occurring in persons who are very ill or who are unconscious, in which the eyes remain open on account of a lessened sensitiveness of the cornea, so that the reflex acts of winking and of shutting the lids are no longer performed.

5. Enlargement or prominence of the eye, such as occurs in staphyloma of the cornea, in Graves' or Basedows' disease, and in proptosis from orbital tumor. The elevated position of the lid in Basedows' disease is supposed by some to be due to spasm of Muller's muscle.

Treatment.—As this is practically a symptom the treatment must depend on the cause. The operation of tarsorrhaphy may be done.

BLEPHAROSPASM.—This is an involuntary contraction of a part or of the whole of the orbicularis palpebrarum, and is either a clonic or a tonic cramp. A clonic spasm in its mildest form is a twitching of a few fibres of the muscle, most commonly in the lower lid, very annoying to the patient and often the cause of undue alarm. It arises from the strain of uncorrected ametropia, prolonged eye use, and deficient amplitude of accommodation. It is often a symptom of hysteria. Children are often affected with it, and in them it may extend to the other muscles of the face, when it must be regarded as choreic. Many cases are plainly due to reflex irritation of the fifth nerve. These are induced by foreign bodies in the cornea or conjunctiva, iritis, cyclitis, and phlyctenular ophthalmia. The most violent cases are met with in association with trifacial neuralgia. There are periods of complete remission, and there is entire cessation during sleep. In some cases the spasm can be arrested by pressure on the supra-orbital, infra-orbital, or temporal nerves.

The treatment is the wearing of proper glasses to

correct the ametropia, and local and general tonics. Resection of the fifth nerve and canthoplasty are done in the severe cases.

PTOSIS.—Falling of the upper lid varies in degree from a failure of the lid to follow the motion of the eyeball in looking upward, to complete closure of the eye. It is due to a variety of causes, such as increased weight of the lid from inflammatory hypertrophy, or morbid accumulation of fat, tonic spasm of the orbicularis, injury of the nerve or muscle, imperfect development or innervation of the muscle, and paralysis. Paralysis of the levator may be central or peripheral, and it is sometimes hysterical. A slight drooping noticed only when the eye looks upward and the lid fails to follow the motion of the ball, has been attributed to paralysis of Muller's muscle which is described as an organic muscle arising from between the striated fibres of the levator along the under surface of which it runs to the upper margin of the tarsus. Muller's muscle is innervated by the sympathetic. Some similar fibres are found in the lower lid. Paralysis of Muller's muscle causes the condition of the upper lid already mentioned and with it there is found a slight elevation of the lower lid, contraction of the pupil, hypersecretion from the conjunctiva, increased temperature of the side of the face, and diminished tension of the eyeball, all these being symptoms of disease or injury of the cervical sympathetic.

Treatment.—Ptosis of paralytic origin may disappear spontaneously, or may be amenable to treat-

ment without operation. This is true specially of syphilitic and rheumatic cases. Operation should not be done early in the history of the case,—not within several months of the onset. If an operation is done we must be sure that there is no diplopia which may prove to be a greater evil than the ptosis.

CHAPTER III.

DISEASES OF THE LACRYMAL SYSTEM.

The diseases which affect the lacrymal gland are rare and only two of them need be mentioned. These are (1) Dacryoadenitis, and (2) Hypertrophy of the lacrymal gland. They are to be treated on the general principles of surgery.

The diseases affecting the drainage apparatus are very common. All the parts are liable to pathological changes. The puncta, the canaliculi, the lacrymal sac, and the nasal duct are all the seat of disease processes. The puncta are liable to occlusion, or may assume a malposition; the canaliculi may be closed by strictures, or may be obstructed by the formation of dacryoliths, by the growth of polypi, or by the entrance of foreign bodies; the sac is subject to acute and chronic inflammation which may lead to the formation of a fistula; and the walls of the nasal duct are often the seat of inflammatory processes resulting in narrowing of its lumen. All these conditions have a common symptom; the passage of tears from the eye to the nose is interfered with, and in consequence they overflow on the cheek. This is called epiphora, or stillicidia lacrymarum, and this in itself tends to set up a chronic conjunctivitis and an eczematous condition of the face.

ATRESIA OF THE PUNCTUM.—This may be either a congenital or an acquired condition. Complete obliteration does not occur except from injury, such as laceration, or its destruction with some caustic agent. If the canaliculus is intact it will not be a difficult matter to remedy the atresia. Generally a slight depression marks the position of the punctum, and with a needle or a sharp pointed probe an opening may be made into the canaliculus, through which larger probes may then be introduced. When displacement of the punctum is present also, the canaliculus must be slit, or no relief will be given to the epiphora.

MALPOSITION of the puncta gives rise to epiphora. The puncta may be partially or completely everted; they may be inverted; or, owing to the small size and deeply set position of the eyeball, they may not be in apposition with it. The efficient remedy is the slitting of the canaliculus.

DACRYOLITHS occasionally form in and obstruct the canaliculi. The mass is a fungus, usually a leptothrix. When the canaliculus is slit their removal is easy. Polypi and small foreign bodies are found in the canaliculus.

DACRYOCYSTITIS.—This is an inflammation of the lacrymal sac, and is met with in a chronic and an acute form. Primary inflammation of the sac is rare. In most cases it is secondary to and dependent

on disease of the nasal duct, stricture being the condition which gives rise to it. With this as a cause it begins as a mild chronic affection, unattended by pain, but with epiphora and the accumulation of tears and mucus in the sac. Acute exacerbations of the catarrhal condition, with the formation of pus, occur from time to time, and this constitutes the acute daeryocystitis. The cause of this is the entrance of micro-organisms into the sac, exposure to cold, some constitutional disturbance, or the closure of the canaliculi at the point of entrance to the sac. There is severe pain, with tense swelling of the sac, marked oedema and redness of the lids, constitutional disturbance such as fever, loss of appetite, insomnia. Thick pus forms in the sac which after several days tends to point beneath the internal palpebral ligament. In a few cases the pus escapes through the canaliculi. As the inflammation subsides, and the discharge lessens, the opening through which the pus has escaped lessens in size, and in the course of a few weeks closes. A permanent fistula may, however, develop from the continual discharge of tears through the opening. The treatment is mainly directed to the lacrymal duct, as its stricture is the common cause. In the acute stage a local application of a lotion of opium and acetate of lead by a pad of gauze, or blood-letting will relieve. A purgative must be given, and an anodyne to subdue the pain. If the lotion does not control the inflammatory action, poultices may be used. As soon as pus has formed it should be evacuated by an incision into the sac. In the acute stage no attempt can be made to open the nasal duct.

STRICTURE OF THE LACRYMAL DUCT.—This is commonly due to partial or complete closure, through nasal disease, of the duct where it enters the nose ; to inflammatory swelling of the mucus lining ; to fibrous stricture of the upper end of the duct ; or to disease of the bony walls surrounding it. The treatment is directed to re-establishing a passage into the nose. In some cases treatment of the nose is of the first importance, as the removal of bands of cicatrices, or hypertrophy of the lower turbinals, will be sufficient. In other cases the cure of the inflammation in the sac by syringing allows the duct to open. For the more serious cases it is necessary to use the probe repeatedly, or to wear a style continuously, till the tendency to re-contraction of the stricture has been fully overcome. The probes should be as large as can readily be passed. Disease of the bony walls requires a radical operation for the removal of the diseased bone.

CHAPTER IV.

DISEASES OF THE CORNEA.

These form from one-fourth to one-third of all the diseases of the eye. The cornea is the most exposed to external injuries of all the portions of the eyeball, and it is not supplied with blood-vessels. The central zone is quite a distance from the nutrient vessels, and, as compared with the conjunctiva, it lacks sufficient strength to combat the causes of disease. In ordinary traumatic disturbances the regenerative processes are almost as rapid as those of the conjunctiva, and much more energetic than those of the sclerotic. When the reparative processes are complicated by micro-organisms, regeneration is delayed and much inferior to that of the conjunctiva under similar conditions. All portions of the cornea are subject to the influences of ordinary pathogenic causes—physical, chemical, and microbic—but they are not equally susceptible to alteration of nutrition in consequence of such noxious influences. Bowman's membrane and the hyaline lamina of the membrane of Descemet are slow to take on pathological processes. The epithelial and the endothelial layers react energetically to pathogenic causes.

KERATITIS.—Before discussing the varieties of keratitis it will be well to consider the condition generally.

There are three pathognomonic symptoms of keratitis—(1) corneal disturbance, (2) inequalities or dulness of the corneal surface, and (3) ciliary injection.

1. Corneal disturbance.—Gray or yellowish discoloration may be present in varying degree. When the epithelium alone is affected the discoloration is trifling, and the naked eye cannot discern it. Oblique, focal, or lateral illumination will decide in difficult cases. The appearance is intensified, or even made quite discernible by coloring matter that penetrates the corneal tissue through epithelial lesions. A drop of a two per cent. aqueous solution of fluorescein gives a greenish yellow color to the substance proper of the cornea, and resorcine, in two per cent. solution, gives it a reddish brown color. In this manner an exact idea of a corneal lesion can be formed. Old corneal spots and maculae are not colored, nor are deep infiltrations, if the epithelium is intact.

2. Dulness or inequalities of the corneal surface. A slight dulness can only be seen with difficulty, by careful examination by reflection and with the ophthalmoscope.

3. Ciliary injection. The superficial and deep pericorneal vessels supply all the nourishment to the cornea. In any marked case of keratitis both sets of vessels are congested, but only the superficial ones are visible. There are three symptoms which indicate the gravity of the disease: (1) The congestion of the iris, (2) the intolerance of irritating drugs, and (3) the formation of deeply seated vessels in the cornea. The symptoms of congestion of the iris

will be discussed under hyperaemia of the iris. They consist of contraction of the pupil, sluggish action of the iris, discoloration, and ciliary pain. Remedies suitable for conjunctivitis are sometimes used when the corneal trouble is not recognized, with the result of causing great irritation, the pain and ciliary injection being much increased. When a keratitis is complicated by vascularization of the cornea, the affection is seen to be deep or superficial by the position of the vessels.

Other symptoms are photophobia and blepharospasm. Lacrymation accompanies these. There are also visual disturbances. When an eye is first affected with keratitis it easily becomes fatigued. Later, vision is diminished by opacities.

General Therapeutics.—One of the most important principles in the treatment of diseases of the cornea is not to use any irritant. The next point is the protection of the eye. This is secured by the occlusive and compress bandage, and by dark glasses and shades. The act of winking is a mechanical irritation, and on this account alone it is advisable to bandage the eye. A certain amount of pressure is beneficial, and the dressings should be absorbent to take up all the secretions. At the same time the bandage prevents the entrance into the eye of all dust particles. The third point is as to the use of antiseptics. Most cases of keratitis are infected or are liable to become so. For this reason it is necessary to keep thoroughly clean the surface of the cornea, the conjunctival sac, the edges of the eyelids and the surrounding skin. We may use the boracic acid solution, or the bichloride of mercury, 1 to

5,000, or 1 to 10,000, or biniodide of mercury, 1 to 20,000. Pyoktanin is also used, 1 to 1,000 to 1 to 10,000. The next point is the use of mydriatics. Atropine in four grain solution is of great use in many cases of keratitis, it being indicated in the cases where there is iritis or hyperaemia of that membrane. By dilating the pupil it contracts the vessels of the iris, while ciliary pain subsides as soon as dilation commences. It does not seem to have any direct effect on the cornea, and to produce the indirect benefit the instillations must be continued till the pupil is dilated. It is not called for and does not give relief in the superficial form of keratitis which is local and does not cause ciliary neuralgia. In such a case the dilatation increases the photophobia by allowing more light to enter the eye. It is also contraindicated when dilatation of the pupil is impossible and where there is severe hypopyon and iritis, or in which anterior or posterior synechiae are present. In the latter cases it tends to produce a glaucoma. Miotics may be used to diminish the tension of the eye by contracting the intraocular muscles and freeing the angle of filtration. Eserine is generally used, but pilocarpine is also effective. The contraction of the pupil is useful in ulceration to prevent ectasis or perforation, and in reducing any peripheral prolapse.

Cocaine is useful to allay the superficial pains and renders the cornea insensitive to severe applications such as the thermo-cautery. If used to excess it may lead to exfoliation of the epithelial layer and so aggravate the condition it is intended to benefit.

Cauterization is efficacious in the treatment of infiltrations and infected ulcers which are often progressive.

VARIETIES OF KERATITIS.

- (1). Superficial keratitis.
 1. Superficial traumatic keratitis.
 2. Phlyctenular keratitis.
 3. Granular pannus.
 4. Acne of the cornea.
 5. Herpes of the cornea.
 6. Dendritic keratitis.
 7. Filamentary keratitis.
 8. Superficial punctate keratitis.
 9. Vesicular and bullous keratitis.
- (2). Deep keratitis.
 1. Deep ulcerative and suppurative keratitis.
 2. Deep non-suppurative keratitis.
- (3). Cicatricial sequelae of keratitis.
- (4). Corneal tumors.

SUPERFICIAL TRAUMATIC KERATITIS.—A simple wound of the cornea usually heals in such a way that it cannot be called a keratitis, but the injury may be followed by an infection and this will constitute a keratitis. The infection may come from a blepharitis, affections of the lacrymal passages and of the nose, or it may be conveyed by the hands or handkerchief. The treatment consists in the removal of the cause if this is determined, the use of antiseptic lotions, the application of the protective bandage, and, in certain cases, the use of the yellow oxide ointment and the curet.

PHLYCTENULAR KERATITIS.—What has already been said about phlyctenular conjunctivitis applies here. The conjunctival condition may precede, accompany, or follow the corneal phlyctens. The phlyctens usually appear at the corneo-scleral margin. Their tops, at first gray, grow yellow, break down and form superficial ulcers. There is local congestion, increased lacrymation, and photophobia. The phlyctenular ulcer has a tendency to creep over the surface of the cornea toward the pupil, taking behind it a leash of blood vessels. When the ulcer heals, the blood vessels disappear but a strip of opacity remains. There is a tendency to recurrence, but in mild cases the result is scarcely noticeable. The treatment is the same as has been already outlined for phlyctenular conjunctivitis. It should be both local and general.

GRANULAR PANNUS.—This has been mentioned when speaking of trachoma. It is a vascularized granular keratitis, usually involving the upper half of the cornea. It is subdivided into pannus tenuis and pannus crassus. Both forms are very persistent, may last for years and completely destroy vision. In treating the condition it is first necessary to get rid of the trachoma, when the milder forms disappear without further treatment. For the severe cases peritomy is done and the treatment by jequirity may be employed. The latter produces an inflammatory reaction resembling the purulent form of conjunctivitis.

ACNE OF THE CORNEA.—Acne of the face may be accompanied by eruptions on the cornea which have the appearance of small phlyctenules. They are found only in those who have passed adolescence. They are very difficult to treat and are prone to relapse. Calomel, antiseptic lotions and the yellow oxide ointment are used.

HERPES OF THE CORNEA. — The vesicles are transparent, are more or less numerous, arranged in groups, and are not larger than the head of a pin. It usually appears in the course of febrile or catarrhal troubles, especially with bronchitis, pneumonia and influenza. The vesicle bursts and leaves a small slightly infiltrated ulcer. The treatment is by a bandage, antiseptic lotions, and atropine if necessary.

DENDRITIC KERATITIS. — This is also called malarial keratitis. It begins with a circumscribed intense infiltration which penetrates to a certain depth. The infiltration then ulcerates, the borders of the ulcer being perpendicular and infiltrated. The affected area has first the appearance of a comma, but it elongates and becomes arborescent and ramified. When neglected it may suppurate and penetrate. The treatment is the same as for infected ulcers. The cauterization is of great use.

FILAMENTARY KERATITIS.—This is a rare condition seen in the eyes of old people. With slight pericorneal injection, pain and photophobia, some

small vesicles appear on the cornea. These are tiny globules attached by a slender pedicle. The smallest of these are swept off, the larger become filaments which hang over the surface of the cornea. The affection may continue for months or years. The treatment is to remove the filaments, but subsequent eruptions may occur.

PUNCTATE KERATITIS.—This superficial form of keratitis is also rare. There appear on the cornea small, superficial, yellowish-green spots that are fairly well defined. There may be from five to fifty of these. They last a few days and suddenly disappear. No irritant should be used in treating the condition.

VESICULAR AND BULLOUS KERATITIS.—These affect only the epithelium. Sometimes they appear in eyes not otherwise diseased, but they are commonly found in eyes having large corneal opacities or staphylomata, which are often glaucomatous, blind and lost from irido-cyclitis. The removal of the vesicles and of the bullae gives relief.

Deep keratitis will be discussed under the two forms of ulcerative or suppurative keratitis and non-suppurative keratitis. The first is caused by exogenous microbial infection, and the second by endogenous, microbial or non-microbial infection. The first is a local disease, the second is usually constitutional.

ULCERS OF THE CORNEA.—An ulcer is a loss of tissue which is or has been progressive,—that is, the process has invaded the surrounding tissues. The point of interest in connection with an ulcer is its source of infection. The staphylococci, the pneumococcus, the streptococcus, and some undefined bacilli are found. The following classification may be made :

1. Simple ulcer.—This is a small superficial gray lesion either idiopathic or traumatic.

2. Deep or purulent ulcer.—This consists of an area of yellowish purulent infiltration surrounded by a zone of hazy cornea with a tendency to travel inward and to produce perforation.

3. Idolent ulcer.—This depends on some failure in nutrition due to nerve disturbance. The patients are usually anaemic.

4. Sloughing ulcer.—These spread widely and easily become complicated with hypopyon and iritis. They are often seen in old people as a result of some trifling injury and they are then styled serpiginous. A slight injury from a chip of stone, a splinter, a beard of wheat or the like, which may be an insignificant injury in a young person, produces in the aged this dangerous form of ulcer.

5. Ulcus rodens.—This also attacks old people, beginning at the margin of the cornea and undermining the superficial layers. It does not tend to perforate but heals at one side while it progresses at the other till the whole cornea is rendered opaque.

6. Circular ulcer.—This is in the form of a crescentic groove which girdles the cornea.

7. Dendriform ulcer.—This is the malarial form of keratitis which has already been described.

The progression of an ulcer is caused by the appearance of new infiltrations. The floor of an ulcer is often studded with infiltrated areas or necrosing corneal lamellae, that are in the process of being cast off by the inflammatory process. Sometimes the floor is transparent, especially when composed only of the membrane of Descemet.

The retrogression of an ulcer.—An ulcer begins to clear up when the resistance of the tissues prevails against the destructive action of the microbes. The shreds of necrosed tissue are thrown off, and the epithelium of the sides extends gradually over the floor or bottom of the affected areas, which becomes more or less bright or polished in appearance. Vessels may develop in the sides and bottom of large ulcers. The loss of tissue is gradually made good. The tissue used in the process of repair is at first cellular, and is later transformed into fibrillary cicatricial tissue, covered by a layer of nearly normal epithelium. Ulcers of long duration, affecting the deeper layers, sometimes do not fill completely, and thus leave a corneal depression. The new connective tissue is always distinguishable under the microscope from normal tissue by the irregular arrangement of its fibrils. The maculae are more or less apparent according to the extent of the ulcer and the length of time it has remained vascular. The membrane of Descemet is distinguished from the rest of the corneal tissue by its greater power of resistance to injurious agencies. It is also very elastic so that when the ulceration has destroyed the corneal tissue just in

front of this membrane it yields to the intraocular pressure and bulges forward, remaining transparent and becoming only slightly or not at all affected. This is called keratocele and it usually terminates in perforation. An ulcer may perforate without a preceding hernia of the membrane of Descemet. The actual rupture may take place in consequence of some effort which increases the intra-ocular pressure, such as coughing, sneezing, or stooping. The patient feels a sudden sharp pain, which is followed by a gush of hot liquid. The aqueous humor runs out, the iris and the lens are brought close to the posterior wall of the cornea, thus abolishing the anterior chamber, and the tension of the eye is very much lowered. After perforation the symptoms of keratitis generally abate, the pain ceases, and the ulcer begins to heal. The opening is closed by the pressure of the iris and lens, and it may be further obstructed by the extension of a plug of fibrin from the iris. The aqueous humor re-accumulates, gradually filling the space between the cornea in front and the iris and lens behind, so that the latter are pressed back to their normal positions. Such a favorable result can only be looked for in small ulcers. Persistent adhesion of the iris to the cicatrix is more common, this being termed anterior synechia. In large ulcers a hernia of the iris is likely to take place, the pressure from the aqueous holding the iris in place. As the prolapse increases the hernia may rupture. A large central perforation may allow the expulsion of the lens when perforation takes place. An extensive prolapse of the iris may become cicatrized as a thin fibrillary membrane, pigmented posteriorly and

covered with epithelium anteriorly. An ectasis is produced by the aqueous humor pushing the cicatrix forward. More of the cornea gives way under the pressure, and a staphyloma is formed consisting of the prolapsed iris, cicatrized on its surface and covered over with epithelium. A staphylomatous eye soon becomes glaucomatous. Even when there is staphyloma, if the synechia be large or total, the eye will be lost from glaucoma. Traction on the iris and deep infection of the eye may lead to iridocyclitis, phthisis, panophthalmitis, or intra-ocular haemorrhage that may disorganize the eye. Sometimes the perforation will remain open for a long time, so as to form a fistula of the cornea.

Etiology of Ulceration.—The chief predisposing cause is the absence of bloodvessels in the cornea, by which the resistance of the tissue to infection is materially lessened. The exciting causes are traumatic and microbic.

Prognosis.—This is very variable and must be estimated according to the locality, depth, size, and degree of infection, of the ulcer.

Treatment.—Causes should be searched for and eliminated as far as possible. Foci of infection, such as blepharitis, or blennorrhoea of the lacrymal sac are to be abated or destroyed. Boracic acid lotions should be used frequently. Other antiseptic preparations may be used. The bandage is to be applied, and atropine instilled. A profuse secretion may contraindicate a bandage, as the retained secretion undergoes decomposition and so infects the ulcer. Atropine allays the pain dilates the pupil and so prevents the formation of posterior

synechiae, and breaks recent adhesions. Atropine is not to be employed when it fails to dilate the pupil, as it then renders the eye glaucomatous. In such a case eserine or pilocarpine is better. In the more severe cases it is necessary to use such anti-septics as the bichloride or cyanide of mercury, or iodoform may be brushed into the eye, or the crayon of protokatin applied. When rapid progress is evident in the infection, mercuric iodine is to be used. When perforation seems inevitable, it is better that the opening should be made by the surgeon, in a healthy part of the cornea, than by the ulcer. A prolapse of the iris should be relieved by excision or the cautery. A membrane should be tapped or pierced. An indolent ulcer may be lightly scraped with a curet.

SUPPURATIVE KERATITIS.—This may be termed purulent ulcer and abscess of the cornea. It is always the result of severe microbial infection due either to the presence of a large number of microbes, or to bacteria of great virulence. The resistance of the cornea may be lessened by a contusion or as the result of some general dyscrasia. The infection always comes from without but the point of entrance may be very minute.

Symptoms.—A purulent infiltration with no opening for the escape of pus may vary in intensity and size. It is distinguished by an intense yellowish-white color which diminishes toward the periphery and merges into a slightly congested oedematous zone. A deep infiltration usually increases in size before it ulcerates. In most of these cases pus

appears in the anterior chamber, and this is termed hypopyon. The pus mixes with the aqueous humor and sinks to the bottom of the anterior chamber, where it forms a yellowish-white collection which is horizontal on top. Often the pus is compact and fibrinous; when it is liquid it readily changes its position as the head is moved from one side to the other. The pus may reach the level of the pupil, or may completely fill the anterior chamber. It is always a serious complication. A small amount of pus in the anterior chamber may be absorbed and disappear, but a large collection tends to produce necrosis of the cornea and destroys the sight. The pus in hypopyon comes from the irido-corneal angle, from the iris, and from the ciliary body.

The prognosis in this condition is always serious. The cornea becomes opaque, anterior and posterior synechiae remain and predispose to a secondary glaucoma. The lens may become opaque, and corneal staphyloma are frequently formed.

Treatment.—This is the same as for grave corneal ulcers. When the hypopyon reaches the level of the pupil, it will no longer absorb and must be evacuated by a paracentesis. Forceps will usually be necessary to remove the mass, or the anterior chamber may be irrigated with a salt solution. The puncture should be made below the level of the pus, and in a part of the cornea which is still healthy. Atropine is of no use in large collections of pus. During the last few years subconjunctival injections of solutions of the bichloride of mercury have been tried. The results have not been very satisfactory.

NEUROPARALYTIC KERATITIS.—This condition is observed in complete paralysis of the trigeminus or in one of its ocular branches, and especially the nasal branch. Under these conditions the reflex actions of winking and of lacrymation do not take place. The eye ordinarily remains open, its surface becoming dry and being exposed to contusions, foreign bodies and desiccation from evaporation. When exfoliation takes place infection occurs and infiltration goes on rapidly. Suppuration and hypopyon, perforation, staphyloma, and phthisis bulbi complete the case.

Etiology.—There are various theories to account for the condition :

1. It may be due to trophic changes. It is supposed that there are trophic nerve fibres in the trigeminus which control the nutrition of the elements in the cornea. Trophic nerves are still spoken of, but their existence has not yet been clearly demonstrated.

2. It may be due to the lessened power of resistance in the cornea to external injuries as a result of the insensibility.

3. It may be due to irritation of the fifth nerve by the lesion.

4. It may be due to micro-organisms.

5. It may be due to increased evaporation from the cornea.

The true theory is probably in a combination of these possibilities. It occurs in connection with disease of the Gasserian ganglion, of the nuclei of the fifth pair of nerves, and with periostitis of the orbit, syphilitic deposits, and fracture of the base of the skull.

Treatment.—Diligent and careful treatment may

often save some useful vision. Local measures, based on the traumatic theory, are needed. Antiseptics are necessary, and a bandage to protect the eye, or the lids may be kept closed with adhesive plaster.

DEEP, NON-SUPPURATIVE KERATITIS.—These conditions are due to constitutional troubles. The keratitis begins in the tissue proper of the cornea, and is therefore analogous to diseases of the fibrous tissues in other parts of the body; and, like them, are of long duration and demand general treatment. They do not suppurate or ulcerate.

INTERSTITIAL KERATITIS.—This is the common form of deep, non-suppurative keratitis. It is also known as interstitial keratitis, and deep diffuse keratitis.

Etiology.—The common cause is inherited syphilis. Hutchinson has called attention to the association of two other symptoms,—deafness and a peculiar conformation of the teeth, with interstitial keratitis, as a result of congenital syphilis. Acquired syphilis very rarely gives rise to interstitial keratitis. It is also attributed to scrofula, malaria, rheumatism and depressed nutrition. It occurs usually at puberty, but may come as early as five and as late as fifteen years.

Symptoms.—Points of ciliary congestion appear and then spots of opacity in the lamina propria. Gradually in a few weeks the whole cornea has a steamy, ground-glass appearance, and blood vessels run into the cornea producing the “salmon patch of Hutchinson.” Ulceration does not occur. Vision is

greatly diminished, and may be reduced to mere perception of light. The disease usually attacks both eyes, either simultaneously or consecutively. After two or three weeks, sometimes after several months time, the condition begins to disappear, starting with the periphery. The clearing process may occupy months or even a whole year. Examination will always show a certain diffuse opaqueness in the centre of the cornea. The subjects of typical forms of the disease present a remarkable combination of physical defects:—dwarfed stature, coarse flabby skin, sunken nasal bridge, scars at the angle of the mouth, malformed permanent teeth, the central incisors being vertically notched; there is deafness, some cicatrices in the pharynx, chronic periostitis of the tibia and hardened glands in the postcervical and epitrochlear regions.

Treatment.—This must be general as well as local. The first indication in the local treatment is to use atropine to keep the pupil dilated, so as to prevent glaucoma which would be sure to arise from the formation of synechiae. Dark glasses or a shade may be worn for the photophobia. All irritating applications are to be used with great care. When the process of resorption begins we may use hot compresses and the yellow oxide of mercury ointment. Some massage may be employed with the ointment. Subconjunctival injections of bichloride of mercury have recently been recommended. As to the general treatment, the syphilitic forms will require the usual specific treatment, though many of these patients are already debilitated and cannot bear the mercurials. Inunction may suit some of them. For feeble infants,

the iodides should be combined with codliver oil. For robust young people, hot baths of the entire body, followed by sweating in bed, will be found beneficial.

SEQUELAE OR CONSEQUENCES OF KERATITIS.

(1). Opacities which are more or less permanent. According to the density of the opacity these are classified as: (1) nebula, (2) macula and (3) leucoma. The term sclerosis is also used for a very dense leucoma. The position of the opacity will determine the interference with vision. The more central the greater the disturbance.

Treatment.—A macula may disappear spontaneously, if it be recent and not too intense. The clearing of all kinds of opacities of the cornea is favored by means that are more or less irritating to the eye, such as hot compresses, steam, yellow oxide ointment, with massage through the eyelids. Scraping of the cornea or cutting off the superficial layers has little effect as healing takes place by the formation of new tissue that is not transparent. It has been attempted to insert in an opaque cornea a button of glass, of celluloid or other transparent substance, but this is a physiological impossibility. Efforts have also been made to fill up a gap in a leucomatous cornea with transparent animal cornea the grafts becoming attached organically, but the tissue always becomes cloudy and the gain in vision is nothing.

(2). Inequalities of the cornea distort the retinal images and produce astigmatism. Nothing can be done for such a condition.

(3). Dense maculae are produced by incrustations of lead from applications to the eye of collyria made of acetate of lead. The incrustations are usually in Bowman's membrane, are covered by the epithelium and so are permanent. No lead lotion should be used in any ulcer of the cornea.

(4). Staphyloma of the cornea. The iris usually forms a good part of the staphyloma. It is always consecutive to a perforation with more or less destruction of the corneal tissue. The iris adheres to the remnant of the cornea, there being no longer any anterior chamber. The eye is more or less hard. The sclerotic may take part in the process and the eye is then said to be in the condition known as buphthalmia. The lids will then be unable to cover the protruding mass. Vision is abolished. The vitreous humor becomes softened and reabsorbed. The choroid, retina, and the ciliary body undergo atrophy. Operation is usually necessary.

(5). Fistula of the Cornea.—A perforation of the cornea may fail to close for a week or more. A permanent fistula does not occur. In some cases the eye must be removed.

(6). Malformations of the cornea.—There are three of these:—1. Keratectasia is a bulging of the cornea alone, the iris not being involved in it, as in staphyloma. 2. Keratoglobus. This is the result of infantile glaucoma. The whole cornea becomes thin and distended. 3. Keratoconus. In this the centre of the cornea becomes thin and is pushed forward, so that the cornea is conical but transparent. At first there are symptoms of myopia. It appears between the ages of fifteen and thirty, but the cause is not known. The treatment is optical and operative.

CHAPTER V.

DISEASES OF THE LENS.

LUXATION OF THE LENS.—This is either traumatic or secondary to some pathological change in the eye. In either case it is rare. Sometimes a rupture of the sclerotic accompanies the condition and the lens will be found under the conjunctiva. It may also take place into Tenon's capsule or into the vitreous, or forward into the anterior chamber.

CATARACT.—This is an opaque condition of the lens, or of its capsule or of both. We therefore speak of capsular, lenticular, and capsulo-lenticular cataract. A classification is made into (1) primary, (2) secondary, and (3) symptomatic. A cataract may be partial, complete, stationary or progressive. When complete it is said to be ripe. The clinical divisions are:

1. Senile. (a). Nuclear. (b). Cortical.
2. Congenital or Juvenile. (a). Zonular. (b). Central Lental. (c). Pyramidal, Anterior Polar, or Capsular. (d). Posterior Polar.
3. Secondary or Complicated.
4. Traumatic.
5. After-cataract.

They are also classified as hard, soft, fluid or Morgagnian, and sometimes by color, as black, white or amber.

Symptoms.—(1). Loss of sight, or change in the visual acuity. This is the only constant symptom. There may also be (2). Hyperaemia of the conjunctiva. (3). Pain and photophobia. (4). Polyopia and monocular diplopia. (5). The anterior chamber may be changed,—either shallower or deeper. (6). The pupil is frequently contracted. Its color varies according to the stage of the cataract, but a naked eye examination is no guide to the exact condition of the lens. The diagnosis must depend on the use of the ophthalmoscope. There is also the old catoptic test by the candle flame. The development and course of cataract vary from a few months to a few years. After maturity or when over-ripe it may gradually shrink to a flat disc, or there may be liquifaction of the cortex, the nucleus floating about. This is called Morgagnian cataract. Cataract associated with diabetes may undergo absorption but not others.

Etiology.—1. The most common cause is the age of the patient.

2. Certain diseases produce it. Diabetes, epilepsy, other convulsions, atheroma of the carotid, some cutaneous diseases, and after meningitis.

3. Certain occupations. It is seen in glass blowers and others exposed to intense heat and light and excessive perspiration.

4. Heredity plays some part. It tends to follow through the female line.

5. Certain toxic agents produce it. It may be produced artificially in rabbits by injection into the blood of naphthalin. This also produces changes in the retina and vitreous.

6. Traumatism is a frequent cause. The injury to the lens may be direct, or indirect, i.e., by concussion. To this class belong those caused by lightning stroke. The latter is complicated by optic neuritis, atrophy, rupture of the choroid, iritis, myosis or mydriasis, and paralysis of the accommodation.

7. Certain diseases of the eye produce secondary cataract. The more common are iritis, irido-cyclitis, choroiditis, detachment of the retina, glaucoma and disease of the cornea.

8. Strain of accommodation such as occurs in hypermetropia and astigmatism may cause it.

The etiology is by no means always clear and several factors may enter into its production. The cause may be quite extra-ocular and depend on nutritive disturbances.

Prognosis.—In estimating the prognosis regard must be had to the following points: (1). The probable condition of the interior of the eye. The patient should always have perception of light, and the field of projection should be good. (2). The probable condition of the refraction. (3). The mobility of the iris and its reaction under a mydriatic. (4.) The age and the general condition of the patient. Diabetes and Bright's disease do not forbid the operation, but great feebleness, dementia and chronic bronchitis are unfavorable. (5). The condition of the field of operation and its surroundings. Diseases of the lacrymo-nasal channels, granular lids, chronic conjunctivitis, and blepharitis all contra-indicate the operation. (6). The type and condition of the cataract.

Treatment.—Drugs do not exist which can dissolve a cataract, and electricity has been used without effect. During the progress of the trouble comfort may be given by attention to three points. (1). The refraction should be carefully tested and the exact glass given and changed when necessary. (2). Any congestion can be allayed by alteratives like potassium iodide, and tonic doses of strychnia will also help. (3). If so far advanced that glasses do not help, some comfort may be given by keeping the pupil moderately dilated with a weak mydriatic. This is only of use when the opacity is central. In some cases it is necessary to ripen the cataract artificially. The operations will be described elsewhere. When the lens has been removed the eye is in the condition called aphakia.

CHAPTER VI.

DISEASES OF THE SCLEROTIC.

As the sclera has a small supply of blood vessels and nerves it is not very liable to primary inflammation. There are, however, two forms of inflammation seen, scleritis and episcleritis. It is not usually possible to distinguish between these conditions and it is not important to do so. They occur in the form of small, dusky-red, subconjunctival swellings in the ciliary region. They run a definite course and come one after the other around the cornea. It is usually associated with a rheumatic or gouty diathesis and often follows an acute attack. Prognosis is good if the disease is superficial and not complicated. The treatment must be non-irritating. The pain may be controlled by heat. Other local treatment has very little effect on the course of the disease. The proper general treatment for the rheumatism or gout is necessary.

CHAPTER VII.

DISEASES OF THE IRIS AND CILIARY BODY.

HYPERÆMIA of the iris is a symptom rather than a special disease. It may be the precursor of iritis. There are three main symptoms. (1). A change in the color of the iris. (2). Contraction of the pupil. (3). Pericorneal injection. There is likely to be some photophobia and lacrymation. The treatment is in the management of the cause and the instillation of atropine.

IRITIS.—The usual classifications are as follows :

1. Idiopathic. 2, Symptomatic. 3, Traumatic.

The clinical divisions are : 1, Plastic. 2, Serous.
3, Purulent.

According to the cause the following classification is made: 1, Syphilitic. 2, Rheumatic, 3, Gouty, 4, Gonorrhoeal. 5, Diabetic. 6, Tubercular. 7, Scrofulous. 8, Cachectic. 9, Traumatic.

The symptoms of iritis in general are :

1. Change in the color of the iris. There is a loss of lustre and of the striated appearance of the membrane.

2. Pericorneal injection of the ciliary vessels. The redness is greatest near the cornea and shades away toward the equator of the globe.

3. Impaired mobility of the iris. There is a tonic contraction of the sphincter muscle from the irritation

of the ciliary nerves, so the pupil is contracted. The reaction of the pupil may be diminished or lost.

4. An exudation of inflammatory products always takes place. This may be (*a*) into the tissue of the iris, (*b*) upon its anterior or posterior surface, (*c*) into the pupillary area, or (*d*) into the aqueous humor. Exudation from the posterior surface of the iris produces adhesions, called synechia, between the iris and the capsule of the lens. These synechiae are formed where the iris naturally lies on the capsule, *i.e.*, at the uveal ring. They may be single or multiple, long or short, narrow or wide. They may not be seen till a mydriatic is used. The adhesion may extend all around, and is then termed complete annular synechia, and exclusion of the pupil. When the exudate fills the pupil so as to form a false membrane, it is termed occlusion of the pupil. An exudate into the tissue of the iris may produce irregularities in its surface.

5. Haziness of the cornea may be present. The opacity may be punctate.

6. There is a change in the character of the aqueous. The turbidity may be from pus, blood, or an exudate.

These are all objective symptoms of iritis. The subjective symptoms are,

1. Pain, photophobia and lacrymation. The intensity of the pain varies very much in different cases. It is usually severe and of the character known as ciliary. It comes first in the eyeball, then is supraorbital, infraorbital, or temporal. It is throbbing and stabbing in character, and is increased at night.

2. Disturbance of vision is in proportion to the disturbance in the media. Very great impairment denotes extension to the ciliary body or deeper structures.

3. Tenderness of the eyeball is usually present. If very great it indicates extension to the ciliary body.

4. There is often general disturbance, with malaise, fever, nausea, and marked depression.

Progress, Duration and Termination.—An acute case lasts from a few days to eight weeks. Recovery may take place without permanent synechiae being formed. Sometimes spots of pigment can be seen on the capsule of the lens indicating where an adhesion had been formed and broken by the action of the mydriatic. The subacute and chronic cases tend to relapse.

The simple or plastic form of iritis is the most common. It is seen in

1. In syphilis. About sixty per cent. of all cases of iritis is due to this cause. Both the congenital and the acquired form gives rise to it. In the latter case the inflammation comes usually between the second and the ninth month after the initial lesion, but it may be as late as the eighteenth-month. Both eyes are attacked, one a little later than the other. It does not show much tendency to recur.

2. In rheumatism. This is a predisposing cause in about thirty per cent. of the cases. It is common between the ages of twenty and fifty. One eye only is affected. Relapses are frequent at any interval. If properly treated perfect cure results. The term rheumatic is here used in a loose way to include all cases believed to be due to exposure to cold.

3. In gout. This resembles the rheumatic form. It may be the first symptom of the diathesis and be followed by an outbreak elsewhere.

4. In gonorrhoea. Iritis is met with in the gleet stage of gonorrhoea, and is nearly always preceded by, or associated with articular pain and swelling.

5. In diabetes. When this occurs it is usually intractable and is sometimes accompanied by haemorrhage into the anterior chamber.

Serous iritis is characterized by a serous or sero-plastic exudate deepening of the anterior chamber, slight dilatation of the pupil, haziness of the cornea and aqueous humor, and punctate deposit on the posterior surface of the cornea. There is very slight pericorneal injection and no great tendency to the formation of synechiae. Tension is likely to be increased.

Parenchymatous iritis is characterized by a general or a localized discoloration or swelling of the iris from inflammation of the tissue. The effusion becomes purulent with the filling up of the pupil and the formation of hypopyon. It is usually syphilitic and belongs to the secondary or tertiary stage. It is also called gummatous iritis.

Treatment.—There are three main indications.

1. To treat any constitutional condition that may underlie the disease. 2. To relieve pain, congestion and photophobia, to secure rest for the inflamed eye, and to combat sleeplessness. 3. To dilate the pupil and to keep it dilated till the inflammation subsides.

The most important local drug in all forms of iritis, except the serous, is atropine, which should be

pushed to keep the pupil widely dilated. It relieves pain, prevents or breaks up synechiae, favors the circulation and rests the eye by suspending accommodation. The effect may be increased by adding cocaine. If atropine is not tolerated one may use hyoseyamine, hyoseine, or duboisine. In using strong solutions of atropine care must be taken not to produce the physiological effects. Heat, either moist or dry, may be used to relieve the pain and to modify the inflammation. For the same purpose we may use phenacetine, chloral, or morphia. Local abstraction of blood is a useful accessory to the employment of mydriatics. The artificial leech is the best plan. When a case depends on a diathesis, the proper constitutional treatment must be adopted and carried on with vigor.

In serous iritis atropine must on no account be used or glaucoma may develop. The increased amount of aqueous may be responsible for this, as it does not readily pass from the eye. Diuretics, diaphoretics, and laxatives are indicated. Iodide of potash acts well, and if tension is increased then surgical treatment is called for.

Two surgical operations are done for iritis—viz., paracentesis and irideetomy. The latter is performed to secure one or all of three ends.

1. Prevention of recurrent attacks.
2. Re-establishment of the communication between the anterior and posterior parts of the anterior chamber.
3. For the improvement of vision.

CYCLITIS.—Primary and uncomplicated inflammation of the ciliary body is rare. The term iridocyclitis is generally properly applied. There are all the symptoms of iritis with decided tenderness on pressure, and there is likely to be severe complications in the way of secondary inflammations such as chemosis. There are the same varieties as in iritis and the same principles of treatment apply.

Course and sequels.—Any form under vigorous treatment may terminate in healing and a useful eye. Prognosis is always grave, however, because in the serous form, glaucoma is apt to develop and in the purulent form atrophy of the iris and choroid may result. Then the vitreous fills with opacities, and its contraction produces detachment of the retina, and shrinking of the eyeball,—*i.e.*, phthisis bulbi. If these eyeballs remain tender on pressure there is always danger of sympathetic inflammation and they should be removed.

MYDRIASIS.—This refers to an abnormal dilatation of the pupil and it may be either active or passive; active, from irritation of the sympathetic, passive, from paresis or paralysis of the oculo-motor nerve. The active form is not common. The dilated pupil reacts to light and to accommodation. It may be a symptom in certain nervous diseases, such as cerebral or spinal meningitis and intracranial tumors. It is present when the cervical sympathetic is irritated by wounds, new growths, or in other ways. Active dilatation of the pupil accompanies anger, fear, and some other emotions of the same kind.

The passive form is much more common. The more important conditions in which it is found are,—

1. Paralysis of the third nerve. The pupillary branch alone may be affected.

2. Progressive paralysis of the insane, tumors and other lesions in neighborhood of the nucleus of the third nerve, and thrombosis of the cavernous sinus.

3. The local application or internal administration of such drugs as atropine, homatropine, scopolamine, and daturine.

4. In the paresis that follows diphtheria, and in poisoning from the ptomaines in decaying articles of food.

5. In glaucoma.

6. Syphilis may cause a unilateral mydriasis.

7. After injuries, such as blows on the eye.

MYOSIS.—This also is either active or passive. The active form follows the use of such agents as eserine and pilocarpine locally, or the internal use of morphia, nicotine, and some other drugs. It is seen in the early stages of meningitis and apoplexy, and where a new growth irritates the third nerve. Passive myosis is seen in paralysis of the cervical sympathetic when it is associated with drooping of the upper lid, enophthalmos, reduced intra-ocular tension, and changes in the vascularity of the same side of the face. It is a condition that may follow injuries to the neck, such as stabs, gunshot wounds, and surgical operations. Myosis is found in the early stages of locomotor ataxia. In the latter con-

dition the Argyle-Robertson pupil is found,—the pupil which does not react to light, but does react to accommodation and convergence.

HIPPUS.—This is a rapidly alternating contraction and dilatation of the pupil, but is not common. It has been reported in meningitis, and in multiple sclerosis.

IRIDODONESIS.—This is a trembling of the iris which occurs when the iris has lost its support from the lens. It is detected when the patient turns his head rapidly from one side to the other.

CHAPTER VIII.

SYMPATHETIC OPHTHALMIA.

This term is applied to affections in which one eye is implicated as a result of disease in, or injury to the other. One is the exciting eye, the other the sympathizing eye. The condition is an inflammation, usually plastic, sometimes serous, affecting the iris, ciliary region, and choroid. There is no satisfactory explanation of the manner in which the inflammation passes from one to the other, but it is likely that the whole nervous mechanism of the exciting eye participates in the transmission of the trouble to the other.

One of the following conditions is present :—

1. Punctured wounds of the ciliary region. These cause eighty per cent. of the cases of sympathetic disease.
2. A foreign body in the eye.
3. Perforation of the cornea by wounds or ulcers, with incarceration of the iris.
4. Certain operations on the eye may cause it, viz., cataract operation, sclerotomy, iridectomy, discission, and couching.
5. Luxation and wounds of the lens may set it up.
6. Intra-ocular tumors may cause it.
7. Ossification and calcification of the choroid and ciliary body.

8. Pressure from an artificial eye, or incarceration of the stump of the optic nerve after enucleation.

A distinction is made between sympathetic irritation and sympathetic inflammation. Sympathetic irritation is a functional disturbance with a series of symptoms. These are photophobia, lachrymation, blepharospasm, defective or impaired accommodation, lessened visual acuity, inability to perform close work, neuralgic supra-orbital pain, photopsia, and contraction of the field of vision. Some tenderness makes the condition much more serious as to prognosis. This irritation disappears entirely on removal of the exciting eye. In the exciting eye the most important symptom is tenderness on pressure, but there is also lachrymation and neuralgic pain.

The sympathetic inflammation may come after a period of irritation, or it may be without any such premonition. It is recognized in three forms, 1. Iridocyclitis. 2. Scrous iritis. 3. Retino-choroiditis.

The period of incubation is from three to six weeks. It has come on as early as the seventh day, and as late as twenty, thirty, and even sixty years.

Treatment.—When the inflammation sets in it must be treated on the same principles as cyclitis and iritis. Prophylaxis is of the greatest importance, and this means the removal of the diseased or injured exciting eye.

An eye is to be enucleated or not on the following considerations :

1. Remove any eye which has been recently injured in the dangerous zone if recovery of sight is hopeless.
2. Remove any eye which has suffered injury if

the sight is defective or lost and there is tenderness on pressure.

3. If sympathetic irritation is present remove the exciting eye, if the sight is defective or lost.

4. If sympathetic inflammation is present,

(a). Remove the exciting eye if it is of no use.

(b). Do not remove the exciting eye if there is any useful vision.

CHAPTER IX.

DISEASES OF THE CHOROID.

The various forms of choroiditis cannot be diagnosed except by the use of the ophthalmoscope. There are no subjective symptoms which are peculiar to these conditions. With the ophthalmoscope there will be found an alteration in the uniform, dull, red surface of the eye-ground. This is caused by :—

1. Absorption of the pigment epithelium.
2. The formation of patches of a pale, yellow color with irregular boundaries, due to exudate.
3. The formation of patches of white color due to exposure of underlying sclerotic.
4. The formation of patches of pigmentary degeneration, scattered over the fundus, and especially near spots of atrophy.

Changes are found in the transparent media, particularly opacities in the vitreous. The disturbance of vision is in direct relation to the situation of the lesions and the amount of the atrophy. If peripheral, vision is not affected ; if near the macula, sight may be lost entirely. The diagnosis is made with the ophthalmoscope. To decide whether the retina is involved note the position of the retinal vessels in relation to the pigment masses or atrophic spots. The following structures are liable to be involved with the choroiditis :—

1. The retina. The condition may be a chorio-retinitis, or a retino-choroiditis. 2. The optic nerve and disc. 3. The vitreous. 4. The lens. What is called a posterior polar cataract develops. 5. The iris. Irido-choroiditis is the common form. 6. The sclerotic.

The prognosis depends on the position of the disease. The various forms are, 1. Superficial choroiditis. 2. Deep choroiditis. Of this there are two forms; the diffuse exudative and the disseminated. 3. Central choroiditis. 4. Myopic choroiditis.

Treatment.—This consists in rest, protection from light, blood-letting in the early stages, and the use of alteratives.

CHAPTER X.

DISEASES OF THE VITREOUS.

Of these there are two to be discussed. 1. Purulent hyalitis. 2. Opacities in the vitreous.

PURULENT HYALITIS is usually part of a panophthalmitis. It is caused by a penetrating injury or a foreign body and in connection with a purulent choroiditis. It follows inflammation of the cord in newly-born children, and it is seen with scarlet fever, erysipelas, and relapsing fever.

Symptoms.—If the cornea is clear a yellowish reflex is seen shining through the pupil. Tension is diminished.

Treatment.—No medicinal treatment is of any value. The eye will shrink and enucleation is demanded.

OPACITIES IN THE VITREOUS are either fixed or moving. They vary in size, shape and color. They may be in the form of membranous bands, dots, flakes, threads or strings, or it may be dust like and diffuse. The fixed opacities are usually adherent by two or more points to the choroid, retina, optic disc, and sometimes to the ciliary processes, or even to the capsule of the lens. The vitreous can only be examined by the ophthalmoscope. The opacities move in a direction opposite to that which the eye takes; an opacity on the cornea, or in the anterior part of the

lens goes with the eye. The subjective symptoms depend on the amount and density of the opacity. Patients complain of black or gray spots before the eye, either fixed or moving.

Etiology.—1. Refractive errors, especially high myopia. 2. Diseases of the eye, such as cyclitis, irido-cyclitis, choroiditis, and retinitis. 3. Injuries to the eye. 4. Diseased conditions of the system. The exhaustion of the infectious blood diseases, low fevers, endarteritis, gout, syphilis, malaria, portal congestion, anaemia, irregular or suppressed menstruation, and the prolonged use of arsenic. In old people the condition comes without apparent cause.

Treatment.—This will depend on the cause. If the patient can bear it, pilocarpine gives some definite results.

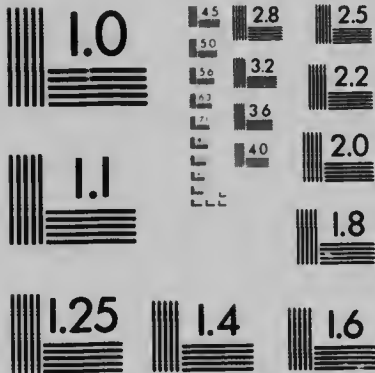
MYODESOPSIA or muscae volitantes are black specs and motes seen floating in the field of vision, especially when the eye is directed to a bright surface. They are annoying, but do not interfere with vision. Nothing can be seen with the ophthalmoscope. They are probably due to shadows thrown on the retina by elements in the vitreous. They are often ascribed to the torpidity of the stomach and liver, and are aggravated by the habit of searching for them. The only treatment is to remove any cause of eye strain and to give alteratives.

SYNCHISIS or fluidity of the vitreous shows lowered tension and minute opacities floating about on movement of the eye.



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CHAPTER XI.

GLAUCOMA.

This is a condition depending on an excess of pressure in the chambers of the eye. The causes are various, but all culminate in an obstruction to the escape of the intra-ocular fluid. Increased tension is the leading symptom of glaucoma. This was first recognized in 1830 by Mackenzie.

Etiology.—The remote causes of glaucoma include constitutionial disease such as rheumatism, gout, syphilis, disorders of the respiratory, vascular and nervous system, injuries of many kinds, morbid growths, congenital imperfections and senile changes.

The immediate cause in every case is an obstruction in the path of the intra-ocular fluid. The obstruction is different in different forms of the disease. When the anterior chamber is deepened, the lens and iris being displaced backward, the obstruction lies either in the contents of the chamber or in the tissues of the filtration area. When the iris is bulged forward by retention of fluid in the posterior aqueous chamber, the obstruction is primarily at the pupil, secondarily at the periphery of the chamber. When the pupil is open and the anterior chamber shallower, or at least not deeper, than in the healthy eye, we may expect compression of the filtration angle by pressure of the ciliary processes against the base of

the iris. The cause of the displacement is sometimes a tumor or an effusion of blood into the vitreous chamber. Primary glaucoma appears to depend on some vascular disturbance which congests the uveal tract, or upon a faulty relation of the lens to the parts around it. In any case the filtration angle is narrowed or closed. Glaucoma is rare before forty years of age. The Jew is specially liable. It may be hereditary. In eyes predisposed to it, it is excited by worry, insomnia, or any disturbance of the circulation. The use of atropia will bring on an attack in those predisposed to it.

Symptoms.—The objective symptoms are,—1. Increased intra-ocular tension. Tension is determined as follows:—The patient looks downward without closing the eyes tightly. The observer, standing in front and steadying his hands by resting the outer fingers of each on the patient's forehead, places the tips of the two index fingers on the upper eyelid, and with gentle alternate pressure feels the globe behind the corneal region. He then feels the other eye for comparison. The symbols of Bowman are in constant use to record the tension. T_n = tension normal. $T+1$ = slight increase. $T+2$ = considerable tension. $T+3$ = stony hardness. $T-1$ = slight decrease.

2. The second objective symptom is a change in the size and shape of the pupil, and in the mobility of the iris. The pupil may be round or oval or egg-shaped, semi-dilated and sluggish, or inactive.

3. There is a loss of transparency of the cornea which resembles ground glass. This is due to the oedema.

4. There is a change in the depth of the anterior chamber. It is usually lessened, but it may be increased.

5. There are changes in the normal appearance of the iris, and turbidity of the aqueous and vitreous.

6. Venous hyperaemia of the conjunctival and episcleral vessels.

7. Excavation of the nerve head or cupping of the disc. It is necessary to distinguish between this and the cupping that occurs physiologically and following atrophy.

8. Pulsation of the blood vessels on the surface of the disc. A venous pulse is often seen in healthy eyes at a knuckle of the veins as they bend over into the excavation. Pulsation of the arteries is to be seen in aortic regurgitation and in glaucoma. It is caused by resistance to the entrance of the blood into the eye.

The subjective symptoms are,—

1. Pain. This is severe and neuralgic. In violent cases the pain is intense and is accompanied by depression, pallor of the countenance, nausea and vomiting.

2. Diminished sensibility of the cornea. This is the result of pressure on the corneal nerves.

3. Loss of vision. This varies considerably in different cases and in the same case at different times. In each attack of subacute glaucoma the vision fails and gradually returns after the attack passes off, but each recurrence leaves a more permanent impression. In acute glaucoma vision is lost in a few hours.

4. Change in the refraction and accommodation, and in the field of vision.

5. Iridescent vision. With this there is also halo-vision, photopsia and chromopsia.

Clinical Types of Glaucoma.

1. Acute primary glaucoma. This is inflammatory or congestive. Two stages are recognized. (a) The prodromal or incubation stage in which there is a sudden failure of vision for a few moments or hours at a time with failure of accommodation, attacks of foggy vision, and halo-vision. These attacks come when the head is congested, after a full meal or during emotional excitement and with insomnia. This period may last a year or two. (b) The period of attack. This may come without warning. There is violent pain in the head, nausea and vomiting, usually coming on during the night. The symptoms come on rapidly. If left to itself it goes into the state of absolute glaucoma. The eyeball is stony hard, the iris atrophic, the lens opaque, the anterior chamber obliterated, and there is general disorganization of the eye.

2. Subacute primary glaucoma. This is characterized by its being intermittent. The first few attacks may amount to only slight obscuration or rainbow vision. Gradually the recurrences become more frequent and severe, and the remissions less complete and by degrees a persistent congestive glaucomatous condition is set up. It runs from several months to a year, and leads to total blindness.

3. Chronic primary glaucoma. This is also called simple glaucoma. It begins and progresses slowly, with little tendency to exacerbation or remission. The patient is usually over fifty years of age. There is an absence of the usual signs of glaucoma

in the anterior aspect of the eye on ordinary inspection, and there is no pain. Tension is only very slightly increased, and is often doubtful. The diagnosis is made from the excavation of the disc, and the contraction of the field. It may pass into either of the forms already mentioned.

4. Absolute glaucoma. This is the term used when the stage of blindness is reached. The main symptoms have already been mentioned. Advice is sought for the pain, which may be severe.

5. Haemorrhagic glaucoma. This condition has an important bearing on the operation.

6. Secondary glaucoma.

Treatment.—The progress of glaucoma can only be arrested by measures which lower the tension of the eye, and these must be employed early if loss of sight is to be avoided. In the absolute form treatment is only for the relief of pain.

Eserine and pilocarpine are used to lower the tension by opening the angle of filtration. Morphine internally will sometimes cut short an attack. Aperients are also indicated.

Operative treatment is often necessary. Paracentesis will relieve the tension temporarily and is often done preliminary to a more extensive operation, to determine the tendency to haemorrhage. Iridectomy is the usual operation done to open the angle between the iris and cornea. About one-fifth of the iris should be removed, and the wound should be in the sclerotic but in front of the iris, and large enough to permit extensive detachment of the iris. The knife should be withdrawn slowly to prevent a sudden gush of the aqueous, for too rapid reduction of tension

leads to intra-ocular haemorrhage. Care must be taken that no part of the iris remains in the wound. If tension is lowered a favorable result is indicated.

Scleral puncture or posterior sclerotomy is also done. It is indicated in advanced cases where the eye is blind and to relieve pain, or as a preliminary operation in cases of suspected haemorrhagic tendency. Sclerotomy is an operation resembling the incision in iridectomy, but leaving the iris intact.

CHAPTER XII.

DISEASES OF THE RETINA.

ANAEMIA AND ISCHAEMIA OF THE RETINA.—Ischaemia of the retina is the name given to the most profound retinal anaemia. It is seen as a symptom in embolism of the central artery, and in compression of that artery by disease or neoplasm. Anaemia is a symptom of local pressure, general anaemia, cerebral anaemia and syncope. It is most often seen as a result of extensive haemorrhage. The fundus-picture shows thin arteries, dark veins, and occasional spontaneous arterial pulsation.

Treatment.—Nitrite of amyl will restore vision for a few minutes in the recent cases. General treatment is not of much value.

HYPERAEMIA OF THE RETINA.—This is characterized by increased calibre and tortuosity of its vessels. This must often be inferred from the appearance of the vessels over the optic disc, showing increased redness. The condition is (1) active, when increased blood is sent to the retina because the systemic tension is increased, *e.g.*, in the tachycardia with fever or pneumonia; (2) passive hyperaemia, when the blood is not returned from the eye, as occurs in mitral disease, emphysema, violent cough and convulsive seizures. The treatment must have reference to the primary cause. Ametropia is to be corrected.

HYPERAESTHESIA OF THE RETINA.—This is found in neurotic and hysterical patients and may or may not be associated with ametropia. It is characterized by the symptoms which indicate a supersensitive retina, *i.e.*, photophobia, lachrymation, blepharospasm, neuralgic pain and imperfect eye-indurance. It is seen with chronic headache, neuralgia, and after prolonged fevers and pulmonary disorders. It may depend on disease in the nose and naso-pharynx. The treatment is to find the cause if possible and eliminate it. General tonics, rest and massage are of use.

RETINITIS.—The general symptoms are as follows :

1. Loss of transparency of the retina. This is the only characteristic ophthalmoscopic symptom. It may be a diffuse haze, a circumscribed opacity and swelling, or streaks of white infiltration.
2. Areas of exudation. This is a more advanced stage. White spots, sometimes discrete, sometimes confluent, or patches of bluish-gray, buff or yellow color are seen.
3. Tortuosity of the vessels and change in their size. The veins are darker than normal and wavy in outline. The arteries may not be changed.
4. Haemorrhages. These are either in the fibre layer or in the deeper parts of the retina. They may occur independently of inflammation. In the superficial or nerve fibre layer it is flame shaped. When in the deeper layers it is clean cut and more rounded.
5. Changes in the optic disc. There is increased

redness and loss of the distinct outline. Atrophy of the disc follows severe retinitis.

6. Pigmentation. This is not necessarily a symptom of retinitis.

7. Atrophy of the retina. This is marked by a permanent white or yellow opacity.

8. Change in the visual acuity.

9. Change in the field of vision. The entire field may be contracted, or scotomata may appear.

10. Distortion of vision. The forms of this are micropsia, macropsia and metamorphopsia.

11. Pain and photophobia are rare. There is usually a sense of discomfort rather than actual pain.

The diagnosis of any case depends on the loss of transparency determined by the ophthalmoscope. The other symptoms make up the characteristics of the various types.

Prognosis may be favorable or fatal according to the extent of the inflammation, its situation, and the cause.

Treatment.—Rest and blood letting are the local measures. The medicines most likely to be useful are mercury, iodide of potash, bromide of potash, ergot and pilocarpine.

The varieties of retinitis are as follows: 1. Primary. 2. Secondary. 1. Circumscribed. 2. Diffuse.

The clinical divisions are 1. Syphilitic. 2. Purulent or Septic. 3. Haemorrhagic. 4. Albumenuric. 5. Diabetic. 6. Retinitis pigmentosa.

Serous retinitis or oedema of the retina is a condition in which there is infiltration of the nerve fibre and ganglionic layer causing opacity, oedema and

venous hyperaemia. There are no external signs. Vision is foggy. The causes are cold and exposure to undue heat and light. No cause can be assigned frequently.

Parenchymatous retinitis shows in addition to oedema a cellular infiltration and organic change leading to atrophy. The cause of this is various constitutional complaints, disturbance of uterine functions, and intra-cranial diseases.

Syphilitic retinitis may occur in both acquired and congenital syphilis. In the acquired form it appears from one to two years after infection. Purulent retinitis is seen in pyaemia, purperal septicaemia, putrid bronchitis, and such pyogenic conditions. Both eyes are affected. Haemorrhagic retinitis may exist without inflammation. The size, number and position of the haemorrhages vary. They are either linear, flame-shaped, or irregular and round. The causes are diseases of the heart and blood vessels, such as hypertrophy, aneurism, and endarteritis; suppressed menstruation and the climacteric. The haemorrhage is due to the rupture of a small vessel whose coats have degenerated. The haemorrhage may set up a retinitis. The prognosis is usually unfavorable. In albumenuric retinitis variously shaped and placed white spots appear, beginning in or near the macula. These are first small, discrete and sharply separated, and later form a star-shaped figure. Haemorrhages of a flame shape also are seen, but not constantly. They indicate the violence of the disease. The common cause of this is Bright's disease, especially the chronic granular kidney, but it also occurs with the large white kidney and in

lardaceous disease. It also is seen with scarlatinal nephritis and the albumenuria of pregnancy. Three stages are recognized. 1. Hyperaemia, opacity and haemorrhage. 2. Fatty degeneration. 3. Retrograde metamorphosis.

Diabetic retinitis occurs in several forms. There are no pathognomonic signs.

In Retinitis Pigmentosa there are no phenomena of inflammation. There is degeneration of nerve tissue associated with great contraction of the blood vessels and the deposition of pigment in the retina. The pigment masses resemble bone corpuscles. Nystagmus is a frequent symptom with it. There is also hemeralopia or night-blindness. Treatment is of no value.

DETACHMENT OF THE RETINA.—This is a separation of the retina from the choroid due to serous fluid or blood between these membranes. The normal color of the fundus is lost and appears grey or bluish-grey, and the retina stretches out into the vitreous in folds which oscillate with the movements of the eye. The vessels look like dark tortuous cords. The detachment is partial or complete and may occupy any part of the fundus, but is most frequently below. The patient complains of metamorphopsia, floating spots or clouds, and phosphenes. The causes are malignant myopia, traumatism, effusion of blood, intra-ocular tumor, tumors and abscess of the orbit, retinitis and irido-eyelitis.

Treatment.—This consists of rest in the prone position, a pressure bandage and pilocarpine. Operation may also be of value.

CHAPTER XIII.

DISEASE OF THE OPTIC NERVE.

Certain congenital anomalies are often seen. These are:—1. Opaque nerve fibres. 2. Irregularities of the disc. 3. Coloboma of the sheath of the optic disc.

HYPERAEMIA OF THE DISC.—The disc is of a dull red or brick-dust hue with slightly blurred edges. The causes are:—1. Errors of refraction, especially hypermetropia and hypermetropic astigmatism. 2. Prolonged exposure to glare and heat. 3. Certain toxic agents. 4. Certain disorders of the brain, of which chronic insanity is a common example.

OPTIC NEURITIS.—Inflammation of the optic nerve may affect:—1. The intra-ocular termination of the nerve. 2. The retro-bulbar portion. 3. The intra-cranial division.

INTRA-OCULAR OPTIC NEURITIS.—This is also called Papillitis or Choked Disc. The symptoms are,—
1. Changes in the disc. These are increased redness and blurring of the borders, swelling of the disc, loss of the light spot, and complete hiding of the margins.

2. Changes in the blood vessels. The arteries are smaller than normal and partly concealed in the swelling. The veins are dark, distended and tortuous.

3. Haemorrhages. These are either in the swollen disc or near it.

4. Vision may not be affected.

5. There are no external changes and no signs of irritation.

Diagnosis is possible only with the ophthalmoscope. The course is very variable. It may come on rapidly or develop gradually for months with progressive failure of vision. As the inflammation and oedema subside the veins are less distended and vessels which were obscured reappear. The borders of the disc become visible, beginning usually at the temporal side. Then the disc becomes very white and atrophic.

Etiology.—The most common cause is brain tumor, and it occurs with all types,—fibroma, sarcoma, carcinoma, solitary tubercle and gummata. It also appears with haematoma of the dura mater and abscess of the brain. Meningitis is next in order of frequency as a cause, especially when located at the base of the brain. Other cranial causes are aneurism cerebritis, haemorrhage, thrombosis of the cavernous sinus, and hydrocephalus. It is also a symptom in the following conditions:

1. Acute febrile affections,—typhus fever, variola, scarlatina, diphtheria.
2. Syphilis.
3. Toxic agents, like lead.
4. Anaemia.

5. Menstrual disorders.
6. Exposure to cold and rheumatism.
7. Injuries.
8. Diseases of the orbital region,—tumors, caries and periostitis.

The treatment will depend on the cause. There is no local treatment.

ATROPHY OF THE OPTIC NERVE.—The symptoms of this are,—

1. Alteration in the color of the disc, varying from a slight gray to a pure gray, greenish-gray, or pure white. Rarely it is blue.
2. Alteration in the centre of the disc. There is a sinking of the surface in different degrees to form the atrophic cupping.
3. Unusual distinctness of the margin of the disc.
4. Change in the vessels. The arteries are smaller and the veins unchanged usually.
5. Change in vision. This is of all degrees.
6. Loss of color vision.
7. Change in the pupil. It does not react to light, but it may to efforts of convergence.

Varieties,—

1. Primary atrophy. This is also called gray, progressive, spinal or tabetic atrophy.
2. Secondary.
3. Consecutive.

The common causes of optic atrophy are locomotor ataxia, general paralysis of the insane, insular sclerosis, lateral sclerosis, exposure to cold, imperfect nutrition, and venereal excess. The condition runs a course extending over months or years.

The treatment is not very satisfactory. Strychnia, santonin and galvanism are used.

ORBITAL OPTIC NEURITIS is also called retrobulbar neuritis. In this the inflammation is in the orbital part of the optic nerve. At first there is no change to be seen in the fundus, and only very slight change to be seen at any time, but there is great loss of vision or complete blindness. The causes are toxic agents, such as lead and nicotine, menstrual disturbances, rheumatism, measles, diphtheria, scarlet fever, and overwork. The treatment is to remove the supposed cause and to use pilocarpine and later strychnia.

CHAPTER XIV.

FUNCTIONAL DISEASES OF THE RETINA.

AMBLYOPIA,—partial loss of vision.

AMAUROSIS,—total loss of vision. These terms are used where there is disturbance of vision without ophthalmoscopic changes. Modern methods of examination have greatly reduced the number of cases where these terms are applied.

Varieties.—1. Congenital amblyopia. In this there is a lack of development of the nerve elements.

2. Amblyopia ex anopsia. This is from want of use. It may be a congenital condition, or due to corneal opacity, persistent pupillary membrane, congenital cataract, or squint.

3. Congenital amblyopia for colors. Color blindness is present in about three per cent. of men, but only one-fifth of one per cent. of women. Achromatopsia and dyschromatopsia are terms used in this connection.

4. Reflex amblyopia. This is seen with parasites in the intestinal canal and with carious teeth.

5. Traumatic amblyopia. This comes from severe injuries to the head, bruises along the spine and on the brow along the course of the supra-orbital nerve.

6. Uraemic amblyopia.

7. Glycosuric amblyopia.

8. Malarial amblyopia.
9. Amblyopia from loss of blood.
10. Amblyopia from abuse of drugs. Those which may produce amblyopia are lead, tobacco, alcohol, nitrate of silver, mercury, carbon-bisulphide, nitro-benzol, salicylic acid, and quinine.
11. Hysterical amblyopia.
12. Simulated amblyopia. This is diagnosed by the use of prisms (the diplopia test), and by the use of colored lenses and letters or wool.

HEMIOPIA.—This is also called Hemianopsia or Hemianopia. In glaucoma, optic atrophy and neuritis one-half of the visual field may be wanting, but that must not be confused with this condition which depends on a lesion in the optic chiasma, in the visual tract, or in the visual centre in the occipital lobe.

The Visual Tracts.—The macular fibres in the retina make a triangular bundle, entering the papilla at the infero-temporal side. In the orbital part of the nerve it runs in the axis, coming to the upper and inner part just before the chiasm. Beyond the chiasm it again finds the axis and follows that to the brain. In the chiasm there is a semi-decussation. The tract winds around the crus cerebri and terminates in two roots,—corpora geniculata, externa and interna, and upon the posterior part of the optic thalamus (pulvinar). Fibres go to the anterior part of the corpora quadrigemina which are concerned in the activity of the pupil. These parts are the primary visual ganglia or primary optic centres. From these, fibres

radiate through the internal capsule to the cortex, winding outside the tip of the lateral ventricle to the lower part of the median surface of the occipital lobe.

1. Homonymous Hemianopsia. In this the corresponding halves of each field is wanting, *i.e.*, either both rights or both lefts.

2. Heteronymous Hemianopsia. Of this there are three forms :

(a). Binasal. The lesion is at the anterior and posterior angles of the chiasm.

(b). Bitemporal. The lesion is on both sides of the chiasm.

(c). Horizontal. The lesion is above or below the chiasm.

In the first form the lesion is on the opposite side to the dark fields. It is caused by a lesion in the occipital lobe, the optic radiations, the internal capsule, the primary optic centres or the optic tract. These are all back of the chiasm.

The pupil in Hemianopsia.—If we reflect the light on the dark field and reaction takes place, the lesion is back of the primary centres. If no reaction takes place, then the lesion is in or in front of the primary optic centres. This is Wernicke's symptom of hemioptic pupillary reaction.

The condition of hemianopia cannot be diagnosed by the ophthalmoscope, but only by the answers of the patient.

CHAPTER XV.

DISEASES OF THE ORBIT.

The general symptoms of disease of the orbit are,—

1. Proptosis or exophthalmos.
2. Immobility of the eyeball, either complete or partial.

The following symptoms are less frequent :

3. Chemosis of the conjunctiva.
4. Redness, swelling and oedema of the lids.
5. Pain, especially on attempted movements of the eye and on pressure. Frontal headache points to involvement of the frontal sinus. Tenderness on pressure along the margin of the orbit points to periostitis.
6. Fluctuation.
7. Disturbance of vision. This may be absent. When present it is due to interference with the optic nerve producing papillitis, atrophy or haemorrhage.

CELLULITIS.—This is an inflammation of the connective tissues of the orbit, and may be acute, sub-acute or chronic. It may be monolateral or bilateral and may undergo resolution or terminate in suppuration. When mild the symptoms are dull pain, slight swelling of the lids, slight exophthalmos and diplopia, without inflammatory or constitutional

symptoms. When severe there are chills, fever, deep-seated pain, general headache, limited movements of the eye, oedema of the lids and chemosis. Vision is not affected unless there is neuritis from extension to the nerve,—then atrophy may result. The abscess may be chronic and much less violent.

Etiology.—It may be idiopathic and due to exposure to cold. It may follow typhoid or scarlet fever, or may result from meningitis. It occurs with erysipelas. Some cases are metastatic and occur with pyaemia or septicaemia.

Prognosis.—In serious cases there is often a fatal termination from pus finding its way to the brain through the sphenoidal fissure.

Treatment.—Locally, frequently changed hot compresses and bleeding from the temple are of use. Open if there is any suspicion of pus. The opening is preferably made through the conjunctiva. Iron may be given internally. Quinine may not be used on account of the tendency to aggravate a meningitis.

TUMORS OF THE ORBIT are either simple or malignant. Clinically they are classified according to the structures from which they spring.

1. Tumors of the bony wall.
2. Vascular tumors.
3. Tumors of the connective tissue.
4. Tumors of the optic nerve.
5. Tumors of the lacrymal gland.

Tumors of the orbit do not extend to the eyeball. They may destroy vision when they set up inflamma-

tion. The only exception to this is in the case of a tumor of the optic nerve. If, therefore, a tumor is seen in both the globe and orbit it is safe to infer that it started in the globe. As a tumor of the orbit grows it produces more and more exophthalmos and interferes with the movements of the globe. Vision is most frequently lost by pressure producing either neuritis or atrophy. Certain tumors may extend to the orbit from adjacent parts,—

1. Encephalocele.
2. Nasal polypi.
3. Growths from the accessory cavities of the nose.
4. Tumors of the lids and skin of the face.

CHAPTER XVI.

DISORDERS OF THE OCULAR MOVEMENTS.

Movements of the eyeball are required to place the most sensitive part of the retina where it will receive the image of the object especially looked at ; to keep the eye turned in the desired direction during the movements of the head and body that would otherwise displace it ; and to keep the two eyes directed to the same point to secure images which, by fusion, will give binocular vision. There may be inability to execute these movements, or they may be accomplished by undue effort. If an eye is so directed that the image of the point on which attention is fixed falls on the fovea, the eye is said to fix that point.

Normally both eyes fix the same point. If one does not fix the point looked at, but has its visual line directed elsewhere, it is said to deviate. Such an eye is called the deviating eye, the other is called the fixing eye. The point fixed is called the point of fixation, the angle between the deviating position of the visual line and its normal direction through the point of fixation is the angle or degree of squint. An eye which deviates is said to squint. The deviation constitutes a squint or strabismus.

The varieties of strabismus are,

1. Strabismus convergens.
2. Strabismus divergens.
3. Strabismus deorsum vergens.
4. Strabismus sursum vergens.

Convergent squint.—In this the visual line of one eye is directed to the object fixed while that of the other is deviated inward and intersects that of the sound eye at some point nearer than the object fixed. If, for example, the left eye squints the right projects images correctly, the left makes a false projection to the left side, or the diplopia is simple or homonymous.

Divergent squint.—Here the visual line of the squinting eye lacks the necessary movement inward to fix the object. The diplopia is crossed or heteronymous.

In vertical squint the diplopia is crossed.

Another classification of squint is 1, Concomitant, and 2, Paralytic.

In the concomitant form the angle of the squint is the same in all positions of the eyes. In the paralytic form it varies.

Paralytic strabismus.—The general symptoms are,—

1. Loss of binocular vision,—*i.e.*, diplopia. The separation of the images increases as the object is moved to the side of the paralyzed muscle.

2. Strabismus or non-correspondence of the direction of the two eyes. This depends on the loss of power in the affected muscle and the unrestricted action of its antagonist. This is not always plainly manifest and may appear only when an attempt is made to move the eye in the direction of the affected muscle.

3. Loss or limitation of movement. This is also called the primary deviation. The limitation is always in the direction of the action of the affected

muscle. Consequently the deviation of the eye is in a direction opposite to the action of the muscle.

4. Deviation of the sound eye when the affected eye fixes. This is the secondary deviation. During the act of fixation by the affected eye the same degree of nervous impulse passes from the centre to the muscles of the affected eye and to those of its non-affected associate; the former requires an abnormally great influence to stimulate its movement and hence the latter is over-excited and the resulting movement is excessive. The secondary deviation, then, is greater than the primary. Primary and secondary deviations are in opposite directions.

5. There is false projection of the field of vision. This depends on an inaccurate estimation of the position of an object situated in such a position that it requires an effort on the part of the affected muscle to turn towards it.

6. Vertigo may be produced by the diplopia and the confusion which arises from trying to distinguish between the true and the false.

7. Altered position of the carriage of the head. This depends on the impulse of the patient to carry his head in that direction in which he is least troubled by double images. This is usually toward the side of the affected muscle.

Special Symptoms in Paralysis of Individual Muscles.—In each case suppose the right eye to be affected.

1. The external rectus paralyzed. The following may be present:

(a) Homonymous diplopia. The images are side by side, parallel, and the distance between them widens as the object is moved to the right.

(b) Convergent strabismus with limitation of movement outward.

(c) The secondary deviation is inward, the false projection of the field of vision is to the right side, and the face is turned to the right.

2. The internal rectus paralyzed.

(a) Crossed diplopia, the images being side by side and parallel, and the distance widening if the object be moved to the left.

(b) Divergent strabismus. The secondary deviation is outward, the false projection to the left side, and the face is turned to the left.

3. The inferior oblique paralyzed.

(a) Homonymous diplopia in the upper field, the images being one above the other, the image of the affected eye being higher and inclined to the right (to the affected side), the vertical distance between them widening as the test object is moved up and to the left.

(b) The affected eye is turned downward and inward. The secondary deviation is upward and inward, the false image is too far upward and the face is directed upward and to the left.

Method of examination and diagnosis of the affected eye.—This is not always a simple matter. If the paralysis is complete there is little difficulty. When partial, strabismus and limitation of movement are wanting, and the diagnosis must be based on an investigation of the double images. The patient is to be seated with the head and eyes in the primary position; that is, twenty feet from the object, in this case a candle flame, and one eye is covered with a red glass to distinguish the images. The following points are then determined :

1. The relation of the double images to each other and whether the images are visible in all portions of the field or limited to a portion of it.

2. The effect upon the lateral separation, the difference in height and the obliquity of the images when the test object is moved along the horizontal plane, to the right and to the left, and above this plane, upward and outward, and upward and inward; then below the plane, downward and outward and downward and inward.

3. The character of the diplopia. If the double images are only visible in the upper field then an elevator is involved, *i.e.*, the superior rectus or the inferior oblique; if only in the lower field, a depressor, *i.e.*, the inferior rectus or the superior oblique. In the former case the false image is higher, in the latter it is lower.

The Causes of Paralytic Strabismus.—These are either peripheral or central. 1. Syphilis. 2. Diphtheria. This affects the ciliary muscle first, and the external muscles later. It comes a month after the attack. 3. Rheumatism. This is a peripheral cause, and usually affects the external rectus. 4. Poisons. Acute and chronic alcoholism, chronic nicotine, chronic lead and fish poisoning, and gelsemium, chloral and carbonic acid. 5. Diseases at the base of the brain. A meningitis, a tumor or an aneurism may press upon the cranial nerves at the base of the brain. 6. Diseases of the spinal cord, especially locomotor ataxia. In the latter case the strabismus is often temporary and partial and may be associated with the pupillary changes characteristic of this affection. 7. Injuries. 8. Congenital paralysis.

The prognosis depends entirely on the cause.

The treatment also depends on the cause. The annoyance of the double images may be obviated by a ground glass over the affected eye. In some cases prisms may be worn to fuse the images. Advancement of the muscle may be done.

Paralysis of the intra-ocular muscles or cycloplegia may or may not be accompanied by dilatation of the pupil. The chief symptom is loss of accommodation just as occurs as the result of a mydriatic. This may be complete or partial. It cannot be detected after the age of fifty.

Concomitant Squint.—In this the squinting eye has the power to follow the movements of the other eye in all directions. It may be periodic or permanent, monolateral or alternating.

Etiology.—1. Disturbance of the relation between accommodation and convergence by errors of refraction.

2. Disparity in the length and thickness of opposing muscles.

3. The size and shape of the eyeball and orbit.

4. Amblyopia of one eye, by the loss of the natural stimulus of diplopia to exact convergence.

5. The distance between the pupils.

Single Vision in Concomitant Squint.—Diplopia may be present at first, but does not continue, for the false image being less distinct than the true one is suppressed by the brain centre.

Treatment of Concomitant Squint.—1. The spectacle treatment. The error of refraction should be determined and the proper glasses worn. In most cases the error is a hypermetropia, often associated with astigmatism.

2. Operative treatment. Tenotomy of one or both recti, with or without advancement of the opposing muscle. Advancement is also made without tenotomy.

Swanzy's simple test for binocular vision.—Hold a pencil midway between the eyes and the page of a book at right angles to the lines of type. If binocular vision is present there is no obstacle to reading; if not, portions of the page are obscured by the pencil.

LATENT SQUINT, INSUFFICIENCY OF THE OCULAR MUSCLES, MUSCULAR IMBALANCE, HETEROPHORIA. —These terms are used to describe a condition in which the patient has a habitual binocular vision, but maintains it by special exertion, and when one eye is covered deviation is manifest. The terms in common use are,—Heterophoria, a tending of the two visual lines to the same point. Esophoria is a latent convergent squint, and is produced by insufficiency of the external recti. Exophoria, a tendency to a divergent squint, is produced by insufficiency of the internal recti. Hyperphoria is a latent vertical squint.

Causes.—The causes include some of the causes of actual squint, opposed by a well-developed power of binocular co-ordination and fusion.

Symptoms.—Headache and eye ache are the most common symptoms. In severe cases vertigo, a sense of strain, or a feeling of mental confusion are also present. Pain in the occiput is common. It may follow the use of the eyes, or it may be delayed and come on at certain hours of the day or night. Chorea, epilepsy, melancholia, migraine, palpitation

of the heart, night terrors, flatulent dyspepsia, and a host of other complaints have been attributed to muscular and accommodative asthenopia. No doubt they are often associated, and cure has followed the correction of the ocular difficulty, but it has been exaggerated as a cure-all. The diagnosis of these conditions is made with the aid of prisms, the Maddox rod or double prism, or Stevens' phorometer.

Treatment.—Small errors are unimportant unless causing symptoms. The error of refraction must be corrected, and this may be enough. Gymnastic exercises with prisms are of value. Practice is given in fusing the double images produced by prisms. Prisms may be ordered for constant wear. If these methods fail a partial tenotomy of the antagonistic muscle or an advancement of the feeble muscle may be done.

NYSTAGMUS.—This is a slight, rapid, involuntary, to-and-fro movement of the eyeballs. It may be from side to side, up and down, or rotary. It is either congenital or acquired. It is usually bilateral. In congenital cases it is seen with defective construction of the eye and in albinism. It may be caused by certain occupations, especially mining, and this form is commonly called miner's nystagmus. This is the result of working in a poor light for hours with the eyes in a strained position. If high astigmatism is associated with it some improvement may follow the use of proper glasses. Change of occupation will also relieve the miner's cases.

CHAPTER XVII.

ABNORMAL REFRACTION AND ACCOMMODATION.

Normal refraction is termed emmetropia. This is the condition in which parallel rays are focused exactly on the retina, the eye being in a state of rest.

Abnormal refraction is termed ametropia, and of this there are three forms :

1. Hypermetropia.
2. Myopia.
3. Astigmatism.

HYPERMETROPIA.—In this parallel rays of light come to a focus behind the retina, the eye being in a state of rest. The causes are either an arrest in the development of the eyeball in its antero-posterior axis, the eye being too short from before backwards, or it may depend on deficient refracting power in the media. To correct hypermetropia a convex lens must be placed before the eye to supplement its power of refraction. The strongest convex glass with which a hypermetropic eye can see distant objects most distinctly is the glass which corrects its error of refraction, and is the measure of the hypermetropia. When no glass is used there is an excessive demand upon the accommodation in the effort to see distinctly. The effect of this strain is to produce,—

1. Cramp of the ciliary muscle.
2. Accommodative asthenopia.
3. Convergent concomitant strabismus.

MYOPIA.—In myopia parallel rays of light come to a focus in front of the retina, the eye being in a state of rest. In most cases the antero-posterior axis of the eye is too long. The amount of the error may be determined experimentally by trial lenses. Concave spherical lenses are used for this purpose, and the weakest lens with which the patient sees perfectly at a distance is the measure of the myopia. It develops from the eighth to the tenth year and is apt to increase, specially during the early years of puberty. Its progressive increase is encouraged by much use of the eyes for near work. When myopia is progressive it may lead to organic disease such as,—

1. Posterior staphyloma.
2. Degeneration of the choroid near the macula lutea.
3. Haemorrhage into the retina.
4. Detachment of the retina.
5. Opacities in the vitreous.

It is also common to find insufficiency of the internal recti muscles associated with myopia.

ASTIGMATISM.—This is a compound form of ametropia, due to the cornea being more curved in one meridian than in the other. The directions of the greatest and least curvature are always at right angles to each other, and usually fall in the vertical and horizontal meridians. The result is that rays of light entering the eye do not meet at a common focus, but form a streak of light. There are various kinds of astigmatism, according to the position of the two principal foci in relation to the retina.

1. Simple hypermetropic astigmatism. In this the eye is emmetropic in one meridian and hypermetropic in that at right angles to it.

2. Compound hypermetropic astigmatism. Both meridians are hypermetropic in this case, but one more than the other.

3. Simple myopic astigmatism.

4. Compound myopic astigmatism.

5. Mixed astigmatism. In this one focus falls behind the retina and the other in front ; one meridian is hypermetropic and the other is myopic.

There is also a condition called *irregular astigmatism* in which the refraction of the eye differs in different parts of the same meridian. This is due to irregularities on the surface of the cornea, the result of ulceration. It cannot be corrected.

ANISOMETROPIA.—This is the term used to denote a difference in the refraction of the two eyes.

PRESBYOPIA.—This is a diminution of the power of accommodation, which begins at an early age, and is due to natural changes in the eyes. At the tenth year of life the near point begins to recede. This is due to a progressive change in the crystalline lens, which becomes harder and, therefore, less easily altered in its curvature. In advanced life there is also diminished energy in the ciliary muscle. As the near point recedes from the eye it finally reaches a distance beyond that at which the person usually reads or writes. This comes between the ages of

forty and forty-five in normal eyes. In hypermetropia it is earlier; while in myopia it is postponed, or in the higher degrees does not come at all.

PARALYSIS OF ACCOMMODATION.—This is usually combined with mydriasis. It can only be ascertained by examination of the function, and it causes inconvenience according to the state of refraction. It is caused by atropine, paralysis of the third nerve, exposure to cold, syphilis and diphtheria. Treatment depends on the cause.

OPERATIONS ON THE EYE.

CHAPTER I.

THE PRACTICE OF OPERATIONS ON ANIMALS' EYES.—The frequent practice of operations on the eyes of animals is of the greatest importance to a beginner, as it enables him to become acquainted with the use of the various instruments, to recognise the difference in density of the tissues which have to be cut, to become familiar with the technic of each operation, and to lose a certain amount of the timidity which is almost invariably present when beginning operative work on the live human eye.

A set of instruments should be obtained and used for this purpose alone. The following are all that are required for practising most of the operations on the eyeball and muscles:—An eye speculum, a pair of fixation forceps, an angular keratome, a Graefe cataract knife, a pair of iris forceps, a pair of iris scissors, a cystotome, a scoop (Daviel's), a cataract needle, a strabismus hook, a pair of strabismus scissors, a small scalpel and a few curved needles.

Pigs' eyes are the most useful for practice, as they more nearly resemble human eyes in size and density of tissue than do the eyes of other animals that are readily obtainable. Sheep's eyes and cows' eyes will do for demonstration, but are too dense and too large. For operation upon the muscles, the orbits and the lids it is necessary to have the head with the eyes in position. If possible the operations should be practiced also on the head of a cadaver, but it is difficult to obtain material of this character, and even when it is at hand the eyes are often so shrunken and collapsed, and have undergone so great changes, that they are not satisfactory. It is advisable to obtain some experience also on the eyes of living animals. Dogs, cats and rabbits may be used for this purpose, of course under chloroform.

If not convenient to use the dead eyes at once they may be kept fit for operation purposes in a 1-10th of 1 per cent. solution of formaldehyde. When operating on animals' eyes it is customary to place them in a mask representing a human face. In the orbital cavities are placed removable sockets in which the eyes are firmly held, and by means of a central screw the intraocular tension can be changed at will. If one does not possess a mask a very good substitute can be had in a large piece of cork. The eye is fastened to this by a few pins or tacks. A still more simple plan is to use a towel in which the eye is wrapped and held in the hand, either one's own or that of an assistant. This is the best plan in practicing puncture and counter-puncture and the different varieties of corneal section.

IRIDECTOMY.—This is the principal operation done on the iris. It consists in an excision of part of that membrane. The indications for it are,

1. In closure or obstruction of the pupil to make a new opening for the rays of light. This is termed an artificial pupil.

2. In central opacities of the cornea and lens.

3. In high degrees of keratoconus. In connection with this the point of the cone is removed by cauter, the knife or a caustic.

These three indications are for optical purposes. The operation is also used for therapeutic reasons, and is then termed curative iridectomy.

4. To reduce increased tension of the eyeball.

5. To cure or improve chronic iritis and iridocyclitis.

6. To remove tumors and foreign bodies in the iris.

7. To ripen immature cataract.

8. As a preliminary step in cataract operation.

9. In removing traumatic or operative prolapse of the iris.

The instruments necessary are a lid speculum, a pair of fixing forceps, a bent lance-shaped knife, a pair of curved iris forceps, a blunt iris hook, a pair of curved iris scissors, a spatula, a blunt pointed probe and a narrow bladed cataract knife.

The Execution of the Operation.—The patient lies on the bed or table ; his eye is sterilized and cocaine-ized. In glaucoma and when the eye is much inflamed it is necessary to use general anaesthesia. The speculum is introduced, the eye is held by the fixation forceps at a point opposite the point of punc-

ture. The lance-shaped blade is entered at the limbus of the cornea, the point being directed at first slightly toward the iris. As soon as the point of the knife enters the anterior chamber, the direction is changed so that it is pushed toward the axis of the eye, and parallel to the surface of the iris. If necessary to enlarge the wound this may be done when withdrawing the knife by turning it to one side or the other. Next the iris forceps are entered and the edge of the iris caught near the pupillary margin. The iris is then withdrawn and the protruding part cut off with the scissors. If the iris maintains its tone, the corners return to their natural position, and the pupil has the appearance of a key-hole. If the iris is caught in the wound it must be freed by the blunt pointed probe. The eye is then dressed. There is ordinarily not much reaction.

Instead of the lance shaped knife, the narrow cataract knife may be used, and it is a decided advantage in glaucoma and when the anterior chamber is shallow.

The iridectomy in glaucoma should be large and in the periphery. The Graefe knife is kept well in the scleral border, and as much of the iris removed as possible. The iris is cut first at one margin, then it may be torn from its attachment or it may be cut, and then a third snip removes the other corner.

If it is necessary to make a very small round opening for optical reasons, we make a small corneal incision a short distance from the limbus.

In an aphakial eye it is difficult to catch the iris with forceps, so we use a blunt hook for the purpose.

Accidents and Mistakes.—1. When the anterior

chamber is very shallow the knife may be advanced only between the layers of the cornea. This position of the knife should be recognized by the absence of the metallie lustre which any knife blade has when in the anterior chamber. If such a mistake happens, the knife should be withdrawn and a new incision made.

2. The knife may engage the tissue of the iris. If it cannot be freed the knife may be withdrawn, enlarging the wound at the same time by cutting from within out. If the wound is still too small, it may be enlarged with a pair of scissors.

3. The capsule of the lens may be injured. This will be followed by cataract unless the lens was in this condition before. The injury may be done by the point of the knife or may be caused by the iris forceps in the attempt to catch the edge of the iris.

4. Haemorrhage into the anterior chamber may be the result of two causes, either a faulty technic in the operation or a haemorrhagic predisposition of the eye. When the whole cavity is filled some of it may at once be removed by the spatula.

6. Prolapse of the vitreous may occur. In glaucoma no harm comes from this. Some operators consider it rather a favorable condition.

7. Ineareeration of the iris. This is one of the most common imperfections of the operation. A second operation may be done to relieve it.

OPERATIONS ON THE CRYSTALLINE BODY.—Cataract operations are of three kinds : 1, displacement,

when the cataract remains within the eye but is pushed away from the pupil; 2, extraction, where it is taken out of the eye; and 3, discission, where the lens capsule is divided, and the lens substance brought in contact with the aqueous humor, by which it is gradually dissolved and absorbed. This operation is also called the method by solution.

DISPLACEMENT.—This is now more of historical than practical interest. From antiquity down to about 1850 it was the recognized operation for cataract. It was done in two ways:

1. By depression. A broad needle was introduced through the lower segment of the cornea into the pupillary space, with the surface of the blade flat upon the capsule of the lens, then by gradually raising the handle of the needle the lens is pressed down and couched in the lower anterior part of the vitreous.

2. By reclinatio. The needle is introduced through the sclerotic some distance behind the cornea, the eye being rotated at the same time in the opposite direction. The needle is thrust obliquely forward to enter the lens which is then torn away from its ligament and pressed down into the vitreous.

The cataract would often rise again before the needle was withdrawn, and the operation had to be repeated. It mostly rose again the following day or some time later. It produced irido-choroiditis, glaucoma, detachment of the retina, and phthisis bulbi. The operation is still recommended by a few for certain cases of shrunken and secondary cataract.

EXTRACTION.—This operation was first done by Daviel in 1745. It was not universally adopted till almost a hundred years later. The operation is in-

icated in all hard cataracts when the functional examination warrants the possible restoration of vision. There must be perception of light from all parts of the field of vision.

The age of fifteen years is usually considered the end of discission and the beginning of extraction. Old age is no contraindication, if the health is good. The question is often asked whether we should operate for cataract as long as the other eye has good sight. The answer to this must depend on the conditions surrounding each patient. We should operate when the chances for success are greatest. It is never advisable to operate on both eyes at the same time.

The instruments necessary are : A speculum, a fixing forceps, a Graefe's knife, a cystotome, a Daviel's spoon, a wire loop, a spatula and blunt pointed probe, and if excision of the iris is necessary, the iris forceps and scissors.

The Technic of Extraction.—The first step is the corneal section. The puncture is made through the limbus of the cornea on the temporal side about one-half to one millimetre above the horizontal meridian; the knife passes straight across the anterior chamber, keeping clear of the iris, and transfixes the limbus of the cornea on the nasal side at a point just opposite to the point of entrance on the temporal side. By backward and forward movements of the knife the section is completed in the limbus, but at the last a small conjunctival flap may be made. The section comprises almost half of the corneal circumference, and lies from one end to the other in the same plane.

The second step is the opening of the capsule, which is done with a cystotome. The latter is introduced with the knee forward, the incision is made in the capsule, and in withdrawing it the knee is again kept forward.

The third step is the removal of the cataract, *i.e.*, the expulsion of the lens. Pressure is put on the eyeball by means of a Daviel scoop or a spatula at the lower part of the cornea, the pressure being directed towards the centre of the globe. This makes the wound gape, the lens pushes the upper part of the iris up, tilts the corneal flap forward, presents itself in the gap, and under continued pressure it will make its escape. When the bulk has passed the pupil, the lens may be followed up with the spatula, and by slight stroking and pressing, the lens is completely expelled with the cortex. The eye is now closed and allowed to rest for a minute. Then the pupil is cleansed and the remnants stroked out of the wound with a spatula, so as to get perfect coaptation of the edges of the cornea. The lids are now closed and the dressings applied.

Mistakes and Accidents Happening during the Operation.—1. When the knife passes through the anterior chamber its point may engage the iris, or the counterpuncture is not at the point desired. In either case the knife may be withdrawn and the trouble corrected.

2. The iris may fall over the knife when cutting upward. The edge of the knife may be turned slightly forward to avoid it. If in spite of this the iris still remains before the knife, it has to be cut and the operation completed in the usual way. It may involve an iridectomy.

3. The knife may be introduced with the back up instead of the cutting edge. This can be remedied by simply turning the knife and continuing the section as if nothing had happened.
4. If the knife deviates from the plane of the section, it will make an uneven surface which is less favorable for primary union.
5. In using the cystotome the ligament of the lens may be ruptured. This may not involve anything more than removing the capsule with the lens, or it may necessitate an iridectomy.
6. We may fail to open the capsule. Then the cystotome should be again introduced.
7. The section in the cornea may not be large enough to allow the lens to pass out. In such a case the wound should be enlarged with scissors.
8. Prolapse of the vitreous is one of the common accidents, and it may be unavoidable. As a result of disease the ligament may be frail or ruptured, and as soon as pressure is put on the eye vitreous presents.
9. Haemorrhage from the depth of the eye is most serious. This may occur during the operation or soon after. It is generally accompanied by intense pain.

DISCUSSION.—This is indicated,—1. In cataracts of young people up to the age of fifteen, and sometimes up to the age of thirty-five.

2. To ripen cataracts.
3. As a step in the surgical treatment of high myopia by extraction of the lens. This is known as Fukala's operation.

4. As a frequent operation for secondary cataract.

The instruments required are, a speculum, fixation forceps and discission needles of different sizes and shapes.

Performance of Discission.—The needle is thrust through the cornea towards its margin, the puncture being slightly oblique. It is then passed through the lens capsule more or less extensively according to the effect desired. In tough capsules, we may obtain a better opening by lacerating the capsule with two needles. In this double needle operation an assistant steadies the eye with the fixation forceps, and one needle is entered from each side. The capsule can be torn without pulling on the ciliary processes. In cases requiring this form of operation it is probably safer to extract the membrane.

OPERATIONS ON THE CORNEA.

REMOVAL OF THE SUPERFICIAL LAYERS OF THE CORNEA.—This is called also abrasio corneæ. It consists in scraping or shaving off the corneal epithelium, and the underlying layers if necessary. It may be done with a Graefe's knife, a lance shaped knife, or a sharp scalpel. The indications for it are,—

1. In deposits of different substances in the cornea.
2. In the degeneration of the corneal epithelium in which a strip of the tissue becomes opaque. It is best to remove only a small portion of such opacities first, and if the result is satisfactory then the rest may be done later.

INCISION, CURETTING, AND DISINFECTION OF CIRCUMSCRIBED INFILTRATIONS OF THE CORNEA.—

This is applicable :—

1. In pustules of the cornea.
2. In marginal infiltrations which produce crescentic, annular, and progressive ulcers.
3. In irregular, progressive infiltrations, such as accompany dendritic, serpiginous, and malarial keratitis.

A fine sharp spoon is used to scrape away as much tissue as may be necessary, and then the area is touched with iodine, nitrate of silver, or bichloride of mercury. Iodine is the best. There is also the method of hydraulic curetting by means of a fine jet of antiseptic solution thrown with considerable force from a fine syringe. This operation is facilitated by the use of fluoresceine.

CAUTERIZATION.—The cautery may be chemical, thermic, or electric, and is used in diseases of the cornea, and conjunctiva, and for certain conditions of the lids and lacrymal apparatus. Nitrate of silver is the chemical caustic most in use. The actual cautery does not require a special instrument, but may be used in the form of a platinum or silver wire heated in a spirit lamp. The galvano cautery may be used in the following conditions. 1. In infected corneal ulcers. 2. In keratoconus. 3. In infected wounds after cataract extraction. 4. In trachoma. 5. To obliterate the lacrymal sac. 6. In small staphyloma of the cornea.

PARACENTESIS OF THE CORNEA.—This is made with a straight or bent lance or with a narrow or triangular cataract knife. The indications are,—

1. To evacuate blood from the anterior chamber.
2. To evacuate pus from the anterior chamber.
3. In iritis serosa.
4. In glaucoma.
5. In swelling of the lens after discission or injury.

After the incision is made the aqueous is evacuated by slowly withdrawing the knife while pressing the posterior lip of the wound, or after the knife is removed a probe or director may be used to keep the wound open.

KERATOPLASTY.—Attempts are occasionally made to remove opaque scar tissue and to replace it with transparent substance. In 1856 Nussbaum used a disc of glass. It healed and gave fair vision for a time and then it incruited and was cast off. The transplantation of cornea from animal to man has been tried since 1824. The experiments prove that cornea can be inserted, will take root and remain transparent for a time. The operations of Von Hippel have been the most successful, but after all the results have been meagre. The operation is done with a small trephine, and either the whole thickness or the anterior layers of the cornea removed and a corresponding piece from another cornea inserted. No suture is used, but the eyes are kept closed with a bandage for several days.

TATTOOING THE CORNEA.—This operation is suitable only in old leucomas of unirritable eyes. The

best substance to use is India ink. It should be sterilized, and rubbed up to an oily consistence in a sterilized mortar. The operation is done with a pencil of four to eight round needles which are thrust obliquely into the cornea a great many times, so as to destroy the epithelium completely, and make a great many small canals in the corneal substance for the reception of the ink, which is rubbed in freely with the finger or a small spatula. Then the cornea is irrigated with a warm solution of chloride of soda.

OPERATIONS FOR PTERYGIUM.—1. The method of Arlt, by exsecting a rhomboid piece. The portion on the cornea is caught with forceps and removed from its apex with a knife. Then a triangular piece of the bulbar part is exsected, and the defect covered by drawing the conjunctiva from above and below.

2. Szokalski's method is by ligation of the epibulbar part. A thread armed with a needle at each end, is passed first near the cornea, then, with the other needle, three or four millimetres farther back, so between the pterygium and the sclera that the thread remains double at each end, single in the loop. Both needles are cut. One single thread is tied over the pterygium near the cornea, the other near the caruncle, so as to constrict the pterygium. Then the loop is tied so as to constrict the base. The portion between the threads is necrosed and the portion on the cornea wastes away so as to leave an opacity.

3. Desmarres' method of transplantation into the lower fornix of the conjunctiva, consists in removing

the pterygium from apex to base, making a curvilinear incision with curved strabismus scissors, into the conjunctiva of the lower fornix, and stitching the apex into the angle of the incision.

Any of these operations may be followed by relapse.

Stationary pterygia and pingueculae need not be operated on except for cosmetic purposes.

SCLEROTOMY.—This is the only operation done on the sclerotic, and is chiefly for the relief of glaucoma. We distinguish between anterior and posterior sclerotomy according as the incision is before or behind the insertion of the iris.

Anterior sclerotomy is done with a narrow Graefe knife and is really the same incision as is made in the operation for iridectomy and in that for extraction of cataract, but the middle third is left uncut. It is advised that the internal layers in the corneo-scleral border in that part uncut, should be incised, and this can be done before the knife is withdrawn. Such a wound heals more readily than the iridectomy wounds, but there is a great tendency to incarceration of the iris.

Posterior sclerotomy is done through the lower and outer part of the sclerotic, between the inferior and external recti, and behind the ciliary muscle. A simple incision is made which is really a sclero-chorio-retinotomy. Posterior sclerotomy is indicated in:—1. Traumatic haemophthalmus. 2. In glaucoma, when other operations have failed. 3. In detachment of the retina. 4. As an initial step in other

operations, *e.g.*, removal of foreign bodies and parasites.

OPERATIONS ON THE MUSCLES OF THE EYE.—

These are intended to move the insertion of the muscle either forward or backward. The instruments necessary for these operations are a wire speculum, two pair of fixing forceps, a pair of delicate toothed forceps, curved strabismus scissors, two squint hooks, needle holder, fine curved and half-curved needles.

TENOTOMY.—This is setting the muscle back. There are a number of methods which all give good results. The one recommended is as follows: The conjunctiva is grasped in front of the insertion of the tendon with the fixing or iris forceps, one blade up the other down, raised in a fold, and incised with the squint scissors. Then through this opening the centre of the tendon is picked up and incised in the same way. Now the strabismus hook is passed through this opening and the remaining portions of the tendon picked up and divided. When the tendon is all divided the hook passes freely under the conjunctiva quite up to the cornea. Unless there is over-correction the wound is not closed with sutures. Except in very young children it is not necessary to use a general anaesthetic. The eyes should be examined immediately after the operation to determine how much the deviation has been reduced. The immediate effect commonly differs from the ultimate effect. After a tenotomy of the internal rectus the primary effect is apt to diminish for several days, and then it increases gradually for weeks, months or

years. The immediate effect of a tenotomy of the external rectus increases the next three or four days, then it diminishes very gradually so that the ultimate result may be that the eye is in the same position as before the operation. In divergent strabismus there is not much danger of converting into a convergence.

To diminish the effect sutures are applied, either a simple closing suture, or a restrictive suture, taking a firm hold.

To increase the operative effect the wound may be extended up and down, but this must be done with great care. If overdone it makes the eyeball protrude and the caruncle sink, giving the eye a staring look. For the same purpose the eyeball may be drawn to the other side by a suture passed through the superficial layers of the sclerotic near the cornea and the corresponding lid commissure.

The following accidents and mistakes may happen :—

1. The wrong eye may be operated upon.
2. Haemorrhage may occur into the capsule of Tenon so that the eye protrudes.
3. Perforation of the sclerotic may occur.

ADVANCEMENT OF THE MUSCLE.—This is also called prorrhaphy. The original operation was devised by Critchett in 1862. A portion of the tendon is cut off and the stump stitched forward to the sclerotic. There are numerous modifications of the operation, the pulley operation of Prince being popular for some years. Wootten's operation, without tenotomy of the antagonist is the most satisfactory. The muscle may also be shortened by folding and stitching without cutting off any part of it.

ENUCLEATION, OR SHELLING OUT THE EYEBALL.

—The ball is removed with preservation of the conjunctiva, muscles, and all the other contents of the orbit. The operation as it is usually done was first described by Bonnet, in 1841. The conjunctiva is incised with strabismus scissors around the corneal margin and dissected from the sclerotic as far as the insertions of the recti muscles. The tendons are severed as in the squint operation, one after the other, together with the subconjunctival tissue. Then the eyeball can be dislocated by pressing the speculum backward. This facilitates the division of the optic nerve. To cut the nerve a pair of scissors curved on the flat, slightly heavier than the strabismus scissors, are necessary. These are introduced at one side or the other, closed, till the optic nerve is felt. Then they are slightly withdrawn, opened and the nerve gotten between them, when it is cut off close to the sclerotic. The ball now protrudes readily and it is held with the fingers till the oblique muscles and the remaining connective tissue is cut. No suture is necessary. Haemorrhage is sometimes free but can be controlled by a compress and bandage. Perforation of the sclera may occur. In such a case we must proceed slowly in dissecting all the tissues from the globe. The operation takes longer but is not difficult. If one eye has an intraocular tumor or other condition that does not show by ocular inspection, we should be on our guard lest we take out the good eye. Such a serious mistake has occurred.

EVISCERATION OR EXENTERATION OF THE EYEBALL.—In this operation the cornea is excised and

the contents of the ball down to the sclerotic removed by a sharp spoon. Then the lips are drawn together by sutures through the conjunctiva and sclerotic. Thus the circular form of the wound becomes linear with projecting corners, unless we remove small triangular pieces at the ends. The inner surface of the sclerotic must be left perfectly clean, though it is allowed to fill with blood. The advocates of this operation substitute it for enucleation in all cases except intraocular tumors and foreign bodies.

EVIscERATION WITH THE INSERTION OF AN ARTIFICIAL VITREOUS.—This is known as Mules' operation. After evisceration a bead of glass is inserted before the wound is stitched. Many of them heal nicely, the artificial eye fits well, and moves perfectly.

OPERATIONS ON THE TEAR PASSAGES.

1. DILATATION OF THE LACRYMAL PUNCTA.—This is done with a conical probe, usually as a preparation for washing the passages.

2. SLITTING THE CANALICULUS.—A canaliculus knife with a probe point is used for this.

3. SYRINGING the canaliculi and the other parts of the tear passages. Anel's or Meyer's syringe is used. The fluid may regurgitate through the same canaliculus, it may escape through the other canaliculus, it may distend the sac, or it may pass through the duct into the nose.

4. PUNCTURE OR PARACENTESIS of the lacrymal sac is done with a small scalpel or a cataract knife, below the inner canthal ligament, through skin, muscle, and lateral wall of the sac.

5. PARTIAL EXCISION of the sac and extirpation of the sac are extensive operations. They should not be resorted to until other operations have failed.

6. PROBING the lacrymo-nasal duct. Bowman's or Theobald's probes are used.

CHAPTER II.

OPERATIONS ON THE EYELIDS.

OPERATION FOR CHALAZION.—The incision may be made either through the conjunctiva or the skin. The latter is chosen when the cyst is of large size and is nearer to the skin, and when this is necessary it is advisable to use a general anaesthetic. Ring forceps or a Snellen clamp is used to give complete control of the lid and to prevent bleeding. The incision should be horizontal. The sac is then caught with forceps and dissected out with a small knife or small seissors curved on the flat. The cartilage and conjunctiva should be spared as far as possible. If the wound is large it may be closed by very small sutures which may be removed in twenty-four or forty-eight hours. No special dressing is needed. Cold applications will diminish extravasation and oedema. When the incision is made through the conjunctiva local anaesthesia is employed. The clamp must be dispensed with on account of the pain. Pressure and a small curet are used to remove the contents of the sac.

OPERATIONS FOR TRICHIASIS AND DISTICHIASIS.
—These are directed to repeated removal of the offending lashes, correction of their deviated positions, or destruction or excision of their bulbs. Simple extraction of an inverted lash is a palliative measure

only, though in rare instances the frequent repetition of this causes the bulb to atrophy and the lash ceases to grow. The epilation is done with cilia forceps. When only one or two lashes are involved, the rest of the lid margin being normal, it may be well to be content with the relief obtained in this way. Individual lashes may be gotten rid of by electrolysis. By this means the bulb of the lash is destroyed. A constant battery of six or ten cells is used. A very fine needle of steel or platinum is attached to the negative pole, then introduced into the follicle at the side of the lash, and the circuit closed by applying the sponge electrode to the temple or hand. A milliamperic meter is necessary also, for not more than five milliamperes should be used for this purpose. When the circuit is closed, a slight frothing is seen around the stem of the needle, caused by the escape of bubbles of gas, and this is the sign for breaking the current. The lash comes away with the needle or is withdrawn by very gentle traction, if the application has been successful. There is some pain in the operation.

Where the trichiasis involves a small group of lashes the Gaillard suture is used by many operators. A thread is entered through the skin at the edge of the lid near the deviated lashes, passed deeply underneath the muscle, brought out half an inch from the lid margin, and firmly tied. It is left to slough out and so forms a cicatricial band which holds the lashes everted.

There is an ancient operation known as "illaquaetio ciliorum," that is still done to change the direction of individual lashes. Celsus refers to the

operation but without approval. "Some allege that 'tis proper to pierce the external part of the eyelid near the eyelashes with a needle which must be passed through with a woman's hair doubled for thread; and when the needle has gone through, that the offending hair must be taken up into the loop of the woman's hair, and by that drawn upward to the superior part of the lid, and then to be glued down to the flesh, and a medicine applied to close up the orifice thus made." The only difference now is that a thread is used in place of the hair. The trouble with this little operation is that the cilia only live for three or four months and their successors cannot be depended upon to grow in the new direction.

Another operation is that of "scalping." The edge of the lid is split and an incision parallel to the lid margin is made through the skin and muscle only. This separates a narrow band of tissue containing the bulbs of the cilia, which is dissected away. The cut edges of the skin and conjunctiva are united with fine sutures. Care must be taken to remove all the bulbs, and search for them may be made with a lens, the part being kept bloodless by clamp forceps.

OPERATIONS FOR ENTROPION.—The curability of disease is in inverse proportion to the number of remedies proposed for its cure. If that is true entropion is a very difficult condition to treat. In going over the literature on the subject one soon comes to the conclusion that since the time of Celsus every surgeon who has treated the eye has devised an

operation of his own, or at least has modified the operation of some other operator. It would not be profitable to attempt to describe even the modern methods of operating. It will be enough to point out the four classes of operations done.

1. Those that propose to evert the lid margin by the removal of the skin of the lid, or by the contraction resulting from the use of caustics, cauteries or sutures.

2. Those that depend on the tension of the skin caused by uniting it with the orbital margin of the tarsal cartilage.

3. Those based on the transplantation of the bulbs of the cilia.

4. Those in which the tarsal cartilage is incised or grooved on its inner or outer surface.

OPERATIONS FOR ECTROPION.—Acute swelling of the conjunctiva producing ectropion may be relieved by scarification of the membrane. This is best done by introducing one blade of a pair of sharp-pointed scissors beneath the membrane and slitting it freely throughout its whole length. The operation may be repeated several times if necessary. If the lids are permanently everted by hypertrophy, a portion of the thickened conjunctiva should be excised. This may be done with the sharp pointed scissors, or the lid may be held in the clamp and a fold of the conjunctiva dissected out with a knife. Such an operation must often be combined with slitting the canaliculus, to provide an exit for the tears. The canaliculus is converted into an open trough.

In simple removal of the margin of the lid from the eyeball, due to senile relaxation or partial paralysis of the orbicularis, the appearance is much improved by narrowing the commissure; the edges of the lids are freshened and brought together by a suture. This is termed tarsorrhaphy. Snellen's operation by ligature will give good results in ectropion of the lower lid without cicatricial contraction and without much elongation of the lid margin. Each end of a thread is attached to a needle, and both needles are entered through the conjunctival fold and brought out through the skin some distance below the margin of the lid. The points of exit should be wider than the points of entrance. Traction is made on the ends of the thread till the lid is replaced, and then they are tied over a piece of adhesive plaster. Two such sutures may be introduced. A compress bandage is applied, and the threads are allowed to remain for four days.

Dieffenbach's operation is more certain and permanent. An incision is made in the skin parallel to the lower margin of the orbit and slightly above it. The wound is made to gape by stretching, and the dissection is continued till the conjunctiva is reached. It is then incised throughout the extent of the wound, and the anterior edge of this conjunctival incision, which is connected with the attached margin of the tarsus, is drawn into the wound by hook or forceps and secured there by sutures. When there is considerable elongation of the lid margin it is necessary to remove a portion of it, and a number of operations are practiced for this purpose.

Adams' operation removes a wedge shaped piece,

involving the whole thickness of the lid. This is removed at the middle of the lid margin and the edges of the wound are brought together by small harelip pins. The healing of a wound in this situation is apt to be interfered with by the accumulation of tears, and a puckered, irregular cicatrix in the middle of the lid is a serious deformity.

Von Ammon's operation does away with this objection. The redundant lid is shortened by removing a piece at the outer canthus.

When the eversion is due to contraction of the skin, as is the case after burns, some operation must be adopted that will return the surface of the lid to its normal position at the expense of the skin of the neighboring regions. These are plastic operations, and must usually be devised to suit the case.

OPERATIONS FOR PTOSIS.—In most cases the muscle has lost its power, so that not much can be expected from its advancement. The latter form of operation would only be successful in those rare cases where the muscle has been detached from the cartilage by a wound. In all other cases the object is to promote the supplementary action of the occipitofrontalis.

The simplest operation is the removal of an elliptical piece of skin from the lid and bringing the edges together with sutures. The result is satisfactory when there is only redundancy of the integument, and will answer in the slighter cases from other causes; but in the higher degrees the effect is insufficient.

By Graefe's operation the lid is shortened subcutaneously and the power of the orbicularis is weakened.

Pagenstecher's operation is done for the purpose of connecting the cartilage with the frontal muscle by means of cicatricial bands. The skin is not incised. Each end of a long silk thread is attached to a needle; one needle is entered just above the lid margin, passed horizontally beneath the skin, brought out an eighth of an inch from its entrance, re-entered at the same point, and passed beneath the skin to emerge a finger's breadth above the eyebrow; the other needle is entered where the first one was, and passed up directly beneath the skin to emerge on the brow by the side of the point of exit of the first. The two ends are then tied over a piece of adhesive plaster, and it is either removed after some days, or is gradually drawn out above as the loop cuts its way through the subcutaneous tissues. Two such sutures are used.

Panas' operation is most frequently done. In this a horizontal incision is made down to the periosteum, just below the margin of the orbit, and another slightly longer, just above the eyebrow, and the bridge of skin between them is dissected up. A tongue-shaped flap of skin and muscle is then formed on the lid, with its free end at the lower of these incisions and its base at the tarso-orbital fold, and this is drawn up under the bridge to be stitched by three sutures to the upper edge of the upper wound. To prevent eversion of the lid margin, two lateral sutures are used, including only the suspensory ligament and conjunctiva.

The most satisfactory operation for ptosis is not to be found in the text books, but was described by Mules in 1894. A report of it is in the *Lancet* for May 11, 1895, page 1187. The principle of the operation is to substitute the frontalis muscle for the levator palpebrae by extending the former muscle to the margin of the lid by permanent wire suture. A needle with its eye near the point is passed deeply through the frontalis tendon over the eyebrow, and the point brought out at the margin of the lid behind the lashes, taking up part of the tarsal cartilage on its way. A piece of silver wire is then threaded through the needle, and it is withdrawn, bringing the wire with it. The needle is passed again in the same way at a distance of about half an inch from the first and parallel to it. When it is withdrawn the second time it leaves a loop of wire passing from the brow to the lid and back to brow again. This is now tightened till the lid is sufficiently raised, the edge of the lid being slightly grooved by an incision to allow the wire to sink into the substance of the lid. The points of entrance are also united by an incision, before the ends of the wire are twisted on each other, till the lid is raised permanently. The ends of the wire are cut off and the wire is allowed to sink beneath the level of the skin. The skin heals over the wire quickly, and it may be allowed to remain permanently. The lids can be closed and remain closed during sleep.

CANTHIOPLASTY.—This is done to enlarge the contracted commissure by freeing the external canthus. The latter is incised as far as the margin of the orbit,

and the cut edges of the skin and conjunctiva united with sutures. The lids are stretched by fingers, speculum or lid elevators, while the cut is made with a pair of scissors or a director and knife may be used. The incision divides skin, muscle, conjunctiva and external palpebral ligament. The haemorrhage may be arrested by pressure, hot water, or by twisting one or two small arteries, and the skin and conjunctiva are stitched together usually by three sutures. If a greater effect is desired, the palpebral ligament may be divided more freely by stretching the upper lid toward the nose, and dividing it vertically by a pair of small scissors beneath the skin.

TARSORRAPHY.—This is done to diminish the extent of the palpebral commissure by contracting the canthus, or it may be done to close the eye by uniting the lid margins. If the union is intended to be permanent the cilia should be included in the strip of tissue removed, but if temporary, only that part of the lid margin posterior to the cilia. When the object is to protect the cornea it is necessary only to unite the lids near their middle, on either side of which useful vision may be retained.

ANKYLOBLEPHARON.—This is usually accompanied by symblepharon. When there is adhesion of the lid margins only, it is easily cured by a simple incision, and frequent separation of the lids. If the canthus is involved a canthoplasty will be necessary.

SYMBLEPHARON.—This is difficult to treat, the difficulty increasing in proportion to the extent and

closeness of the adhesions. When the lid is adherent only anteriorly, near its margin, and a probe can be passed along the cul-de-sac beneath the adhesion, it is possible to prevent reunion after separation by a simple incision, but when the cul-de-sac also is involved and there is a continuous raw surface extending from the lid to the ball, the symblepharon will be reproduced during the process of cicatrization in spite of all the procedures that have been proposed to prevent it.

Arlt's method is satisfactory if the adhesion is narrow and has been stretched into a band by the constant movements of the ball. The band is caught by forceps and stretched while it is dissected from the ball well down into the cul-de-sac. A thread with a needle at each end is passed through the free end of the flap, which is doubled on itself. The needles are inserted into the bottom of the wound and brought out through the skin just above the margin of the orbit. The two ends of the thread are then tied over a small roll of plaster, and the flap is held with its raw surface in contact with the raw surface of the lid and its sound surface opposed to the raw surface of the ball. The bared space on the ball may be covered by uniting the edges of the conjunctiva.

Transplantation of mucus membrane from the lips and from the vagina, of skin flaps without pedicle, of the rabbit's conjunctiva, and of the skin of a frog has been tried but with indifferent success. The Thiersch graft has been most useful.

Close adhesion of the whole surface of the lid to the ball is a most discouraging condition to treat.

DISEASES OF THE EAR.

CHAPTER I.

THE CLINICAL EXAMINATION.

The examination of a patient with any form of ear disease resolves itself in three parts, as follows :

1. The clinical history.
2. The physical examination.
3. The functional examination.

The clinical history :—First a record should be made of the patient's name, age, residence and occupation. The patient or his friends may be allowed to do most of the talking, while obtaining the previous history, or, at least, the surgeon should not ask questions likely to suggest symptoms not noticed by the patient himself. The important symptoms to be determined by the narrative are pain, deafness, tinnitus, sensation of fulness or obstruction in the ears, autophony, headache, vertigo, disturbances of vision or gait, discharge from the meatus or itching in the ears and facial or other paralysis. The combination of symptoms present in each case will guide

the surgeon in the choice of methods to be adopted for the physical and functional examination. A clinical history alone is not sufficient to form an accurate diagnosis, except in the case of lesions of the auricle.

The Physical Examination :—This resolves itself into four parts as follows :

1. Inspection by the naked eye of the auricle and surrounding parts, and examination by the finger of the parts around the auricle.
2. The use of the speculum to examine the meatus, the membrana tympani, and sometimes the tympanic cavity.
3. The use of rhinoscopy and the finger to examine the nose, nasopharynx and pharynx.
4. Examination of the eustachian tube and tympanum by inflation and the diagnostic tube.

Inspection by the naked eye is made to determine the state of the skin, the presence of eczema, intertrigo, swelling, inflammation, tumors, boils, malformation, facial paralysis and injuries and collapse of the meatus. Inspection is supplemented by palpation to discover hard tumors, fluctuation and tenderness. In regard to tenderness the following rules will usually hold. Tenderness over the tragus indicates inflammation of the meatus ; tenderness below the auricle on deep pressure into the glenoid cavity indicates inflammation of the middle ear ; tenderness on pressure over the mastoid denotes mastoid inflammation. The second part of the examination has to do with the external meatus and the membrana tympani. The first essential in making this examination is suitable light, which may be either direct or indirect ; direct when thrown from the

source straight into the ear ; indirect when it is reflected by a mirror into the ear. The light may be sunlight, diffused daylight or artificial light. The two former show the natural color of the parts seen, but sunlight is not always to be had, and diffuse daylight varies greatly in intensity and cannot be depended upon. Any form of artificial light will do if sufficiently intense ; in a darkened room a common candle will do very well, while in the patient's house a kerosene lamp or the ordinary gas light answers the purpose. In an office it is best to work in a bright room, using the incandescent gas light with a Mackenzie condenser. This light is not only the best, but the cheapest. The mirror used to reflect the light is worn on the forehead and the polished surface is concave with a focal distance of from eight to twelve inches. The size of the mirror varies from two and a half to four and a half inches in diameter. The mirror is perforated at the centre and is worn so that the perforation is directly in front of one eye or the other. The position of the light in relation to the patient and to the examiner is important. The surgeon should sit directly facing the ear, having the light to the side of and beyond the patient's head and on a level with the ear and his own eye. If the right eye is used the light must stand to the right ; if the left eye, to the left. It is impossible to view the drum membrane with both eyes on account of the small aperture, the length of the canal and the short distance at which it is necessary to work. The eye behind the mirror is used, the other being completely relaxed. The specula used are either long, short or dilating. The long consists of a long, narrow fun-

nel, either round or oval in section. These may be introduced into the osseous meatus, and are supplied in sets of three or five, being made of silver or vulcanite. The dilating speculum consists of two blades introduced closed, and then dilated either by a screw or handle. Seigle's pneumatic speculum is a modification devised to examine the mobility of the membrane. To introduce a speculum it should be held lightly between the thumb and index finger of the left hand, the auricle grasped firmly at its upper and posterior margin, between the third and fourth fingers of the same hand. As the speculum is introduced the auricle is drawn upwards and outwards, and it should be of such a size that the walls are simply separated by it and not stretched. Forceful insertion or attempts at dilatation are to be avoided.

In making the examination attention must be paid to certain points regarding the canal. Note whether it is free throughout its entire length, or partially or completely obstructed. If not free the nature of the obstruction should be determined. It may be a foreign body, a mass of impacted secretion from the ceruminous glands, or epithelial debris from an inflammatory process or from a parasitic growth, or it may be a fluid—blood, serum or pus. The canal may be obstructed at only one point, in which case a probe is used to determine its density, whether it is hard or soft, tender or anaesthetic, and whether presenting a denuded surface. The canal may be narrowed uniformly, the density of the walls being determined by the probe. The condition of the skin lining the canal must be noted to determine whether it is dry and desquamating or moist and

reddened, or covered with patches of dry crust. Next the drum membrane is examined for pathological changes. A perforation can in most cases be easily made out. It may, however, be so small that it is not seen, or it may not be recognized on account of its valvular shape. Inflation while it is under observation or with the diagnostic tube will show its existence or position. Variations in the lustre of the membrane furnish valuable indications in certain affections. In health the parts have a peculiar bright appearance which may be diminished or wanting, the latter condition indicating a loss of the superficial epithelium. The cone of light is to be carefully examined, its shape, position and extent, and the presence of one or more bright points or light reflexes in other parts of the membrane all give assistance in forming a diagnosis. The membrana vibrans should be of uniform texture except at the periphery and umbo where it is somewhat thickened. In disease this may undergo hypertrophy in places, the affected areas appearing less translucent than the surrounding portion. The same effect is produced by calcareous deposits, which appear as opaque, well-defined, lustreless, white areas. Displacement of the drum may be either outward or inward. In the bulging outward is excessive the line of demarcation between the canal wall and the drum is obliterated.

Accumulations of fluid in the tympanum is the common cause of such displacements, but in slight degree they may be produced by simple relaxation. Retraction of the drum head produces prominence of the tympanic ring and foreshortening of the malleus

handle, if no adhesions exist between it and the inner tympanic wall. When such adhesions do exist, the malleus handle being firmly bound down and the air in the tympanum rarified, then the anterior and posterior segments of the drum collapse and the handle appears as a prominent ridge but is not foreshortened. Such a condition is frequently seen in children with adenoid vegetations. The pyramid of light is also displaced. If the membrane is too concave the light does not reach the circumference; when the concavity is very great it appears as a round, bright spot near the umbo, or is lost entirely. When the membrane is destroyed some part of the inner wall of the tympanum can be seen.

3. The examination of the nose, naso-pharynx and pharynx. This should be done thoroughly. Anterior rhinoscopy is used to detect malformations, polypi, diseases of the bone, hypertrophic and atrophic catarrh. In the pharynx and naso-pharynx we look for granulations, polypoid growths, cicatrices of former ulcers, enlarged tonsils, hypertrophic and atrophic pharyngitis. In the mouth carious teeth should be noticed.

4. The examination of the eustachian tube, the tympanum and the mobility of the drum membrane by inflation and the diagnostic tube. So far the examination has been of those parts which can be seen or touched. We have now to use the sense of hearing for the examination of those parts not accessible otherwise. The diagnostic or auscultation tube is a long rubber tube with ivory ends; one end is placed in the meatus of the patient and the other in that of the surgeon. Inflation of the tympanum is produced

by a sudden condensation of the air in the nasopharynx, which causes a corresponding increase of air pressure in the middle ear, provided that the eustachian tube is open. As the tympanum is separated from the external meatus by only the thin membrana tympani the impact of the air upon this delicate membrane is readily heard by the diagnostic tube. This sound of impact under normal conditions is of a sharp metallic character, and is due to the stretching of the drum head by condensation of the air in the middle ear. The sharp metallic click or snap is sometimes followed later by a similar sound of lower pitch and less intensity, due to the return of the membrane to a condition of equilibrium. Familiarity with these sounds in health enables one to interpret the meaning of any modification due to pathological conditions. If a perforation of the drum exists a whistle is noticed, while if moist sounds are produced fluid is present.

Methods of Inflation.—1. Valsalva's method. The patient compresses the alae nasi with the thumb and forefinger to close the nostrils; at the same time the mouth is closed and an attempt made to force the air through the nostrils by an expiratory effort. The result is to force air up the eustachian tubes into the tympanum. This may be done while the surgeon has the speculum in position and he can see the effect on the drum of increased intra-tympanic pressure.

2. Politzer's method. This consists in the use of a rubber bag to force air through the eustachian tube. The extremity of the tube is provided with a nose-piece which is inserted so as to close the nostril. The other nostril is closed by compression, and the

patient is directed to take a small quantity of water into the mouth and to swallow it only when directed to do so. At the moment of deglutition the bulb is compressed and the air is driven into the vault of the pharynx and from there into the eustachian tubes. The act of swallowing shuts off the oropharynx and renders the eustachian tubes more permeable. If the pressure is not exerted at the proper moment, the air suddenly enters the oro-pharynx and forces the water either into the larynx, when the patient will have a seizure of coughing, or out of the mouth, deluging himself and usually the surgeon as well. Some modifications of this plan are employed. Holt's modification is to close the mouth and puff out the cheeks; or he may repeat rapidly the letter K or any syllable containing the K sound. In infants the act of crying produces sufficient closure of the naso-pharynx. If no rubber bag is at hand the surgeon may use an ordinary piece of rubber tubing and his own breath, but this is not very elegant.

Catheterization of the Eustachian Tube.—By this the surgeon directs a current of air into the tympanum of one side or the other by means of a cannula passed through the nose and inserted directly into the orifice of the tube. It is to be employed when air cannot be driven through the eustachian by any of the methods detailed, or when the observer desires to study carefully the sounds heard by the diagnostic tube. In the way of treatment it is employed where it is desired to act on one ear only. The catheter is of silver, vulcanite or gum-elastic, from six to eight inches long, bent in the arc of a circle at one end. The other end is dilated so as to

receive the nozzle of the air bag, and here also is fixed a guide ring to indicate the direction of the curved point after it has been introduced into the nasal passages. The catheters vary from Nos. 3 to 6 of the French scale. Pure silver or vulcanite is to be preferred because the curve of these can be easily changed to suit individual cases. The catheter should be introduced into the nostril with the curved point downwards. As soon as the point passes the elevated anterior margin of the floor of the nose, the hand is to be raised so as to bring the straight part of the catheter to the horizontal position. The instrument is guided straight backwards until it reaches the posterior wall of the naso-pharynx. Force should never be employed. To bring the catheter from this position into the orifice of the eustachian one of two methods may be employed. It may be drawn forwards about $\frac{3}{8}$ or $\frac{1}{4}$ of an inch and then rotated till the guide ring points directly outwards to the side to be inflated. The hand is then elevated a little and carried slightly towards the opposite ear; this causes the pharyngeal end to descend and press lightly against the lateral pharyngeal wall. Then by drawing the catheter a little outward the tip can be felt to impinge on the posterior lip of the tube. It is to be drawn over this, the tip being slightly lowered if necessary, avoiding undue force. Then the catheter is rotated, until the ring points upward and outward towards the ear, while at the same time the outer end of the catheter is pressed against the septum. It is now firmly held in position by the left hand, the right being free to compress the bulb forcing air through the tube into the middle ear. The second

method is to have the point of the catheter against the posterior wall as before, then to rotate it 90° towards the opposite side, then withdraw it till the curve hooks the septum. While held firmly in this position rotate again 180° , the outer end being pressed against the septum. When the point of the catheter is in the right position the guide ring looks towards the outer canthus. If the point does not engage, either the curve is not right or the end is not sufficiently pressed against the septum. If in doubt as to the position of the end of the catheter a rhinoscopic examination should be made to verify its being properly placed. When the catheter is in place the nozzle of the air bag is fixed in its outer extremity and air forced through. This is at once felt by the patient and heard by the surgeon. If a moderate amount of obstruction exists, the same effect is only produced by compressing the air bag as the patient swallows. When one nostril is closed the catheter may be passed through the other side, the curve being lengthened. There is also Pomeroy's catheter to be used through the mouth. Unpleasant results from the use of the catheter are rare. Cases are reported of loss of consciousness and convulsive twitching. A more common occurrence is emphysema of the tissues in the neighborhood of the orifice due to wounding the mucus membrane and the entrance of air into the tissues. Syphilitic infection has been reported from the use of the catheter, but in these days of sterilization such an accident is inexcusable. In cases of obstruction of the tube the examination may be continued by means of bougies passed through the catheter. This is dangerous and must be prac-

tised with great caution. Over inflation of the good ear may be avoided by tilting the head till the side to be inflated is uppermost and then having the patient press firmly into the meatus on the side not affected so as to support the drum.

The sounds heard on auscultating are produced either in the tympanum, in the eustachian tube or at the pharyngeal orifice. A great deal of practice is necessary to differentiate and interpret these sounds. When the tube is open a sound from the tympanum is full, clear and unmistakable. If the drum is perforated the sound varies with the size of the orifice. When large the air seems to blow right into the surgeon's ear; if small a whistling sound is heard.

HISTORY.—After completion of the physical examination and before going on with the functional investigation it may be well to enter fully into the history of the case. First the general history and then that of the aural affection.

The age of the patient, the occupation and the habits of life should be known, particularly the habits of the patient regarding the use of opiates, stimulants and tobacco, or the fact of his going through any mental strain or physical exertion. The history of any previous illness should be considered; whether in childhood he had any of the exanthemata or in later life any continued fever. An important factor is the presence of hereditary taint,—tuberculous, syphilitic, gouty or rheumatic, as well as the existence of any chronic aural trouble in other members of the family. Special attention should also be paid as to whether at any time it has been necessary to take continuously large doses of the drugs which

have a specific action on the auditory organs. The present state of the general health should be attended to. The condition of the teeth and stomach is important; so also is the condition of the pelvic organs. The condition of the ears in childhood should be ascertained and the length of time that the present trouble has existed. The symptoms upon which the patient lays most stress are impairment of hearing, tinnitus, discharge from the ear, and pain. Nausea, vertigo and general headache may be present and not mentioned, as they are by the patient referred to some other cause. If of long duration, it is important to know whether the progress of the trouble has been gradual or whether it has been aggravated under certain conditions. If the prominent symptom is deafness or tinnitus, we should discover under what conditions these are most troublesome,—whether the patient hears better in a noisy or in a quiet place, and whether the chief difficulty is confusion during a general conversation, or whether it is equally difficult to maintain a dialogue. The particular time of day when the disturbance is severe should be determined,—whether in the morning, or at the end of the day when tired physically and mentally. Care should be taken not to attach too much importance to any one symptom lest the patient be led to exaggerate it unduly. This is specially necessary in regard to the tinnitus.

FUNCTIONAL EXAMINATION or testing the hearing power.—The ear perceives not only the intensity of a sound, but also its pitch or quality, so that a complete examination requires the estimation of both the qualitative and quantitative condition of hearing.

There are many patients who consult the surgeon for tinnitus and whose hearing is distinctly impaired, yet deny any suggestion of deafness. The fact is that in ordinary surroundings the normal ear is rarely called upon to exert its functions to the fullest extent possible; and so a considerable degree of deafness may exist without any corresponding appreciation of the fact.

Sound waves may be carried to the sensorium in two ways,—

1. By air conduction, and
2. By bone conduction, through the bones of the head.

There are two practical methods of testing the hearing power by air conduction; (1) the watch, and (2) the voice. Politzer's acoumeter and Neef's hammer and induction coil are for theoretical demonstration rather than practical use. For convenience the hearing power is usually expressed as a fraction, the denominator of which represents the distance in feet or inches at which the sound is heard by the normal ear, and the numerator designates the distance at which the same sound is heard by the affected ear. Thus if a patient hears a watch at three inches which ought to be heard at thirty inches, $\frac{3}{30}$ ths represents the hearing power. Certain precautions are necessary in testing with the watch. The opposite ear should be closed and the watch brought from a distance towards the ear till the tick is heard, and this repeated several times to be certain the answer is correct. The ideal test is the human voice, since that is the sound which the patient is most desirous of hearing, and because his own esti-

mate of the progress of his disease is based on the ease or difficulty with which he is able to understand the voice in general conversation. The ordinary conversational voice varies so much in pitch and intensity that the forced whistle is used instead. This gives a fairly constant standard. The patient soon becomes familiar with set words and phrases used in this examination, so that it is better to employ numbers of two figures, and to change these constantly. There is a further difficulty in that certain combinations of letters are more easily perceived than others. Even when whispered with the same intensity each letter has a value peculiar to itself, the vowels being heard more easily than the consonants. This logographic value of letters has been worked out by Dr. C. J. Blake for consonants and is as follows:—

T being the letter with the greatest intensity of sound is valued at 100, Z—63, C—62, P—58, G—56, B—53, D—45, S—40, F—35, K—31, L—21, N—11, M—9.

As many patients unconsciously acquire the art of lip-reading it is advisable to seat him sideways with the ear to be tested towards the surgeon.

To make an examination of the qualitative condition of the hearing it is necessary to be provided with some instrument to produce the lower notes of the musical register and the very high notes. The normal ear can perceive vibrations varying from 16 to about 32,500. These are regarded as the lower and upper limits of audition. For the lower tones and for the middle ones a tuning fork is used; for the upper tones, a Galton whistle. Having estimated the extent of the impairment of hearing by these methods,

the next step is to locate the pathological condition in either the conducting or the perceiving apparatus. The most common test is that of Weber who first pointed out that if the stem of a vibrating tuning fork be placed on the middle line of the skull, and if one ear be closed with the finger, the sound is heard chiefly or only on that side. In the same way, in diseases of the external meatus and middle ear, the sound of the vibrating tuning fork is heard better in the obstructed ear. The vibrations are carried by bone conduction, and the deduction is readily made that in cases where hearing is impaired on one side only, or in which it is impaired on both sides to an unequal degree, the perception of the tuning fork from the median line of the head is strongest in the ear in which the pathological condition in the conducting mechanism is more marked. In other words, bone conduction is better in the poorer ear.

If the fork is heard better on the non-affected side or on the side least affected then the pathological condition of the opposite side is in the perceptive rather than in the conducting mechanism. This test does not always prove satisfactory.

Rinne's Experiment.— If a vibrating tuning fork be placed on the mastoid process of a healthy ear till it has become inaudible and then held in front of the tragus the vibrations will be heard again. This result in the normal ear is called positive, while the inverse is called negative.

If this test gives a positive result where the hearing is impaired it justifies a suspicion of labyrinthine disease. On the other hand if the bone conduction is greater than air conduction the inference is that

the lesion is in the conducting mechanism. Opinions differ as to the value of these two tests and there is no doubt the experiments sometimes yield directly opposite results. There are also several other tests but these are refinements into which it is unnecessary to enter here.

The facts from all these may be summed up as follows :

In lesions of the conducting mechanism,—

1. There is loss of hearing the lower notes, *i.e.*, the lower tone limit is raised.
2. Bone conduction increases while air conduction decreases.
3. The highest notes are well heard.

In lesions of the perceptive apparatus,—

1. The lower tone limit is unchanged.
2. The relation between air and bone conduction is the same but the absolute duration of both is decreased.
3. The upper tone limit is lower, there being absolute deafness for certain notes of the scale.

CHAPTER II.

DISEASES OF THE AURICLE.

MALFORMATIONS.—These are common, and may exist alone or be associated with malformations of other organs, such as want of development of the eye or side of the face on the same side. There may be excessive development of two auricles (polyotia). Want of development is apt to occur with defective development of the external meatus and tympanum, and more rarely of the internal ear. Imperfect development (microtia) is common. Surgical treatment is necessary in most of these cases and must sometimes be devised to suit the case. Sometimes the external auditory meatus is wanting and it may be difficult to decide whether it is advisable to attempt to establish the canal. If the obstruction is osseous there is no certainty of the position of the middle ear and it would be inadvisable to attempt any surgical interference.

INJURIES TO THE AURICLE.—These are to be diagnosed and treated on general principles. They are contusions, incised wounds, burns, chilblains and frost bites. The cartilage should not be included in sutures because of the liability to necrosis.

CUTANEOUS DISEASES of the auricle do not differ from similar conditions on other parts of the body. Eczema is the most common. Others are herpes, intertrigo, pemphigus, syphilis, lupus and erysipelas.

The rash of measles, scarlatina and smallpox may affect the ear in the manner which characterizes these affections.

NEOPLASMS AND TUMORS.—In gouty subjects urates are deposited in the auricle and the fibrocartilage may undergo partial ossification. Cysts, fibroma and angioma are rare. Othaematoma or haematoma auris is an effusion of blood either into the substance of the cartilage or between the cartilage and the perichondrium. This is frequently the result of injury, but it may occur without such a history (idiopathic). It is frequently met with in the insane, so frequently that it has been termed *insane ear*, but it also occurs spontaneously in those of perfectly sound mind. The effusion of blood separates the perichondrium from the cartilage. The swelling appears as a rule somewhat suddenly. It may be preceded by a feeling of burning or pruritus, but usually there are no prodromal symptoms. The effusion may disappear spontaneously, or it may be evacuated by spontaneous rupture, or the contents may suppurate. In any case there is more or less deformity at last. Suppuration and necrosis of the cartilage may lead to considerable loss of tissue. In the idiopathic form inflammatory reaction is not usual. Treatment will vary with the size of the tumor and the nature of the contents. If pus is present free evacuation should be resorted to. If the tumor is small and recent and not inflamed pressure alone may be tried. This may be combined with massage. If the effusion is so great as to produce much tension of the overlying tissues, evacuation by free incision is advisable. The cavity should then be freely eurented to remove

all necrotic tissue and to favor a rapid obliteration of the space by granulation and adhesion. The wound should be packed firmly with gauze and managed according to the rules of general surgery. There is certain to be deformity after such treatment.

Malignant growths are sometimes found in the ear primarily. Epithelioma is the common one.

CHAPTER III.

DISEASES OF THE EXTERNAL MEATUS.

CIRCUMSCRIBED INFLAMMATION OR FURUNCLE.—

This is a circumscribed inflammation of the skin or subcutaneous cellular and fibrous tissues of the auditory canal, terminating in a small abscess or boil. It is not confined to any particular part of the auditory canal, but being most likely to occur in a part rich in glands, it is apt to be found in the outer part of the meatus. Boils in the auditory canal may occur independently of an outbreak upon any other part of the body.

Etiology.—These boils are always of artificial origin, being caused by the introduction of septic matter into a follicle of the skin in the act of rubbing or scratching of these parts. The staphylococcus may enter through an abrasion or by way of a hair follicle or ceruminous gland. The predisposing causes as far as known are debility, diabetes, change of diet and similar conditions. These three factors must be taken into consideration:—

1. A constitutional state favorable to the growth and development of the staphylococcus.
2. The presence of the staphylococcus.
3. The admission of this micro-organism beneath the epidermis.

Symptoms.—There is usually a great deal of pain which may precede the local lesion. The pain is in-

creased on movement of the auricle or jaw and may be accompanied by some general elevation of temperature. Several furuncles may be present at once and often as one subsides another develops, and this recurrence often extends over weeks or months. The hearing is not affected except temporarily from closure of the meatus by swelling or accumulation of pus. When the furuncle is situated in the osseous part of the meatus there is sometimes a congestion of the drum itself which subsides only with the disappearance of the furuncle. On inspecting the canal one or more swellings will be seen encroaching upon the lumen of the canal. These may not be recognised as boils by the inexperienced because they are neither red nor acuminated as is usual with boils elsewhere. The skin may not be colored at all and only the severe pain on touching them marks them as inflammatory. Whether left to themselves or punctured, they usually result in the evacuation of a small quantity of pus and a central core or slough. The cartilaginous meatus is the usual situation, but small pustules are sometimes found in the osseous meatus and give rise to very severe suffering because the region contains very little loose tissue and is rich in nerves.

Treatment.—In the immature stage the best application is a mixture of black wash (calomel gra. 30 to lime water 10 oz.) one part in glycerine seven parts. This softens the inflamed tissue with an antiseptic dressing. Renew the pledget of cotton soaked in the wash every hour or two till pus is formed. Then the surgeon should mop away with a formalin solution (1 to 1,000) all the secretions and especially

the open mouth of the boil. Ichthyol and water, equal parts, may then be applied and some forced into the abscess cavity. A boil in the ear should not be incised, as the cut furnishes a furrow for the staphylococcus to grow in. The various specifics are Fowler's solution, sulphide of calcium, quinine and brewer's yeast or protonuclein.

DIFFUSE EXTERNAL OTITIS.—As the term implies this is an inflammation of the external auditory meatus, in which the local condition involves either the entire canal or a very large portion of it, the line of demarcation between normal and affected areas not being clearly marked. The disease is either acute or chronic, the former being frequently dependent upon a previously existing chronic process. We shall consider the chronic process first.

CHRONIC DIFFUSE EXTERNAL OTITIS.—This general term applies to every form and degree of chronic inflammatory condition of a diffuse character. In many works on the ear, an idiopathic affection of this nature is described but careful examination will show that it is always due to some direct and traceable cause. This disease is less dependent on constitutional conditions than the circumscribed form. The most common cause is inflammation of the middle ear with a discharge through a perforated membrane. Traumatism plays a most important part in its production. The injury may be slight, such as may be produced by too thorough cleansing of the canal by towel, ear sponge or spoon. Wounds

inflicted by violence or resulting from the bites of insects are frequent causes. Oleaginous substances may be applied to the walls of the canal for the relief of pain in the ear or toothache and only give rise to irritation of the delicate lining. Foreign bodies may be placed in the ear by mistake or design and by their presence alone cause a diffuse inflammation. When a discharge constantly takes place from the middle ear, the lining of the meatus is constantly bathed in this secretion and the continued warmth and moisture favors the loss of the superficial epithelium. Infection readily takes place through such a denuded surface. A less common cause is the development of a vegetable parasite or fungus in the canal. These minute organisms attach themselves firmly to the walls of the canal and grow indefinitely. The presence of such a fungus produces an effect similar to that of a foreign body. A true eczema of the canal may exist and is an evidence of some diathetic condition. Croupous deposits may occur and diphtheria sometimes attacks the canal.

Symptoms—Pain is usually present and is severe in proportion as the osseous canal is involved. The skin and periosteum are so intimately associated in this region that a dermatitis becomes a periostitis. The pain is increased by movement of the jaw and auricle. In mild cases there is constant irritation or itching in the canal which the patient attempts to relieve by the insertion of the little finger as far as possible into the meatus. This aggravates the condition it is intended to relieve. Deafness is common. This may be from extension of the inflammation to the dermoid layer of the drum and perforation may

ensue; or it may be from obstruction caused by aggregations of epithelium from eczema, or by masses of fungi, or sebaceous crusts or by secretion. Tinnitus is produced either by the myringitis or by the presence of foreign substances. Certain reflex symptoms are often present. These are severe pain over the distributio of the fifth nerve, headache, autophony and epileptiform attacks. Cough is also a symptom. Indeed it may be for the cough that the patient seeks advice. When the inflammation is severe a discharge appears at the orifice of the meatus; when profuse it is watery in character. Glandular enlargement is not uncommon.

Diagnosis.—It is necessary to distinguish between this diffuse inflammation of the meatus and deep inflammation of the mastoid. When the disease is confined to the canal, pressure behind the ear, directed backward and inward, will fail to reveal tenderness; but if the pressure is exerted so as to move the cartilaginous meatus then it will elicit tenderness. So also pressure from above, below or in front of the canal will produce more pain than if exerted over the mastoid. Examination with the speculum in the milder cases of seborrhœa, eczema and aspergillus will show the walls covered with some foreign substance. In the desquamative form the walls of the canal are moist and sodden, the superficial epithelium being easily wiped off by a cotton pledget.

Prognosis.—The course of the disease varies according to the cause. The simple forms are not attended by serious results, but are obstinate to relieve. The prognosis is grave where the deeper parts are affected, where the disease is of long standing, or

where the condition is symptomatic. Hearing may suffer either from narrowing of the meatus or by the development of exostoses. In the desquamative form there may be extension to the cranial cavity and a fatal result. Chronic adhesive processes may be set up in the middle ear from long continued pressure.

Treatment.—In the mild cases the treatment is directed to the relief of the pruritus from which the patient suffers. If crusts are present they are to be removed by some bland oily preparation such as alcoholene or olive oil, after which in most forms it will be enough to apply once a day a stimulating ointment such as ungt. hydrarg. ox. flav. or the ungt. hydrarg. ammoniat. diluted with ten parts vaseline. The patient must refrain from scratching the ear, and to assist him in doing this we may add cocaine or morphia to the ointment. The use of water in the canal must be forbidden, as it increases the activity of the inflammatory process. In the parasitic variety the fungus is to be removed by forceps, curet and cotton pledget, care being taken to avoid wounding the canal. Cocaine may be used to facilitate the removal, as the epidermis will be found extremely sensitive. When as much as possible has been removed a solution of bichloride of mercury, one to eight thousand, in 50 per cent. alcohol, or a saturated alcoholic solution of boracic acid, or a 2 per cent. alcoholic solution of salicylic acid may be applied to the parts by a cotton pledget. Powders may be employed in place of solution. Stearate of zinc with aristol, boracic acid, or a mixture of boracic and salicylic acid, 20 to 1, will be most useful. In the desquamative form the first indication is to remove

the mass of epithelium lining the canal, and this is often by no means easy. By syringing and the blunt hook and curet this will be accomplished. When once cleaned the indication is to get the epidermis into a normal condition. Powders are of special value here. The application must be made by the surgeon himself daily. If necrosis occurs it is necessary to remove the dead bone first and then to manage on general principles. If granulation tissue has developed, a thorough cleaning may be enough when it is small in amount, but if there is any quantity it must be curetted, or the galvano cautery, nitrate of silver, or chromic acid used. Granulations may develop into polypoid masses and then the snare must be used for their removal.

ACUTE DIFFUSE OTITIS EXTERNA.—This usually occurs as an exacerbation of a previous chronic condition. It may, however, present itself as apparently an idiopathic disease, either from exposure to cold, or as a complication of some serious constitutional infection, as epidemic influenza, scarlet fever or typhoid fever. Injuries from violence or from the action of an escharotic may also give rise to an acute diffuse inflammation.

Symptoms.—The first sensation is of fulness or discomfort in the canal quickly followed by intense pain. The constitutional disturbance is marked; fever, prostration, headache and all the symptoms one would expect from an inflammatory process in dense cellular tissue. Tinnitus is present but not complained of, on account of the severity of the pain. The surrounding lymphatic glands, especially those just behind and below the auricle, become infiltrated and

tender so that any movement of the jaw is painful and the mouth is opened with difficulty.

Diagnosis.—This condition may be confused with circumscribed external otitis and with affections of the middle ear and mastoid. Careful examination with the speculum should prevent any error.

Treatment.—This must be directed towards relieving the pain and an attempt may be made to abort the process before pus has formed. To relieve the pain both local and general measures may be adopted. Morphia may be given and some blood drawn from the temple or from the mastoid region. At least two ounces should be drawn and the ice bag or the hot water bottle and hot irrigation used. If these means fail then a deep full incision may be made in the canal.

OTOMYCOSIS.—Most text books describe this as a special disease. It is properly considered as a form of diffuse external otitis. There is a growth in the canal of that kind of fungus called *Aspergillus*, the two varieties found are the *nigricans* and the *glaucus* or *flavescens*. The diagnosis of the condition as well as the form of fungus must be made by the microscope. If the fungus has been in the ear but a short time a patch of pale yellow pollen-like matter is seen at the fundus of the canal. In most cases the fungus mass looks like a ball or plug of wet blotting paper, or the canal may seem to be plugged with cotton wool. The plug may be mistaken for ear wax; but the latter looks more solid, is shining and dried, and does not excite pain and inflammation to the degree produced by the *aspergillus*.

Symptoms.—There is a sense of fulness, slight pain, burning, itching, tinnitus aurium and hardness of hearing. After a few days a slight serous discharge sets in and then the pain usually ceases. Perforation of the drum head sometimes takes place and the tympanum is invaded.

Treatment.—This has already been indicated. There are three points,—to remove the parasite, to kill the germs, and to allay the inflammation. The first is accomplished by syringing and wiping out with a cotton swab. To destroy the parasite the powders mentioned are more useful. Chinoline salicylate in horacic acid, one to sixteen, is specially recommended. This not only destroys the *aspergillus* but allays the inflammation it has produced.

FOREIGN BODIES IN THE EAR.—These are either animate or inanimate. The former may be of great surgical importance from the annoyance, inflammation, pain and deafness which they are apt to produce.

The source of foreign bodies is either from within or without.

Under the first class is placed, abnormal collections of ear-wax, masses of epithelial scales (the *keratosis obturans* of Wreden), and collections of stiff hairs from the auditory canal and tragus; also clotted blood, inspissated discharges, and scales of dead bone.

Under the second head may be classed all things small enough to have been placed in, or to have gotten into the canal from without.

IMPACTED CERUMEN.—This is so common that we will consider it separately. The causes of impacted cerumen are either those which lead to increased production, or those which interfere with its regular discharge from the ear.

Ceruminous glands.—These begin about two millimeters from the opening of the auditory canal and extend to within two or three millimeters of the membrana tympani. They are most numerous at the junction of the cartilaginous with the bony canal, where they average ten to the square millimeter. There are between one and two thousand wax glands in each auditory canal.

Escape of the cerumen from the ear.—The ear wax is formed in the wide end of a detruncated cone. As it forms and collects it presses upon the walls of the auditory canal, which being widest and freest towards its mouth, the mass of cerumen meets with the least obstruction in the direction of its only way of escape. There is also a natural outward growth of the skin of the auditory canal from the membrana tympani to the external meatus. This can be seen by watching a small scratch on the membrane move gradually away from the malleus, out upon the wall of the auditory canal, just as a spot on the finger nail moves from the matrix towards the finger end. There is another force in the movement imparted to the auditory canal by the motion of the jaw.

If the canal presents certain anomalies of curvature or if the orifice is very narrow, or the isthmus (the junction of the cartilaginous with the osseous meatus) contracted, the force produced by the movements of the jaw may have the reverse effect, so that

any body lying in the canal is carried inward rather than outward. If a small mass of cerumen collects in the canal its presence stimulates the glands in the neighborhood to an increased secretion while at the same time it acts as an obstruction to the outward passage of the product of the glands farther in. Upon removal these masses are found to contain certain vegetable spores, desquamated epithelium and sometimes a foreign body which has formed the nucleus of the mass. If the mass is of considerable size it is likely to set up a desquamative inflammation which may result in dilatation of the osseous canal or even destruction of the walls and invasion of the pneumatic spaces of the mastoid. The membrana tympani may be perforated as a result of the pressure.

Symptoms.—These depend on the size of the mass, its location and the amount of inflammation excited. The first sign of trouble may be sudden impairment of hearing following the entrance of water into the ear. The ear feels stuffy and full. This is attributed by the patient to the water in the canal and as he is unable to relieve himself he seeks advice. Examination shows the presence of a plug that must have been there for a long time. The sudden loss of hearing is probably due to displacement of the plug so that it entirely closes the passage or comes in contact with the drum. More rarely the patient complains of very gradual loss of hearing and the beginning of subjective noises. If the closure is complete he complains also of autophony. The pressure may induce severe neuralgia, not in the ear alone but in the temporal and supraorbital regions. A common reflex disturbance is cough, which is

spasmodic and may be severe enough to induce a secondary congestion of the larynx. Other reflex symptoms are aprosexia, vertigo and epileptiform seizures. If the impaction occurs in an ear formerly the seat of a purulent middle ear inflammation there is serious obstruction to the outflow of the discharge.

Diagnosis. Objective examination is necessary to make a positive diagnosis.

Treatment. The first indication is to remove the mass. This should be done at one sitting by means of syringing, the blunt hook and curet. These instruments are to be used only with the greatest care and under perfect illumination.

SEBORRHOEA OF THE EXTERNAL AUDITORY CANAL.—Usually this affects both ears. The patients complain of having some pain or itching which has led them to make various applications to the affected parts or to scratch the canal. This leads to inflammation and pain. The ears become full of inspissated matter, in crust-like pieces, and in consequence there is more or less deafness and tinnitus. On examination the canals will be found filled with grayish-white scales, forming a pellicle, clinging to the wall of the canal and covering the membrane. It is often mistaken for eczema, but eczema rarely attacks the canal, and when it does it will be found on the auricle as well.

Treatment.—The local treatment of most value is the application of an ointment of ammoniated mercury, gra. 10 to the ounce of vaseline. The general health usually needs invigorating.

FOREIGN BODIES FROM WITHOUT.—It sometimes happens to individuals that an insect either flies or crawls into the ear. When this comes into contact with the sensitive osseous meatus or the drum most alarming symptoms may result. Tinnitus, pain and giddiness are present to a greater or less extent. Where a foetid otorrhoea exists flies may be attracted by the foul odor and enter the meatus and deposit their eggs. These develop into maggots, which attach themselves to the drum membrane or enter the middle ear. Great pain accompanies this. More commonly, however, various inanimate bodies are found in the ear. A long list might be made of these. They are such things as peas, beans, seeds, cherry pits, nuts, beads, slate pencils, buttons, shells, cotton wool, small stones, sand, bits of glass, pieces of straw, chips of wood, pins, pieces of gum, paper in wads, round tips of pencils and penholders, and many other similar foreign bodies. For practical purposes it is necessary to distinguish between those which tend to swell by imbibition of moisture, such as peas and beans, and those which do not.

Treatment.—It is most important that the surgeon should assure himself of the presence of a foreign body before undertaking its removal. This advice may seem unnecessary, but it is really impossible to take the statements of a patient or his friends without verifying them by examination. Often no foreign body will be found when the patient is perfectly certain that one is present.

Removal is to be effected by the syringe, hook, forceps or curet. If the drum is perforated and the



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foreign body is in the middle ear, water may be thrown through the eustachian tube while suction externally is employed. If the substance is small and heavy the ear should be syringed with the head down over the end of the table, to get the benefit of the force of gravity. Lowenberg has suggested the application of a small brush dipped in glue, which is allowed to set, so that the foreign body is withdrawn with it. When the meatus is closed or constricted or the foreign body impacted so that it cannot be removed in the ordinary way, then an operation must be done. That is, the auricle is detached posteriorly so that direct access may be had to the osseous portion, followed if necessary by chiselling away the posterior wall of the canal.

Insects in the ear may be killed with a few drops of oil, or by filling the canal with water, and then removed by syringing. Maggots are to be killed by instilling a few drops of ether or ehloreform, and then removed by a hook or by syringing.

EAR OF THE NEW BORN CHILD.—If the external ear and auditory canal of the new born is let alone, no trouble will come from retention of the natural secretions. These will be removed by the natural outward growth of the skin of the auditory meatus. The child is often the victim of swabbing and washing. This may induce infection and inflammation and even lead to perforation.

FRACTURE OF THE TYMPANIC BONE.—This bone enters largely into the formation of the posterior

boundary of the glenoid cavity, as well as into the formation of the anterior wall of the osseous auditory canal. Fracture of it may result from falls or blows upon the chin or cheek. The hæmorrhage from the ear which results has often misled the surgeon into a diagnosis of fracture of the base of the skull. The mistake is all the more likely if the patient is unconscious when first seen. If conscious he complains of pain in the ear, especially on moving the jaw. This symptom, with the swollen meatus and the detection of a projection of bone from the anterior wall into the canal completes the diagnosis.

Excessive hæmorrhage is to be checked in a way not harmful to the drum. Hence cold water should not be syringed into the ear. Any portion of bone projecting into the canal, against or through the drum, should be pushed back or removed, if loose.

BLEEDING FROM THE MEATUS.—This is not always serious. The traumatism may produce no further lesion. A blow on the mastoid has been followed by a sharp hæmorrhage and nothing more. In such a case the bleeding is from a fissure in the skin in the osseous meatus.

CHAPTER IV.

DISEASES OF THE MEMBRANA TYMPANI.

THE OUTER SURFACE OF THE MEMBRANA TYMPANI.—When the membrana tympani is looked at from without there are several prominent features.

1. Its circular shape and peculiar polish and lustre.
2. Its vertical and horizontal inclination.
3. The handle or manubrium of the malleus.
4. The short process of the malleus.
5. The folds of the membrana tympani.
6. The flaccid portion of the drum head above these folds, the so-called membrana flaccida or Shrapnell's membrane.
7. The bright triangular reflection of light in the antero-inferior quadrant of the membrane, called the triangle or pyramid of light.
8. The normal membrane is concavo-convex with the centre at the umbo.

MYRINGITIS.—As an idiopathic disease this is very rare, as a secondary condition very common. Some assert that it never occurs independently, but is always secondary to an inflammation in the middle ear or external meatus.

Symptoms.—A typical case is characterized by pain and tinnitus, but there is little disturbance of

hearing, at least at first. The membrane is seen to be congested, the degree varying according to the intensity of the condition. The position of the drum is not abnormal, and the wall of the meatus near the drum does not take part in the congestion; the eustachian tube is free and there is no evidence of fluid in the tympanum.

Treatment.—Dry heat will usually control the pain in this condition. It may be necessary to use a local anaesthetic application.

WOUNDS AND INJURIES OF THE MEMBRANA TYMPANI.—The drum membrane may be injured by direct or indirect violence; direct, when instruments are introduced into the canal; indirect when the injury is caused by the sudden condensation of the air in the meatus, as when a heavy gun is discharged close to the ear. The upper part of the drum is directly continuous with the integument of the upper wall of the meatus, so that traction upon the auricle, especially in children, may tear this part of the membrane. If a myringitis becomes intense, tissue necrosis may take place and the drum become perforated. Perforation of the drum from inflammation within the middle ear is very common but is of secondary importance. Injuries by direct violence are usually in the upper and posterior quadrant. When due to sudden condensation of the air in the meatus, either from a blow upon the ear or from an explosion, the rent is also in the postero-superior quadrant because the greatest breadth of the tympanic cavity is in this region. Openings through the drum are

usually single when traumatic. They vary in shape from a simple rent, the edges being only slightly separated, to an irregular opening, such as occurs when the force is considerable or when the membrane is very tense. Rupture following severe injury to the head is usually of slight importance in comparison with the fracture of the base of the skull or the cerebral concussion.

Symptoms.—The first symptom is severe pain, referred to the deeper part of the ear. There is at the same time deafness and loud subjective noises. Vertigo may be present and is due to sudden increase of labyrinthine pressure. There soon follows a watery discharge, and the acute pain gives way to a dull throbbing and aching. Upon blowing the nose the attention is at once drawn to the whistling sound produced by the passage of air through the perforation.

Diagnosis.—A recent rupture is easily made out on examination. When close to the margin of the drum it may not be recognized. Wounds in Shrapnell's membrane are less easily seen on account of the natural flaccidity of the parts.

Treatment.—This should be negative as far as possible. Dry the parts very lightly, dust a little boracic acid along the edges of the wound, occlude the meatus with some cotton wool and leave the rest to nature. If infection has taken place the treatment must be the same as for a purulent middle ear inflammation.

MEDICO-LEGAL SIGNIFICANCE OF INJURIES TO THE DRUM MEMBRANE.—After a blow upon the ear, either during a quarrel or in play, an action at law

may be taken to recover damages for supposed injury of the drum and consequent loss of hearing. In such a case the surgeon will be called upon to decide, first, whether there has been an injury done to the drum, and, second, if so, how far will it impair the hearing. In the first consideration he must bear in mind that the drum may have been perforated before the blow was received, though the patient or his friends may or may not have known it. The chronic perforation can easily be distinguished from the acute by its round and cicatrized edges. The acute one is irregular in outline and often has dried blood on its edges. If it is determined that a previously normal drum-head has been ruptured by a blow upon, or a thrust into, the ear, it remains for the surgeon to determine whether the hearing has been or will be impaired by the injury. A simple fissure may not injure the hearing in the least. If there has been no concussion of the inner ear, and no inflammation set up in the middle ear or in the drum head, the rupture will heal quickly if let alone. Ignorance on this score has often led to the use of drops of various kinds immediately after the injury, and these have produced trouble in the middle ear where none would have arisen, but the perforation would have healed in a few days of itself. Thus it would appear that the blow caused the bad result when in reality it was due to the meddling treatment. If in a case of asserted violence to the ear, deafness should be discovered by the surgeon, it must be determined whether it has been produced by the same blow which ruptured the drum or whether it existed before. A temporary diminution of hearing is very likely to oc-

cur after a blow on the ear, hard enough to rupture the drum, but if great and sudden deafness comes on after a blow on a previously healthy ear, and it remains so for several days without signs of improvement, it must be judged permanent.

CHAPTER V.

DISEASES OF THE EUSTACHIAN TUBE.

EUSTACHIAN CATARRH OR TUBAL CONGESTION.

—The most common cause of this condition is acute coryza or acute nasopharyngitis. Rarely it is a primary condition due to exposure to cold. It complicates light attacks of the exanthemata in children. It may depend on the entrance of some irritating fluid while bathing or using the nasal spray. The chief predisposing cause is some obstruction in the nose or naso-pharynx. Adenoid vegetations in the vault of the pharynx are a very important factor, as they become engorged with blood, causing venous hyperaemia of the walls of the tube, narrowing or completely closing its lumen. At the same time this soft tissue affords lodgement to pathogenic bacteria and during respiration, and from this locality they possibly find their way into the canal.

Pathology.—Within the tube the condition is one of simple venous hyperaemia, the mucus membrane becomes swollen and flabby, the walls of the tube lying in contact and adhering closely on account of the viscid secretion. The secretion is at first thin, but when the process is fully developed it becomes thick, tenacious and glairy and may close the tube completely. The cartilaginous part of the tube is most affected. When the eustachian tube is closed for any reason, the air contained in the tympanum

disappears by absorption. This produces diminished atmospheric pressure in this cavity and the pressure without being the same the drum head is crowded inward. If the canal remains closed long, we find the drum membrane displaced or retracted so that it comes in contact with the opposite tympanic wall.

Symptoms.—When this accompanies a cold in the head there is usually a sudden onset of the symptoms. There is a feeling of stuffiness or heaviness in the ear as though the external ear were closed by a foreign body, and the patient has a desire to insert the finger into the meatus to clear the ear. This fingering may produce a momentary relief from exhaustion of the air in the meatus as the finger is withdrawn suddenly. There may be some slight pain in the upper part of the pharynx or near the tonsil, or it may be referred to the larynx or radiate from it toward the ear; but there is no actual pain in the ear. Hearing is impaired and subjective noises are always present. Among the rarer symptoms are vertigo from sudden increase of labyrinthine pressure and mental heaviness and torpidity,—the patient says he feels stupid.

Diagnosis.—Inspection shows a retracted drum membrane; the color and lustre are normal but the light reflex is either absent, displaced or multiple. Owing to the stretching to which the membrane is subjected it may appear thinner than usual. There is no evidence of congestion. The physical appearance is due entirely to the lessening of the atmospheric pressure in the tympanum. When the ear is inflated either by Politzer's method or by the catheter, we find that the canal is opened with some difficulty,

and several attempts may be made before any air enters the tympanum. When it enters freely, the sudden replacement of the drum to its normal position is recognized by the sharp metallic click as the membrane is forced outward. Upon testing the hearing, we find it materially reduced. Bone conduction is increased and the tuning fork on the vertex, forehead or teeth is referred to the poorer ear.

Prognosis.—This is ordinarily one of the simplest affections of the ear and an attack passes off, under treatment, in from five to fourteen days. The danger lies in recurrence and neglect. The abnormal position of the drum head gradually becomes permanent and chronic inflammatory changes are set up in the middle ear.

Treatment.—This is directed to the acute attack first of all and then to prophylaxis. The subjective noises, the deafness and the feeling of discomfort are relieved by inflation which restores the membrane to its normal position. Inflation may be accomplished by Politzer's method or the catheter. The relief is instantaneous when the malposition is corrected, and the mental depression is removed at once. After the first inflation the retraction, and, of course, the symptoms return in from three to twenty-four hours, and it is well always to prepare the patient for this. It is unusual that a single inflation will permanently relieve the condition. The abnormal condition of the tube requires some attention. It is usually the cartilaginous portion of the tube that is affected and an application of an astringent to the mouth of the tube will be beneficial. Nitrate of silver, 10 to 20 grains to the ounce, is probably the best solution.

Prophylactic measures include attention to the mucus membrane of the nose and naso-pharynx. These patients are always subject to colds in the head or throat. Enlarged tonsils and adenoids must be removed. So also any hypertrophy of the turbinated bodies, or deviation of the septum must be radically treated. The general hygiene of the patient must be investigated. The daily bath, the use of all wool underwear and a regulation of the habits of life will tend to prevent successive attacks.

TUBO-TYMPANIC CONGESTION OR TUBO-TYMPANIC CATARRH.—In this condition there are changes in the tympanum in addition to those already mentioned as occurring in the eustachian tube. The congestion in the tympanum depends upon physical changes rather than upon any inflammatory process. The exciting causes are usually the same as those of simple tubal catarrh.

Pathology.—We find in the tympanum a simple engorgement of the vessels supplying the mucus membrane, which may result in one of two conditions; either a hypersecretion and accumulation of mucus within the tympanum, or a serous exudation. The latter may be determined by the tenuity of the vessel walls,—a constitutional condition not uncommon in those afflicted with gout, or with cardiac, hepatic or renal disease. This venous congestion can be seen in the tympanic membrane and is greatest along the manubrium mallei, close to the periphery and in the upper and posterior segment.

Symptoms.—The symptoms given for tubal catarrh are modified when the tympanum is involved.

There is distinct pain and the feeling of heaviness is less marked. Pain is particularly severe when the vault of the cavity is involved. The loss of hearing is not sudden nor as great. Tinnitus is present and is worse when the patient is lying down. When there is fluid in the tympanum, hearing varies according to the position of the patient's head. Another characteristic symptom is the occurrence of a bubbling or snapping sound when the patient blows the nose forcibly or during the act of deglutition. Autophony is also troublesome.

Diagnosis.—The appearances vary in the different cases according to the actual condition present. The distinctive feature as contrasted with simple tubal stenosis, is in certain changes in the circulation. The drum head, instead of being pearly white, is changed to either a dull white or is of a slightly pinkish-white tinge. At the periphery and along the handle of the malleus the change of color is decidedly more marked and is of a dull red hue. These changes indicate a venous congestion and not a true inflammatory action. The collapse of the drum head is not usually so great as in simple obstruction, and if exudation of serum has taken place into the tympanum, the displacement is very slight. Instead of this the lower part of the membrane is slightly yellow, the lustre is diminished and the density is increased. This appearance is due to the fluid, and sometimes we see a sharp line crossing the drum transversely and marking the upper level of the fluid. Movement of the head may cause a change in the direction of this line. When inflation is practised the air bubbles are sometimes visible. Upon

examining the hearing we find diminished air conduction both for sharp sounds and for the conversational voice and for whispered speech. The tuning fork on the middle line is heard better on the affected side.

Prognosis.—It is the exception for the parts to return to the normal condition without treatment. Chronic otitis media is likely to result.

Treatment.—In the acute stage the measures already mentioned for the relief of tubal catarrh are to be adopted. In addition we have to deal with the congestion in the tympanum and with the effusion when it is present. For the latter we must secure its absorption or its exit by mechanical means. To relieve the congestion local blood letting is the most effective treatment. If from two to four ounces of blood be drawn from in front of the tragus the symptoms usually disappear. This should be followed by inflation, which tends to prevent effusion taking place. When effusion is present we may evacuate by an incision through the drum or try to promote its removal through the eustachian tube. The latter plan may be tried first, the frequent inflation of the cavity with medicated vapors and the use of astringents on the mouth of the tube, tend to keep it patulous and so promote drainage of the fluid. If it does not pass off in this way in fourteen days at the most, then the membrane must be incised, and this should be done freely to secure proper evacuation. The incision is usually made in the postero-inferior quadrant. Then a few vigorous efforts at inflation by the Politzer's method will clear the cavity of fluid. To avoid infection the external meatus should be sterilized before the incision is made.

CHAPTER VI.

OTITIS MEDIA.

INFLAMMATION OF THE MIDDLE EAR.—There are four forms of this:—

1. Acute Catarrhal Otitis Media.
2. Chronic Catarrhal Otitis Media.
3. Acute Suppurative Otitis Media.
4. Chronic Suppurative Otitis Media.

Of these the first tends to pass into the second or third; the third frequently passes into the fourth. The second may gradually develop without a previous acute attack. The third is always preceded by the first to a greater or less degree. The fourth is usually preceded by the third, the exception being in tuberculous subjects. It is often impossible to draw the line between these four conditions, so as to say where one ends and the other begins.

It is now agreed that an organism is always present in an acute inflammation of the middle ear. Four of these have been positively determined as producing acute otitis media. These are, 1. *Streptococcus pyogenes*. 2. Frankel's pneumococcus. 3. Friedlander's pneumobacillus. 4. *Staphylococcus pyogenes*.

ACUTE CATARRHAL OTITIS MEDIA.—This is ap-

plied to an inflammation in the middle ear with an increase in the normal secretion.

Etiology.—An acute catarrhal otitis media may complicate a cold in the head, measles or scarlet fever, or is produced by the introduction of fluids into the middle ear through the eustachian tube while bathing or when using the nasal douche. Violent blowing of the nose may force something through the tube and so induce it. Exposure to cold and wet may bring it on without other symptoms in the upper respiratory passages. Traumatic rupture of the drum may lead to it. Any abnormal condition of the naso-pharynx is a predisposing cause.

Symptoms.—These vary according to the age of the patient. In very young children the symptoms may be so severe as to lead one to think that a much more serious disease is present. The attack will usually come on at night; after a restless sleep the child awakens and appears to suffer intensely. The temperature will vary from 102° to 104° . The child may not put its hand to the ear or complain of it, so that it may not be suspected as the cause of trouble. After a few hours there will be a sero-mucus discharge from the ear and the symptoms disappear, the child falling asleep and the temperature coming down. In some cases convulsions or severe vomiting usher in an attack and so simulate meningitis. In other cases the pain does not cease with the appearance of the discharge, even though the drainage is free. This depends upon a continued severe inflammation in the middle ear cavity. In adults the early symptoms may be so slight as to pass unnoticed. Beginning with a fullness or stuffiness, some pain

gradually comes on and steadily increases till it becomes severe. The pain is localized in the ear and is distinctly worse on lying down. Subjective noises of a high pitched character are present, but not complained of. Loss of hearing is at first slight but increases. Each act of deglutition is painful. The general temperature is seldom elevated, but there is great prostration. At any period, from 12 to 48 hours after onset, rupture may take place in the membrane and with a sero-mucus discharge the pain ceases. In many cases rupture does not take place and after the inflammatory process subsides a sero-mucus collection remains in the tympanum. When rupture takes place and the fluid is discharged all the symptoms may cease, the opening in the membrane closes and the parts return to their normal condition; or if the discharge continues, it may by exposure to the air become infected and turn to a purulent secretion. The infection may spread to the middle ear and then the process follows the course of a chronic suppurative inflammation. The character of the discharge varies both in adults and in children according to the period of the disease. During the first few days the fluid is large in amount, turbid from the large mixture of epithelial cells, and viscid from the presence of mucin. The discharge is much more profuse in children. If the case progresses favorably the secretion gradually becomes thinner and more watery and finally ceases altogether. If the perforation in the drum head becomes occluded while the secretion is still free in the middle ear, the constitutional symptoms and the pain are likely to return. A relapse of this kind is always more serious than a first attack.

Diagnosis.—The drum head will be found in the early stages distinctly hyperaemic. The redness is diffuse and this serves to differentiate it from the congestion of tubo-tympanitis in which the vessels stand out prominently. Later on the membrane is uniformly reddened, the lustre is wanting, the landmarks are obscured by oedema, and there is more or less bulging from the effusion into the tympanum. After the discharge appears an examination will discover the canal filled with sero-mucus fluid. When this is removed by the cotton swab the perforation may be seen. It is usually in the inferior segment, either just below the membrana flaccida or in the anterior portion near the periphery. The presence of discharge in the meatus is positive evidence that a perforation exists. Inflation will also afford evidence of this from the sharp high-pitched perforation whistle. A functional examination is not usually made.

Prognosis.—These cases terminate favorably, as a rule, often without treatment. Purulent otitis media and involvement of the mastoid cells may occur. If perforation does not take place the case may fail to undergo complete resolution, and a certain amount of fluid remain in the tympanum, causing deafness and tinnitus. If the fluid is absorbed, the mucus membrane may fail to return to its normal condition and pass into a chronic inflammatory state. The presence of fluid in the middle ear for some time may produce a relaxed drum membrane. When the perforation has taken place the opening may close spontaneously; or it may persist, leaving the internal wall of the tympanum exposed; or the ligamentous structures within the middle ear may undergo cic-

tricial contraction, displacing the parts and interfering with their function. Extension to the cranial cavity does not take place when the disease is of the catarrhal type.

Treatment.—The first indication is to relieve the pain. The patient should be put to bed, a saline cathartic given, and an opiate administered sufficient to allay the pain. Complete relief from the pain should be secured for some hours during which an attempt may be made to abort the inflammation. This is to be done by local bloodletting. From two to four ounces of blood should be drawn from in front of the tragus, or two leeches may be applied in this situation. The application of dry heat is also of value to relieve the pain. This may be secured by the hot water bottle or hot salt bag. Cold applications do harm. Irrigation with hot water is also beneficial as it brings the heat directly to the drum membrane. Oily solutions are of no value. Relief is sometimes given by aqueous solutions of cocaine, morphia and atropine, and carbolic acid in glycerine (1 to 20) is also frequently used. If the attack is not aborted by these means then the membrane should be incised. The local depletion is of great value and is permanent. When bulging is present the centre of the incision should be over the most prominent point. If there is nothing to guide us the knife should be entered close to the periphery, just below the posterior fold, and a curved incision made in the clear membrane parallel to the line of insertion and down to the inferior quadrant. The membrane of the inner tympanic wall should be incised at the same time to secure depletion. Before operation

the canal should be rendered aseptic. Irrigation frequently with a warm antiseptic solution after the membrane has been divided will tend to relieve the pain and to restore the vessels to their normal calibre. During the period of discharge the ear must be kept clear and this may be done by frequent syringing with a mild antiseptic solution. The frequency must depend on the amount of the discharge. Six times a day may be necessary at first, the interval being prolonged as the discharge becomes less. These cases should be seen daily by the surgeon who should cleanse the canal himself, dry it out and then insufflate a small quantity of some antiseptic powder, sufficient being used to dust over the surface lightly but not packing the canal so as to prevent free drainage. In some cases of spontaneous rupture the opening should be enlarged and the cavity then cleared out by inflation, or by using the middle ear syringe. Tinnitus may persist for some time after the parts appear normal and the hearing is restored. Ultimately the subjective noises disappear. Hydrobromic acid is of use to allay a persistent tinnitus of this kind.

ACUTE PURULENT OTITIS MEDIA.—A purulent otitis media indicates an infection of that cavity. Thus it may follow a catarrhal otitis media by infection of the exudation either through the eustachian tube or through the perforation in the membrane. One of the most common causes is an acute infectious disease, such as scarlatina, measles, pneumonia, epidemic influenza, typhus fever or cerebro-spinal

meningitis. It often follows the introduction of fluids into the middle ear through the eustachian tube. An external otitis may pass through the Rivinian segment and set up a purulent condition.

Pathology.—The four micro-organisms which have been shown to produce a purulent inflammation in the ear have already been mentioned. In addition to these there are three others which have been exceptionally found, (1) the bacillus pyocyaneus, (2) the meningococcus intracellularis and (3) the actinomyces.

The first stage is a hyperaemia which produces an engorgement of the tympanum. This is followed by a transudation of the fluid element of the blood and a migration of white blood cells. Then local necrosis takes place, the tissue breaking down with the formation of pus. As a result of the local oedema the blood supply of the ossicular chain is interfered with and bony necrosis may occur quite early. This usually takes place in the incus first because of its limited blood supply in proportion to its size and the fact that the blood vessels follow such a course that they are subjected to pressure early in the attack. The fluid gravitates to the lowest part of the cavity.

Symptoms.—The characteristic symptom is sudden and severe pain deep in the ear. With this there is elevation of temperature, from 101° to 103° , severe headache, constipation and marked constitutional depression. The hearing is impaired, tinnitus is present and sometimes vertigo. In children convulsions may usher in an attack, and in adults delirium may sometimes accompany the elevation of temperature. The pain continues till the pus is

evacuated and this may not be for several days. If the oedema is considerable, the pain is not entirely removed by the rupture, unless it is large enough to permit very free drainage. Extension to the mastoid cells may occur before perforation or subsequent to it, but in either event, it is characterized by a general augmentation of the severity of all the symptoms. Involvement of the structures within the cranial cavity is accompanied by chill or rigor, very high temperature, violent delirium, and convulsive movements followed by paresis. When the lateral sinus becomes involved, either from the middle ear or from the mastoid, symptoms of pyaemia appear. These are a chill or rigor, sudden high temperature with an equally sudden return to the normal or subnormal, and profuse sweating. The sudden changes in temperature are repeated at intervals varying from a few hours to one or two days. When the labyrinth is involved there is vertigo, nausea and either absolute deafness or loss of certain portions of the register. The latter complication is very rare, a fact which suggests that the vascular connection between the middle ear and the labyrinth is not very close.

Diagnosis.—Early inspection of the drum membrane shows the upper part or membrana flaccida congested, presenting a dull red color. In this early stage prompt measures may abort the attack. Later on when engorgement takes place the membrana flaccida is pushed outward. The entire drum is of a deep red color, oedematous, moist and the normal lustre is entirely wanting. The short process and the manubrium may not be visible, being obscured by the oedema. The secretion may be confined by

the mucus folds in the tympanum so as to present several tumified masses in the fundus of the canal close to the superior wall. When perforation takes place spontaneously it is usually found in the posterior portion just above the centre and near the periphery; but it may be above the posterior fold and entirely within the membrana flaccida. When the fluid is in the attic, forcing air into the middle ear before perforation may not show the presence of fluid, and after perforation there may be no perforation whistle.

Prognosis.—When once pus is formed it must be evacuated. The perforation may then heal and the parts be restored to their normal condition. Very rarely the pus finds its way into the throat through the eustachian tube. Under the most favorable conditions there is likely to be more or less permanent destruction of an area of the drum, and the ossicular chain is usually bound down to the internal tympanic wall at various points by cicatricial bands. The interference with hearing depends on the location of these adhesions. In the majority of untreated cases a chronic purulent otitis develops. Death may result from direct involvement of the cranial cavity or subsequent to mastoid inflammation. Involvement of the labyrinth is the exception.

Treatment.—The treatment advised for the catarrhal form should be used first. If the pain continues then an attempt may be made to abort the attack by drawing blood from in front of the tragus. The wet cup or the leech can be used. The leech, however, does nothing which the wet cup cannot do and much time is saved. If depletion in this way does

not give immediate relief then the drum should be freely incised, and the bleeding which follows should be encouraged by irrigation with warm water. We do not expect to find pus, but to prevent its formation, and therefore the greatest care must be taken to keep the field of operation perfectly aseptic. Upon the appearance of discharge either by spontaneous rupture or after incision, the canal must be kept free by frequent irrigation with a warm antiseptic solution. In all cases the patient should be kept quiet and confined to the house. A mild laxative should be given and all stimulants and rich diet forbidden. The action of the skin should be promoted. When the discharge is profuse it may be necessary to douche the ear every hour. The frequency with which this is done must depend on the quantity of the discharge. After the inflammatory symptoms have commenced to subside the dry method of treatment should be adopted to promote healing. This consists of drying the canal and then with a powder blower introducing a powder such as boracic acid, stearate of zinc with aristol, or dermatol (bismuth subgallate). This should be dusted lightly into the canal and not packed so as to prevent the exit of the secretions. If the pus does not gradually cease some astringent must be used. Alcohol is probably the best. In all cases attention must be paid to the nose and naso-pharynx.

CHRONIC CATARRHAL OTITIS MEDIA.—This is an affection of the middle ear, characterized by gradual and progressive changes in the structure of the mucus membrane and adjacent connective tissue,

these changes taking the form of cellular proliferation, organization of new tissue and hypertrophy, followed by contraction of the new tissue and atrophy. Clinically it may be defined as a chronic non-suppurative inflammation with progressive deafness, tinnitus and vertigo, the drum membrane being changed in lustre, color, consistence, tension and curvature. "Catarrhal deafness" is a term frequently applied to these cases and while in a sense it is correct it usually leads to confusion.

Many authors describe two distinct forms of this disease; a chronic exudative or moist catarrh of the ear and a so-called dry form or in other words a hypertrophic and an atrophic or sclerotic otitis. These titles represent different pathological conditions but there are so many intermediate forms and the conditions so often succeed each other that their separation as distinct diseases is not possible. Moreover the clinical symptoms, subjective and objective, are so often the same that it is impossible to differentiate between them in this way.

Etiology.—The predisposing causes are all circumstances which tend to produce a permanent depression of the vitality of the body. Heredity has been regarded as one of the most potent and frequent factors. Certain families show a peculiar predisposition to catarrhal otitis. It commonly begins in early life before the age of twenty. Climatic conditions have an important bearing. Climate is mainly dependent on three factors,—temperature, humidity and barometric pressure. The disturbing effects of climate are based not so much on the yearly range of the temperature, humidity and pressure as upon

the rapidity with which these conditions are apt to vary at any one time. It is a matter of common experience that changeable weather is most favorable to the development of colds; that catarrhal affections of all sorts are most numerous in autumn and spring when sudden alternations of heat and cold occur. Systemic depression is caused most often by sudden chilling of the surface of the body when not prepared for the action of cold. This refrigeration is most often produced by a current of air, and the absolute temperature is not of so much importance as the relative temperature of the air and body. For example a comparatively warm breeze acting upon a skin which is relaxed and perspiring from the effects of exertion and heat, has a decidedly greater cooling tendency than a cold winter wind striking a non-perspiring bloodless surface. The local impression may be profound or slight, the difference depending upon differences in individual susceptibility, which cause the same degree of exposure to be followed in the one case by no ill effect whatever, in another by a cold in the head, and in a third by an attack of pneumonia. Unhygienic surroundings and methods of living is another important factor. Among poorer people, overcrowding, bad air and insufficient or improper food produce a great many sickly and anaemic persons who are prone to catarrhal troubles. Excessive mental and physical strain lead also to a depreciated system. Chronic diseases such as syphilis and serofula predispose to these troubles also. As to the exciting causes, a chronic aural catarrh may follow an acute tubo-tympanitis, or it may be idiopathic. In any case where the disease is

chronic from the first it depends on some fault in the manner of living through which the patient becomes susceptible to vascular changes in those portions of the body lined with mucous membrane. Frequent exposure to cold produces repeated attacks of acute rhinitis or acute nasopharyngitis and this leads to congestion in the tympanum. Reflex irritation from local diseases is also an exciting cause. Another important cause is continual exposure to loud noises and repeated concussion; residents of noisy cities, railroad employees and artisans in noisy manufactories furnish many cases.

Pathology.—The changes in this disease are multiform, but they may be reduced to two sets of phenomena, one comprising the various processes of proliferation, exudation and overgrowth and the other the processes of contraction and atrophy. The membrana tympani usually takes part to a greater or less extent in the processes going on in the tympanic cavity. The changes produced are hyperaemia, retraction, thickening and atrophy. The congestion is specially marked along the handle of the malleus. Retraction is caused by the pressure of the external atmosphere, the air in the tympanum becoming rarified by absorption. If this retraction is maintained for a long time it becomes organic, caused by organization and shrinking of the exudates. When extreme, the drum head lies against the inner wall of the tympanum and it may be immovably attached to it by adhesions. Thickening of the drum membrane is a very common feature. Atrophy is less frequent.

Symptoms. — Deafness is always present and varies from slight impairment to almost absolute deafness. It is progressive but usually so slow that the patient is not aware of the advance. Extreme degrees of deafness indicate involvement of the labyrinth. Moderate degrees are produced by the changes in the middle ear. Altered tension, retraction and rigidity of the drum, displacement and fixation of the ossicles, contraction of the lumen of the tympanum, and diminution of air pressure all interfere with the transmission of sound waves. Peculiar modifications of hearing are frequent in this disease.

1. Autophony. In this the sound of one's own voice is heard either as if coming through the tissues of the head or as if from some outside source.

2. Dysacusma. This is a sensation of pain or discomfort caused by loud or even moderate noises. This differs from hyperaesthesia acustica which signifies an excessive sensitiveness of the auditory centres so that there is an abnormal acuity, the patient hearing sounds inaudible to others.

3. Pseudacusma or false hearing in which outside sounds or one's own voice is heard altered in pitch and quality. This is most likely to be observed in trained musicians and is a serious impediment to the practice of their profession.

4. Paracusis duplicata, in which sounds are doubled so as to be heard twice in the same ear.

5. Paracusis Willisii, or increased hearing power in a noise. This is quite common and has been usually regarded as pointing to an unfavorable prognosis.

Tinnitus is the symptom next to deafness in im-

portance. In many cases it is the only symptom of which the patient complains. If it is at all prominent it is sure to produce great annoyance and distress. If more intense the disagreeable sensation may amount to actual pain; and very aggravated cases make the patient's life a burden to him. The latter are likely to become melancholic and may go on to actual insanity. Like the deafness it tends to increase as the case advances, but it shows great fluctuation both in intensity and constancy. Involvement of the labyrinth may increase or decrease according as the auditory nerve fibres are simply irritated or rendered functionally incompetent.

Tinnitus varies not only in intensity and constancy, but also in quality, pitch and rhythm. There is scarcely a known sound which has not had its counterpart as a subjective noise in the ear. The patient likens the noise to external sounds, with which he is familiar. The mechanic thinks he hears the sound of escaping steam or the noise of machinery; the farmer says he hears the buzzing of bees or the humming of flies. In hysterical patients the imagination comes so greatly into play as to render their account of the character of the noise quite worthless. A pulsating, beating or pumping sound, especially if synchronous with the heart beat, is produced by vibration from the passage of blood through the vessels and transmitted to the internal ear, either through the ordinary channel or through the bones of the head. These vascular sounds are increased on stooping, by physical exertion, mental excitement or anything intensifying the circulation in the vessels of the head and neck. Other sounds are synchronous

with the movements of respiration, mastication or deglutition. Certain other sounds are produced in the ear itself. These may be due to movements of the ossicles, in which the noises are apt to have a metallic character and to be described as ticking or grating; or they may be due to agitation of the dry drum head, and are then spoken of as crackling or crumpling; or they may be caused by the sudden separation of agglutinated mucus surfaces, when the patient says he has the sensation of opening and shutting the ears. Lastly, the sound may be due to changes in the sound perceiving apparatus when there will be some other evidence of labyrinthine trouble. Patients usually complain that the tinnitus is more annoying at night, this being due either to the fact that their attention is more directly called to it when everything is quiet or else because of the increased congestion of the head in the recumbent position. Auditory hallucinations are a form of tinnitus, modified by the patient's imagination. Thus the noise of blood pulsating may, to a nervous person, be transmuted into the voices of dead friends or of enemies or some supernatural sound. The importance of these, apart from the distress they cause, lies in the fact that in persons predisposed to insanity they actually induce it. The hearing of voices is always to be regarded seriously. The third leading symptom is vertigo, which when present is complained of more than all the others. It occurs in about eight per cent. of all cases, and it may not, in the mind of the patient be associated with the ear trouble. In mild cases it is limited to transient attacks of giddiness, while those more severely affected are unable

to maintain their balance and fall to the ground unless supported. This symptom is due either to structural changes transmitted from the tympanum to the internal ear or to simple alteration in the intralabyrinthine pressure from increased tension of the ossicles transmitted through the fenestra ovalis. The difference between these two varieties is of great importance, because while the first cannot be benefitted, the second class may possibly secure some relief. As a matter of fact the removal of the ossicles has been followed by cessation of all vertigo. The discrimination is however difficult and sometimes impossible. It must be remembered, too, that the vertigo may be the result of some intercurrent cerebral disease. Vertigo, like tinnitus, varies greatly, being aggravated by any condition which increases the intra-cranial pressure, such as physical exertion, straining, stooping and mental excitement. Sensations of discomfort in the head and ears are very frequent. These are described as a feeling of weight, pressure or fullness. Pain in the ear is very rare in this condition. It should be regarded rather as an intercurrent symptom. Certain general symptoms are often met with. These are mainly the symptoms of the general condition producing the catarrh. In children we find the pale, bloated or sodden skin, indicating chronic malnutrition from disease or improper hygiene. In adults there are symptoms of nervous exhaustion or depression, such as excitability and irritability of temper, a tendency to become tired in mind and body after slight exertion, and a predisposition to neuralgia or migrane.

Objective Examination.—The diagnosis is effected by three procedures: 1. Inspection of the membrana tympani. 2. Testing the function. 3. By artificial alteration of the conditions of tympanic pressure. The appearance of the drum membrane does not always afford a certain indication of the state of the tympanic cavity, but as it is the only part accessible to direct observation we must be prepared to draw from it whatever inferences we can. Hence changes in lustre, curvature, consistency and tension are carefully scrutinized. The lustre and color may be very nearly normal even when a sclerotic process is far advanced but in most cases the evidence of involvement of the drum is very marked. There may be patches of opacity, or the whole membrane may have lost its translucency, the surface being dull and lustreless. The normal pearly hue is converted into a dull muddy hazy gray; sometimes the surface has a greasy, moist look, sometimes it appears dry like paper. The cone of light becomes shortened, broadened and irregular, grows duller and finally disappears altogether. If the thickening of the tissues goes on all the distinctions on the surface are obliterated and we have simply a porcelain white sheet; but on the other hand if the case goes on to the atrophic stage, the membrane again becomes lustrous and may be more translucent than usual. The degenerative processes may also produce clear-cut, chalky white opacities from the deposition of calcareous matter. The second procedure is to test the function. The tuning fork tests are not entirely satisfactory. The third procedure is the use of the pneumatic test, by the artificial alteration of the intra-tympanic pres-

sure, either by rarifying or condensing the air in the external auditory canal or in the tympanum. For this purpose we use Siegle's otoscope, Politzer's air bag or Valsalva's method. The simplest method is to have the drum under observation when the patient inflates by Valsalva's method or the diagnostic tube may be used. In this way we ascertain whether the eustachian tube is open, and whether the drum membrane moves freely, is rigidly fixed or abnormally flaccid. The hearing should be tested before and after inflation to ascertain how far the deafness is due to eustachian closure.

Prognosis.—This depends upon the age of the patient, the state of his general health and the amount of damage which the ear has already suffered, as well as the duration of the case. It is usually unfavorable.

Treatment.—Unfortunately most of these cases come after the disease has lasted some years and has done great damage. It is often necessary to express an adverse opinion and to decline to treat the case at all. When a case is undertaken an attempt should be made to get rid of the cause provoking the catarrh. The causes for which treatment may be undertaken, are unfavorable climatic conditions, unhygienic conditions of life, diseases producing debility, and the reflex and exciting causes from other organs. Much may be done by attending to proper ventilation and moisture, and the avoidance of draughts in living and sleeping rooms. So also proper clothing should be worn to protect the body against sudden extreme changes in temperature. The middle ear may also be treated by frequent inflation and the introduction of a vapor to influence the tension of the drum and to

remove the exudate or to promote its absorption. The use of the Politzer's air bag to keep the eustachian tube open and to force the drum head out when it is retracted will sometimes break up adhesions between the drum and the inner wall. The injection of vapors through the eustachian is also beneficial. Free iodine is of the greatest service as it provokes a mild reaction which tends to carry off pathological deposits. This is used by placing in the nose-piece of the Politzer bag a few drops of a solution of iodoform in chloroform, one dram to the ounce. When the pressure is exerted the diffusion of the gas is so rapid that it is felt at once in the middle ear. Operative measures upon the tympanum and its contents have been tried lately but without satisfactory results. These operations include paracentesis of the drum head, tenotomy of the tensor tympani and stapedius and the removal of the drum head and ossicles.

CHRONIC SUPPURATIVE INFLAMMATION OF THE MIDDLE EAR.—This is a continuation of an acute otitis media, and therefore the causes need not be discussed again. Middle ear inflammation in measles, scarlet fever and diphtheria is prone to become chronic. In tubercular patients the condition may be chronic from the first, that is, it may not be ushered in by the usual pain and general disturbance, but deafness and a discharge of pus are simultaneous. Otitis in diabetic patients also runs a chronic course. Anatomically all cases of chronic suppuration have the following points in common, viz., a perforation

in the tympanic membrane and more or less purulent secretion thrown off from the mucus lining of the middle ear. There is always more or less deafness, but the degree varies within wide limits. This symptom is due to several factors,—three at least. 1. The perforation. 2. The swelling of the mucus membrane or the clogging of the ossicles with pus. 3. Destructive changes in the tympanum. A perforation is not in itself the cause of very marked deafness. In the case of a very large perforation occupying the posterior and upper part, the hearing is often very good, as the sound waves reach the stapes directly. When the perforation is small the secretion tends to accumulate in the tympanum and so interferes with the motion of the ossicles. In some cases the ossicles have all been destroyed, and then great deafness is likely to be present. When absolute deafness exists it is due to co-existing disease of the labyrinth. The various forms of perforation are :

1. Pinhole perforation. Usually valve like and hard to see.
2. The typical perforation, which is round or oval and clean cut.
3. Kidney shaped. This is owing to the long handle of the malleus.
4. Healing perforation. There is a margin of injected membrane.
5. Unhealthy perforation. The margin is thickened and surrounded by granulations which often give rise to polypi.
6. Dry free perforation. This has healed around the perforation margin and becomes a permanent condition.

7. Dry adherent perforation. This is adherent to the inner wall of the tympanum.

8. Perforation in the membrana flaccida. This is the most serious and dangerous.

Pain is not a symptom of uncomplicated chronic suppuration. Tinnitus is not always present and vertigo is rare. Discharge of pus or muco-pus through the perforation is more or less constant. This may be very abundant so as to flow from the external meatus, or it may be small in amount so that the patient is not aware of it. There is always an intense fetor. That the secretion is irritating is shown by the frequent occurrence of eczema or ulceration about the meatus and auricle. The discharge may be classified as follows :

1. Healthy or what was formerly called "laudable" pus. This is thin and not offensive.

2. Ropy. This is seen after recent acute inflammation and is on account of its admixture with mucus.

3. Thin and watery. During the healing stage it may become of this character. Also in neglected cases it may become so, but then it is acrid, copious and very irritating.

4. Sanguineous. Blood denotes a granulating surface or a soft polypus.

5. Foetid. This is always present in neglected cases and when bone is diseased.

On inspecting the ear various pictures present themselves ; indeed it may be said that no two cases are exactly similar. The discharge must be removed before the drum membrane can be inspected. The latter or what remains of it is more or less thickened ; it may have a fleshy look or contain calcareous de-

posits. More than one perforation may be present in the same membrane.

Diagnosis.—This is simple. Discharge of pus is strong presumptive evidence, while pulsation of the secretion corroborates. The perforation is usually visible and when Valsalva's inflation is done, bubbles of air and fluid are seen to pass through it. The same is the case when Siegle's pneumatic speculum is used. A perforation in Shrapnell's membrane may not give the perforation whistle, because the upper parts of the tympanum may be shut off from the lower by the inflammatory process. The course of uncomplicated chronic suppuration varies. It may, under treatment, gradually cease and the perforation become cicatrized as a dark colored patch becoming gradually more transparent. The cicatrix may become adherent and fix the drum to the inner wall. In a certain proportion of cases the discharge ceases, but the perforation remains. Such a condition is liable to recurrence on account of the exposure of the tympanic mucus membrane. In another class of cases the discharge continues in spite of treatment. This is more likely to be the case when there is perforation of the membrana flaccida.

Prognosis.—This is of interest in reference to life and hearing. In regard to the danger to life, the freer the drainage the less it is. A history of repeated attacks of pain followed by re-appearance or increase of the discharge is a serious matter. As to the hearing power we cannot speak definitely from the appearance. If the perforation is large we can form some idea from the condition of the mucus membrane in the tympanum whether treatment will

he of benefit. If it is much swollen and secreting freely we may expect to restore some part of the hearing. If inflation causes distinct improvement some benefit will come from treatment. The prognosis in such diseases as phthisis and diabetes is not good.

Treatment.—Cleanliness is of the first importance. The patient may be allowed to syringe the ear himself frequently with an antiseptic solution if no unpleasant sensations such as vertigo result from it. If, however, a chronic case is to be cured the surgeon must undertake the whole thing and treat the ear himself every day. The syringe may be used first with carbolic or bichloride solution. Then Politzer's inflation is done to drive all the secretion out of the middle ear. Peroxide of hydrogen may be used on a cotton swab to cleanse the cavity. When once this is done, medication of the diseased surface is to be considered. Alcohol makes the very best application provided there is no necrosed bone and no great periostitis. Lastly the parts are dusted lightly with a dry powder, either boracic acid or stearate of zinc with aristol. If no complication exists this treatment will invariably give good results. The artificial drum membrane may be tried in all cases where considerable deafness is present, after the discharge has almost or entirely ceased. Yearsley in 1841 made an artificial drum with cotton wool and this still remains the best form. They are also made of rubber and of sized paper which is moistened before being applied. Quite a lucrative trade is carried on by quacks in these things, as all sorts of deaf people buy them in the hope of finding something that will

benefit them. There is no doubt that all forms are of benefit merely from the slight pressure exerted. It is impossible to tell except by experiment whether any given case will be benefited by them. It is most useful for cases of large perforation in the posterior superior quadrant exposing the stapes. Some of these patients experience sudden changes in hearing power. Some hear better when some liquid is poured into the meatus or when a drop of glycerine lies on the drum head. If the cotton wool pellet improves the hearing the patient can soon be instructed to apply it himself. Every form of artificial drum is a foreign body and liable to cause irritation. It should therefore be worn for a short time each day. If discharge reappears or pain occur it must be discontinued at least till the ear is better.

The complications and sequelae of chronic suppurative inflammation are of great interest and importance. They are as follows :—

1. Pain.
2. Granulation and polypi.
3. Facial paralysis.
4. Exostoses.
5. Malignant disease.
6. Caries and necrosis and loss of the ossicles.
7. Cholesteatoma.
8. Inflammation of the mastoid.
9. Cerebral complications,
 - a. Thrombosis of the cerebral sinuses.
 - b. Meningitis.
 - c. Cerebral or cerebellar abscess.
 - d. Cerebral embolism.
10. Pyaemia.

These will now be discussed.

1. Pain. In acute inflammation pain is a usual and comparatively innocent symptom, but in chronic suppuration it is always of serious import. When the patient complains of pain, and at the same time a previously existing discharge ceases, danger is imminent. The ear should be carefully examined and if inspissated pus, foetid crusts or any mechanical obstruction to the outflow of the pus be found, active treatment must be employed without delay. Pain usually means imperfect drainage. The prognosis in regard to life is always worse when there is a history of repeated earache. The treatment is along the line of promoting drainage. Inspissated pus must be removed completely. A solution of bicarbonate of soda will be of use in dissolving such a mass, and for the same purpose one of the digestive ferments is sometimes used. A small perforation must be enlarged. If these measures do not speedily give relief then a more extensive operation is necessary. The pus cavity may be curetted with a small sharp spoon through the enlarged perforation. The drum membrane may be detached and the ossicles removed as in Stacke's operation so as to permit direct access to the middle ear cavity and all possible seats of disease.

2. Granulations and Polypi. Granulations are very often seen in middle ear inflammation, and polypi are to be regarded as enlarged granulations. The latter are sessile, red, uneven-looking growths, bleeding freely when touched. They spring from the walls of the tympanum or margins of a perforation, or from the edge of a sinus, or from a drum cavity in which carious bone exists. If granulations are pres-

ent there is more or less blood mixed with the discharge and this is increased by syringing. On examination it is easily made out. If touched by a probe it will be found to have a broad attachment and to bleed readily. After removal they tend to recur rapidly. Perforations of the membrana flaccida are often associated with granulations which tend to take on a polypoid form. As to treatment no fixed rule can be laid down applicable to all cases. If dead bone be the cause little good can come from simple removal of the granulations. A more extensive operation must be done. If suppuration alone is the cause then scraping and the application of caustics will give permanent relief. The curet is first used to remove everything possible. This is followed by alcohol, carbolic acid, chromic acid or the galvano-cautery. For the removal of polypi a fine snare is used. There is usually free haemorrhage but this can always be controlled by plugging the meatus. The pedicle should be destroyed by caustic or the cautery. If the after treatment cannot be supervised by the doctor, some alcohol may be given to the patient to instil once or twice a day.

3. Facial Paralysis. This is not uncommon as a complication of suppuration of the middle ear. Often there are anatomical peculiarities in the middle ear favoring facial paralysis. The paralysis may be caused by inflammation of the neurilemma due to extension from the tympanic cavity, or there may be caries of the Fallopian canal associated with destruction of the nerve. The prognosis is always doubtful because there is no means of distinguishing the favorable from the unfavorable variety except by

the course of the affection. The treatment must be directed to securing free drainage and it is desirable to keep up the nutrition of the facial muscles by galvanism and massage.

4. Exostosis. This sometimes comes from a long continued chronic inflammation. It is of importance so far as the exit of pus may be interfered with, when some operative measure will be necessary to remove it.

5. Malignant disease. Carcinoma is the most common, but even it is extremely rare. Only two cases have occurred in my own practice, both of these being epithelioma. In sixteen published cases of carcinoma twelve appeared after long standing suppuration. The symptoms are pain, associated with vertigo, while the discharge is mixed with carious matter. Facial paralysis is usual. On examination the ear is found full of granulation tissue which bleeds readily and recurs rapidly after removal. The adjacent lymphatics are not always infiltrated, but late in the disease the mastoid is swollen and may become soft and break down. Extension to the cerebral cavity may occur. Death from exhaustion, meningitis or haemorrhage finally terminates an existence which has ceased to have any attractions. Treatment is directed to relieving the pain by cocaine locally and morphia internally.

6. Caries and Necrosis.—Caries and necrosis affecting the temporal bone and ossicles are usually the result of chronic suppurative inflammation, but may occur during the acute stage. Certain forms of inflammation are more prone than others to lead to disease of the bone. In the otitis media of scarlet

fever and in the course of diphtheria the ossicles may be swept away during the acute stage. So also in those afflicted with struma, diabetes, phthisis and syphilis the bone is more liable to be affected. The parts of the temporal bone are attacked in the following descending order of frequency:—1. The mastoid process. 2. The roof of the tympanum. 3. The posterior and upper wall of the external meatus. 4. The ossicles. 5. The inner wall of the tympanum. 6. The groove of the lateral sinus. 7. The floor of the tympanum. 8. The posterior wall of the carotid canal. 9. The labyrinth. 10. The internal auditory meatus. Of the ossicles the malleus and incus are more frequently attacked than the stapes. The foot plate of the stapes is rarely affected. The symptoms differ very much in different cases. In some cases the existence of dead bone is easily detected by objective methods alone, but in others the actual carious area is not detected either by sight or touch. The surgeon must then draw his conclusions from the following data: Pain in the ear is usually present. It is not always constant, but recurs from time to time, lasting for days, becoming worse at night and being often associated with diffuse headache. The pain is aggravated by percussion of the bone and by astringent instillations. The pus is watery and is mixed with masses of cheesy consistence. It is very foetid. Spicules of bone may be found mixed with the discharge. The appearance of the meatus is often much narrowed from swelling of the soft parts or hyperostosis. In the deeper part of the canal luxuriant granulations are seen which bleed readily and grow rapidly after removal. Glandular enlargement

is frequent and the pus may burrow into the neck. During the progress of the case portions of the meatus, mastoid cells, tympanum or labyrinth may be thrown off as sequestra. The prognosis is always doubtful. The danger is from extension to the cranial cavity and from haemorrhage.

Treatment.—The local treatment must be energetic. Antiseptic solutions are to be used freely in cleaning the parts. Nitric acid in $\frac{1}{2}$ per cent. solution is recommended to dissolve the spicules of bone. The digestive ferments are also employed for this purpose. Operative interference early in the course of the disease will give the most satisfactory results.

7. Cholesteatoma. This is a collection of densely packed laminated epithelial cells, undergoing fatty degeneration and intermingled with numerous cells of cholesterin. Sometimes these cells are contained in a kind of capsule of connective tissue. According to Virchow this is a true neoplasm. The mass originates only in cases of perforation, and they may invade the mastoid cells and even lead to actual distension or perforation of the osseous walls. Absorption or erosion of bone and invasion of the deeper parts of the cranium is the common result. In many instances the cholesteatomatous masses can be removed from the ear by syringing. If very dense they must be softened by instillations of hydrogen peroxide or a mixture of bicarbonate of soda, glycerine and water, syringing being repeated till the mass is dislodged. Impactions in the mastoid cells can be reached and removed only by a mastoid operation.

8. Inflammation of the Mastoid. Some anatomical points are of great clinical importance in con-

nection with this disease. The mastoid process which is situated directly behind the ear, usually consists of pneumatic spaces which communicate with the tympanum. The spaces present endless variations, sometimes they are all pneumatic, sometimes they are part pneumatic and part contain diploe, sometimes all contain diploe. The air spaces usually communicate with the tympanum through the mastoid antrum. This latter cavity, the mastoid antrum, very seldom varies. It opens into the tympanum at the upper and posterior part. It is present in the newborn, and the air spaces which are formed later, open into it. It is important to bear in mind that the inner surface of the mastoid process contains the groove for the lateral sinus, and sometimes this is well forward. Another important landmark is found on the outer surface of the mastoid at the anterior superior corner. There is an elevation here called the spina supra meatum which seems to be the posterior part of the zygomatic line, and immediately below it is a depression. This hollow is usually well marked. This is the point at which the mastoid is opened. It is customary to divide inflammation of the mastoid into superficial mastoiditis or periostitis, and deep mastoiditis or empyema of the cells.

Inflammation of the mastoid occurs as a complication of both acute and chronic middle ear suppuration, with or without caries, polypi or cholesteatomata. In acute inflammation the process extends directly from the tympanum through the antrum to the cells. In chronic inflammation the mastoid complication is the result of deficient drainage. The pus finds its way into the antrum and cells and gives rise to caries and necrosis.

The condition is usually associated with considerable rise of pulse and temperature. Usually there is great pain, diffuse headache and photophobia. When it occurs in the course of a chronic suppuration there is a history of discharge lessening or ceasing before the onset of the pain. An examination may show some obstruction to the exit of the pus, and the mastoid process is painful and tender to the touch. As the condition develops, the parts behind the ear become red and swollen and the auricle stands out from the head. Subperiosteal abscesses form over the mastoid or in the posterior wall of the meatus. This is often associated with perforation of the bone at a point over the antrum ; or perforation may take place in the region of the digastric fossa, and so allow pus to burrow into the tissues of the neck. The prognosis is always grave, except where the periosteum alone is affected. In children extensive death of bone is frequent and the patient dies of marasmus from general exhaustion. In adults the chief risk is from cranial affections. The treatment must be conducted along the line of securing free drainage. Polypi and granulations must be removed, a small perforation enlarged, the middle ear irrigated, and hard masses of secretions are to be softened and removed. The local measures applicable to the mastoid itself are blood-letting, the application of iodine and heat. If these methods fail to relieve the pain an incision should be made over the mastoid down to the bone. This is called *Wilde's incision*. It relieves pain by lessening tension on the outer surface of the bone, but it does not aid in draining the tympanum. The incision is

made half an inch behind the auricle, parallel to its attachment and should extend from the tip to near the base of the mastoid. It is usually advised to make the incision from below upward, to avoid any chance of the knife slipping into the tissues of the neck. Opening the mastoid cells has long been recognized as a surgical procedure, but the indications for, and the method of opening are those laid down by Schwartze. The indications are as follows :—

1. Acute inflammation of the mastoid not yielding to other means and threatening cranial symptoms.

2. Recurrent inflammation of the mastoid. It there is a fistula or burrowing of pus the indication is strengthened.

3. When the exterior of the mastoid is healthy, but there is evidence of retention of inflammatory products in the middle ear.

4. In intense neuralgia of the mastoid. This is associated with a sclerosis of the process or filling up of the pneumatic spaces with bone.

5. As a prophylactic operation, in order to establish drainage and facilitate cure in cases of chronic suppurative otitis.

The operation is not devoid of danger. The lateral sinus may be opened, or the facial nerve be injured and a paralysis result, but the danger is really slight as compared with the risk of deep seated tension.

9. Cranial complications.

- (1). Meningitis. This may arise from the middle ear or from mastoid involvement. The process may affect the entire surface or be localized. It is marked by a high temperature which does not fluctuate.

tuates much, varying from 101° to 105°. There is severe headache, photophobia, vomiting and localized or general convulsions. The last symptom is more common when children are affected. Delirium also occurs in young patients. In adults a basilar meningitis affects groups of muscles supplied by particular nerves involved at their points of exit from the cranial cavity. Paralysis follows as the disease advances. When the basilar meninges are affected there is seen the peculiar respiration known as the "Cheyne-Stokes," in which there are several short efforts at inspiration followed by a long sighing expiratory effort. The paralyzes met with are those involving the third, fourth and sixth nerves. Strabismus is thus produced. When the third nerve is implicated there is first a contraction of the pupil and later a dilatation. Meningitis of this kind is usually fatal, but Macewen reports six recoveries after operation. The treatment will be secondary to that necessary for the condition of the ear. The application of ice to the head is agreeable and may retard the progress of the inflammation. Large doses of bromide of soda are indicated. Opiates are to be avoided, but may have to be given on account of the intense pain. Free purging should be had. Surgical measures to be effective must be undertaken early.

(2). Sinus Thrombosis. The occlusion of one of the large venous sinuses within the cranium by an infectious thrombus is one of the possible complications of acute or chronic suppuration in the tympanum. The mastoid veins communicate freely between the lateral sinus and the pneumatic spaces covering it, so that the septic material is readily

carried from the spaces into the sinus. Not only may this happen but a middle ear inflammation, without involvement of the mastoid cells may cause the condition as well. Here the channel of infection may be the superior petrosal sinus or some of the smaller veins. When such a deposit takes place the first step in the process is the occlusion of the sinus by a firm fibrinous clot. The development of pyogenic bacteria in this mass leads to general septic infection by the entrance of bacteria into the general circulation. The thrombus may remain localized in the sinus itself or it may extend to the internal jugular vein. If life is prolonged after the general infection, we find secondary purulent deposits in various parts of the body, the lungs being the favorite site. Secondary brain abscess is also met with and secondary thrombosis of some of the other venous sinuses, and sometimes these secondary lesions are on the opposite side of the brain. The symptoms are insidious and may escape notice. The point which is characteristic of the involvement of a large sinus is a sudden rise in temperature followed by a spontaneous fall to normal or nearly normal. This may escape observation unless the temperature is taken frequently. Then symptoms of general sepsis develop; asthenia, emaciation and an ashy hue of the skin. The rise of temperature is followed by a profuse perspiration. In uncomplicated cases symptoms such as headache, local or general convulsions, paralysis, mental dullness or delirium, are absent. In making a diagnosis it is most important that the temperature be taken frequently,—say every two hours. A second symptom of much importance

is the development of an asthenic condition without local disturbance to account for its development. A few cases recover spontaneously. Death usually occurs from profound systemic infection, from meningitis, cerebral abscess or pulmonary involvement.

The surgical treatment alone is of use, and it must be undertaken early. Particular attention should be paid to the general nutrition of the patient.

(3). Cerebral and cerebellar abscess.

A localized purulent focus within the brain tissue may be either acute or chronic in development. The acute cases are rare and the most common cause is purulent otitis. These abscesses may be single or multiple. They may involve the cortex or deeper regions of the brain and may be limited to one side or met with in both cerebral hemispheres. The common situations are the temporo-sphenoidal lobe and the cerebellum. As a rule they are deeply situated in the cerebral substance and tend to rupture into the lateral ventricles. An abscess may remain latent for years and be excited to renewed activity by the occurrence of an acute inflammation in the region primarily involved. Examination of some of these abscesses shows that the fluid is sterile. When located so that pressure is exerted on the motor tract or upon the motor area in the cortex, localizing symptoms occur. These are at first of a convulsive character if the process is acute. When chronic the increase in pressure is so gradual that the areas are destroyed without a stage of excitement. As the most common site is the temporo-sphenoidal lobe, the characteristic localizing symptoms are only produced when the abscess has attained considerable

size, in which case it involves the speech area and produces either sensory or motor aphasia. If in the cerebellum, there is unsteadiness of gait and vomiting as a result of pressure on the middle lobe. The termination of a case of cerebral abscess is usually sudden, death taking place from rupture into the ventricles, or from compression or destruction of vital centres. As to diagnosis, complicating lesions may render diagnosis difficult. Examination of the fundus of the eye may show choked disc, but this indicates an intracranial lesion simply and is not characteristic of abscess alone. The examination of the field of vision may also yield some information.

Unless surgical methods give relief an abscess in the brain means death. As soon as a diagnosis is made an operation should be done to explore the cavity. Localizing symptoms will simplify the operation.

CHAPTER VII.

DISEASES OF THE PERCEPTIVE MECHANISM.

ANAEMIA OF THE LABYRINTH.—The causes of this condition are general haemorrhage either from traumatism, rupture of an aneurism or uterine haemorrhage, and simple or pernicious anaemia.

Symptoms.—Hearing is impaired for sharp sounds and musical notes of a high pitch. When the labyrinth suffers from malnutrition the patient seems listless and inattentive, and it requires an effort on his part to hear what is said. The subjective noises are distressing and are worse on lying down. The noise is usually dull, low-pitched, synchronous with cardiac pulsations, and is apparently identical with the venous bruit heard over the great vessels in the neck in many cases of anaemia.

Attacks of vertigo are produced by slight pain or some slight visceral disturbance. The patient is dull, abstracted and inattentive. The pallor of the skin will always attract attention. This variation from the normal standard is frequently better observed in the mucus membranes than in the cutaneous surface of the body. The physical examination is negative. The functional examination shows the upper tone limit reduced. Bone conduction is reduced. As to prognosis, a favorable result may be looked for in cases depending on haemorrhage or

simple anaemia. To confirm a diagnosis a few drops of nitrite of amyl should be given when all the symptoms disappear for a short time. In hyperaemia of the labyrinth the same dose aggravates all the symptoms. The specific treatment is to administer trinitrin in doses of 1-100th of a grain t.i.d. Iron and arsenic may be given to improve the quality of the blood. Cardiac stimulants are also in order.

HYPERAEMIA OF THE LABYRINTH.—This may be due either to a venous stasis from mechanical obstruction to the return current, or to an increased quantity of arterial blood being conveyed to the part. This condition is likely to develop in individuals of a full habit and particularly in those who are of a gouty or rheumatic diathesis. Sudden physical exertion, over-indulgence in alcohol, sudden diminution in atmospheric pressure, the prolonged action of one sound, either mechanically or from exhaustion or over-stimulation, as is observed in telephone operatives and boiler makers,—all these are causes. Condensation of the air in the external meatus from a blow on the ear or from an explosion forces the stapes suddenly inward and may cause hyperaemia of the labyrinth. Among the causes which lead to venous stasis may be mentioned mechanical obstruction to the return of blood through the veins of the neck, such as pressure from a tumor, severe attacks of coughing, sneezing, or violently blowing the nose, or any similar strain.

Symptoms.—There is a feeling of fullness and distension in the head, slight giddiness or vertigo, and high-pitched subjective noises. Hearing is slightly impaired unless the vessel walls are diseased. In a

patient of full habit these symptoms come on by any slight exciting cause, such as fright, rage, sudden exertion, indigestion and too free use of stimulants. In making a diagnosis amyl nitrate may be used as already suggested. Physical examination gives no information. The functional examination shows very much the same conditions as are present in anaemia. The upper tone limit is lowered, bone conduction lessened and sharp sounds are painful or not heard at all. As a help to diagnosis the state of the integument of the face may be noted. The prominence of smaller vessels beneath the skin is a fair index of the condition of the circulation in the labyrinth. The prognosis is not very favorable. If the hearing is but slightly impaired we may hope to effect absorption and a return to the normal. When of long standing the outlook is unfavorable. Careful regulation of the habits of life may do much for same.

Treatment.—Local depletion by blood-letting from the mastoid is the most important measure. General blood-letting is permissible when the attack is of unusual severity. Free catharsis and diuresis must be had. Blisters behind the ear may be of some use in chronic cases. Pilocarpine and iodide of potash are useful. Severe and sudden exertion and the use of alcohol should be interdicted. Diet must be regulated so as to diminish the general plethora.

LABYRINTHINE HAEMORRHAGE.—This is caused by external violence, such as a blow on the head, or a fall from a height, or the sudden action of a loud

sound such as an explosion. It may be caused by efforts to relieve some middle ear trouble, such as forcible inflation with the catheter or Politzer's air bag. Various conditions of the blood itself predispose to it, for example, the haemorrhagic diathesis, pernicious anaemia, leukamia, or fragility of the walls of the vessels in old people who are atheromatous. When the haemorrhage is considerable, complete disorganization of the parts may take place. This is the result of pressure, and a complete return to the normal is impossible even though the blood may be absorbed. Where the traumatism is not so great the pressure may be gradually relieved by absorption or organization of the clot and the function is gradually restored.

Symptoms.—Sudden giddiness, intense nausea, severe tinnitus and great impairment of hearing come without warning. Unconsciousness may occur if the attack is severe. If it follows labyrinthine hyperaemia there may be premonitory signs such as a fullness in the head and a throbbing in the ears. The treatment is much the same as for hyperaemia. We exhaust our remedies when we use local depletion, blisters, purgation, pilocarpine and iodide of potash.

SYPHILITIC INFLAMMATION OF THE LABYRINTH.

—Both acquired and hereditary syphilis affect the labyrinth. In the hereditary cases interstitial keratitis is very frequently associated with it. In the acquired cases it is a tertiary symptom. The changes are of a chronic inflammatory nature. Sudden and profound deafness and subjective noises in an adult

apparently in good health without evidence of middle ear disease should always lead to a suspicion of syphilis. The treatment of the acquired cases is satisfactory, but those that are hereditary are not likely to be benefited by any drug.

INFLAMMATION OF THE LABYRINTH secondary to chronic suppurative and non-suppurative inflammation of the middle ear.

Where the tympanic structures have for a long time been subjected to an abnormal pressure from an adhesive process in the middle ear certain changes take place. The terminal filaments of the auditory nerve may be completely destroyed, or the increased tension may prevent the conduction of aerial vibrations, and the filaments undergo atrophy from disuse. An inflammatory process in the tympanum may pass by continuity to the adjacent labyrinth. This is true in both catarrhal and suppurative inflammation. If an infection of the labyrinth occurs it results in disintegration. Fortunately this does not often take place because there is no free anastomosis between the vessels of the middle ear and those of the labyrinth. As to the symptoms of extension it is usually difficult to determine when this takes place. The most constant symptom is the presence of subjective noises. Disturbances of equilibrium are also frequently complained of. This points to an invasion of the labyrinth in the neighborhood of the semi-circular canals or involvement of the canals themselves. Treatment is mainly directed to the condition in the tympanum.

THE ACUTE INFECTIOUS DISEASES and the perceptive mechanism. During the course of scarlet fever, measles, diphtheria, mumps, typhus and typhoid fever, variola, influenza and epidemic cerebro-spinal meningitis, the organ of hearing is often the seat of pathological changes. In scarlet fever, measles, diphtheria and influenza the middle ear is the part attacked, extension to the labyrinth being secondary. There are cases, however, where the specific poison exerts a direct influence upon the labyrinth, the middle ear remaining healthy, or a double infection taking place. The poison is carried to the labyrinth by the blood current and excites an inflammation of the tissues which line its long channels, in some cases causing destruction of the terminal portion of the auditory nerve, while in others there is an effusion of fluid into the labyrinth with increased tension. Pilocarpine and strychnia are said to benefit some cases.

MUMPS.—Epidemic parotiditis or parotitis is prone to affect the labyrinth rather than the middle ear. The local infection is from the blood current in precisely the same manner as in a complicating orchitis. The effect is usually very profound and when it occurs in early life is a frequent cause of deaf-mutism.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.—In all other conditions mentioned the infection is by the blood. In this, the inflammation extends along the lymph channels of the vestibular and cochlear aque-

ducts. If the patient recovers from the meningitis the outlook for hearing is very bad. In severe cases absolute deafness is the result, and in young patients this leads to deaf-mutism, such words as have been learned being forgotten. In older children who are able to read, mutism may not follow, since the association between written and spoken words is sufficient to preserve the power of speech. In acute meningitis of a non-epidemic character the labyrinth may be involved in much the same way. If it is traumatic in origin only one side is affected.

THE EFFECT OF DISEASE OF THE GENERAL NERVOUS SYSTEM UPON THE PERCEPTIVE MECHANISM.— This has reference to those affections characterized by degenerative changes in the various parts of the brain. These are, cerebral congestion, apoplexy, cerebral embolism, endarteritis, cerebral tumors, disseminated sclerosis and tabes dorsalis. From the location of the cortical centres for hearing and the fact that each auditory centre receives fibres from the labyrinth of either side, any cortical lesion must be bilateral and extensive to produce absolute deafness upon either side. The crossing of the auditory fibres takes place in the medulla in the region of the olivary body. So an intracranial lesion on one side could only produce deafness in one ear when situated between the foramen of exit of the auditory nerve and the corresponding olivary body. A tumor at the base of the skull might possibly produce this effect but neoplasms seldom occur in this region. Cases of haemorrhage and embolism show that in very few

cases is the organ of hearing affected to a perceptible degree. Even when one side is destroyed its place is supplied by the corresponding area in the opposite hemisphere, and the loss of function is slight. "Word deafness" is the most characteristic symptom of a cortical lesion, *i.e.*, the words are heard but not understood, the patient simply obtaining the general impression of sound without being able to interpret it. There are also in these cases certain complex auditory impressions or hallucinations. The patient seems to hear voices, either directed to him or he may be simply a listener. Among musicians these hallucinations may assume the character of well known musical compositions. These symptoms *i.e.* the same whether the change in the cortex be congestive, haemorrhagic, degenerative, sclerotic or neoplastic.

As to treatment little can be said. The indications are furnished by the general nervous disease. For the subjective noises, the bromides or hydrobromic acid will be most useful.

THE INFLUENCE OF CERTAIN MEDICINAL SUBSTANCES UPON THE ORGAN OF HEARING.—Of these the most important is quinine. Salicin, salicylic acid and its salts exert a similar effect in a less degree. There seems to be a difference of opinion as to whether this is a hyperaemia or an anaemia. When administered for a long time these drugs produce structural changes in the labyrinth which do not disappear even when the drug is stopped. When the ear is normal to begin with, serious injury from

this source is rare, but where a chronic inflammatory process is going on, their use must be guarded against. They should never be given except in an extremity.

DISTURBANCES OF HEARING DEPENDENT UPON FUNCTIONAL NERVOUS DISORDERS.—Neurasthenia and hysteria are the two common functional nervous diseases which influence the organ of hearing. The manner in which they do is a matter of conjecture. The disturbance probably depends on some pre-existing pathological condition which should ordinarily pass unnoticed. The lesion may be either in the meatus or tympanic cavity and not be recognised by any examination. In any case the disturbance of function is not at all in proportion to the pathological condition present. Hypnotic treatment is of more value in these cases than drugs, and should be tried.

DEAF-MUTISM.—The loss of hearing in early life, or congenital absence of this special sense, invariably leads to deaf-mutism. In many cases it is impossible to tell whether the power of sound perception has been destroyed in infancy or has been absent from birth. Heredity seems to play some part in the cause as several members of the same family are frequently affected, though the children of deaf-mute parents generally escape. Consanguinity of parents is among the most common cause. Defective mental development is not as a rule associated with a congenital defect in audition, indeed in many of these people the mental faculties are developed beyond the normal standard. Hereditary syphilis is a cause in

certain cases. Other causes are injuries to the head during labor or in early infancy, the acute infectious diseases, acute and chronic inflammatory conditions in the ear, and adenoid vegetations.

Symptoms.—In very young children who have never spoken the first symptom noted is usually the failure to acquire the power of speech. In older children there are the usual signs of deafness.

Diagnosis.—As the age at which children begin to talk and at which they respond to stimulation of the organ of hearing, varies greatly, it may be difficult to say whether a child is deaf or whether the development of the special sense is only delayed. It is not safe to give a positive opinion in children under eighteen months. In making a test the examination should be carefully conducted. Tuning forks of high and low pitch should be held near the ear when the attention of the child is diverted from the examiner. If the sound is heard, the child will turn towards it or there will be a change in the facial expression. Clapping the hands behind the child's head, snapping the fingers or ringing a bell are also tests that may be used. Parents will volunteer information that certain sounds are heard, but one must not be misled by vibrations such as are produced by the slamming of a door. If nothing can be done by treatment for these children no time should be lost in placing them in the hands of those who make the education of these patients a life study.

NEURALGIA OF THE EAR.—This is not very common. The causes are dental irritation and any debilitating cause such as would produce neuralgia

elsewhere. The symptoms are pain affecting one side and often associated with neuralgia of the face and scalp. It is aggravated by a heated atmosphere and has a tendency to be worse at certain periods of the day or night. There are no inflammatory signs or symptoms and hearing is not affected. The treatment should be similar to that for neuralgia elsewhere. If a decayed tooth is found it should be removed. Quinine and arsenic are the most used remedies.

EAR COUGH.—It is not unusual to find that a reflex throat irritation and cough are produced simply by touching the skin in the external meatus with a probe. So a foreign body in the meatus may produce syncope, vomiting, giddiness, sneezing and coughing. The cough is the most common symptom, and many interesting cases are recorded in which after searching vainly elsewhere for the cause of a cough, the attention has been directed to the ear, a foreign body removed and the cough has at once disappeared.

AIDS TO HEARING.—One is frequently consulted about some form of instrument which will assist the hearing. Of course no help can be given where the function of the internal ear or nerve centre is destroyed. It may also be laid down as a rule that no form of invisible instrument is of any use. Of the various forms of trumpets, conversation tubes, audiophones, ear cornets, etc., a selection should always be secured for the patient to try, as it is impossible to know except by trial what form of instrument will be best.

DISEASES OF THE NOSE AND THROAT.

CHAPTER I.

CLINICAL EXAMINATION OF DISEASES OF THE NOSE.

The nose may be examined by three methods.

1. Anterior Rhinoscopy.—A speculum is introduced into the nares and the anterior part of the cavity can be seen.

2. Median Rhinoscopy.—By means of a small mirror introduced into the nasal cavity, with the reflecting surface directed obliquely upward, the central part of the nose can be inspected.

3. Posterior Rhinoscopy.—The posterior portion of the nose and the posterior nares can be seen with a mirror placed behind the uvula.

The first essential in an examination of the nose is suitable light, which may be either direct or indirect ;

direct when it is thrown from the source straight into the nares; indirect when it is reflected by a mirror. The light may be sunlight, diffused daylight, or artificial light. The two former show a natural color of the parts seen, but sunlight is not always to be had, and diffused daylight varies greatly in intensity and cannot be depended upon. Any form of artificial light will do if sufficiently intense; in a dark room a common candle light will do, while in the patient's home a kerosene lamp or the ordinary gas light answers the purpose. In the office the operator may work in a bright room, using the incandescent gas light with a Mackenzie condenser. This light is not only the best, but the cheapest. The electric incandescent lamp of Trouve may be used attached to the forehead in place of the forehead mirror. The mirror which reflects the light is worn on the forehead and the polished surface is concave with a focal distance of eight to twelve inches. The size of the mirror varies from $2\frac{1}{2}$ to 4 inches. They are perforated in the centre and are worn so that the perforation is directly in front of one eye or the other. The position of the light in relation to the patient and the examiner should next be considered. The examiner must sit directly facing the patient, having the light to the side of and beyond the patient's head and on a level with the parts to be examined and his own eye. The eye behind the mirror is used, the other being kept open and completely relaxed. To illuminate the parts thoroughly the nostril must be dilated with a speculum, but often much can be seen by simply raising the tip of the nose with the finger and directing the light into it.

There are many useful forms of nasal specula, some of them more or less self-retaining. The model of Lennox Browne is the one recommended. For children the larger sizes of ear specula may be used. It is well to have several sizes and patterns, as one will not answer for every case. The blades should not be fenestrated, because otherwise the vibrissae in the vestibule obstruct the view. The manner of holding the Lennox Browne speculum is of some importance. The blades should be well inserted with the handle upwards towards the forehead. After dilating, it is held between the thumb and forefinger of the left hand, the third and fourth fingers resting on the forehead or over the bridge of the nose where by gentle pressure the position of the patient's head may be changed as necessary. It is sometimes a decided advantage to have the hand holding the speculum above the nose instead of in front of the mouth as is necessary with certain forms of specula.

The Structures Exposed in Anterior Rhinoscopy.—

The inferior turbinated body is seen occupying about two-thirds of the outer wall, and the middle turbinated which is smaller, is seen in the upper part of the cavity, occupying about one quarter of the outer wall and almost touching the septum. The superior cannot usually be seen. The mucus membrane covering the whole cavity is normally smooth and of about the same color as that covering the gums, but often appearing slightly congested. By having the patient move his head to right and left and up and down, a complete view can be had of the lateral wall and septum, the floor and inferior meatus, the middle and rarely the superior meatus. The inferior turbinated

body contains a plexiform arrangement of venous sinuses similar to the corpora cavernosa of the penis and constituting a true erectile tissue. This tissue is also found to a less extent over the floor of the meatus and the lower part of the septum, and sometimes in the lower part of the middle meatus. The function of these erectile tissues is to regulate the area of mucus membrane over which the air passes in inspiration, to secure proper filtration and to impart sufficient warmth and moisture. According to the degree of turgidity, we can see to a greater or less extent along the inferior meatus. After exposure to cold air, dust, and in acute coryza, the erectile tissues are swollen and darker in color. A probe may be used to examine the inferior turbinated when in a state of turgescence. On pressure it is very soft and seems to fluctuate. The application of a 4% solution of cocaine reduces it to its collapsed condition, so that the amount of turgescence or of actual hypertrophy may be exactly estimated. The inferior meatus is that portion of the fessa below the upper border of the inferior turbinated body. Into the anterior part of this opens the lacrymo-nasal duct, but this cannot be seen. The middle meatus lies between the middle and inferior turbinated bodies. Beneath the middle turbinated body a deep furrow, the hiatus semilunaris, extends from the anterior extremity downwards and backward; this is crescentic in shape, the convexity looking forward. The anterior extremity of the hiatus presents a circular opening which is the orifice of the frontal sinus. Immediately behind this the openings of the ethmoidal cells are to be found, and still farther back is the ostium maxillare which leads

into the antrum of Highmore. The superior meatus is not easily seen. Into it opens the sphenoidal sinus. In most individuals there is greater or less deviation of the septum. The most frequent position is at the junction of the vomer with the perpendicular plate of the ethmoid and the triangular cartilage. This increases the difficulty of properly examining the side encroached upon.

Median Rhinoscopy.—This is only rarely of value. A small laryngeal mirror is introduced along the floor of the cavity with the reflecting surface upward. This method may be sometimes of use to determine the presence of small neoplasms.

Posterior Rhinoscopy.—To examine the nasopharynx and the posterior nares the patient, surgeon and light should be in the respective positions already described. To see the parts the tongue must be depressed, the soft palate relaxed and a small mirror so placed behind the uvula as to reflect an image of the parts above. Hence in addition to the light and reflector a tongue depressor and a small mirror on a long handle are necessary. There are many forms of tongue depressor, and one is perhaps as good as another; each has its advocates. It is well, however, to have several of different sizes and of a form easily cleaned. The small mirror should be from one-half to three quarters of an inch in diameter and attached to the handle at an angle of from 90° to 130° . Some operators use a combined depressor and mirror, while some employ only the ordinary mirror handle to hold down the tongue. A great deal depends on how far the patient has his tongue and throat under control. Some are able to keep the

tongue down and the parts relaxed so that the mirror may be introduced alone without touching the tongue, while others require an excessive pressure upon the tongue with a depressor. A patient may be educated to hold the depressor himself. In any case the mirror must be gently carried behind the uvula without touching either it or the posterior wall of the pharynx, or else the patient will certainly gag. Firmness and gentleness are absolutely necessary, and if the parts are sensitive it is well to make a number of examinations rapidly rather than prolong a single attempt. When the tongue is depressed and the light focussed it is necessary to see that the palate is relaxed. Most individuals when the mouth is open and the tongue held down, draw up the palate and breathe through the mouth. They should be asked to breathe through the nose, and though they may not succeed, the very effort is often sufficient to produce the necessary relaxation. Sometimes the application of a 5 or 10% solution of cocaine to the fauces will be of assistance; although it may sometimes aggravate the reflex retching and gagging, in spite of the anaesthesia. Finally if these means fail or the space between the soft palate and the pharynx be narrow it will be necessary to draw the soft palate forward with a palate retractor. When operations are to be performed the palate may be tied forward with tape, or a soft rubber catheter may be passed through the nose, brought out through the mouth and tied. The catheter should be smeared with sterilized vaseline before being introduced. The rhinoscopic mirror must first be warmed by holding the reflecting surface over the flame of the lamp for a moment to

prevent the moisture of the breath from condensing on the glass and so obscuring the view. After warming, the back of the mirror should be tried against the hand to see that it is not too hot. The mirror is to be held lightly like a pen, and introduced with the reflecting surface upward, and without touching the fauces, tongue or uvula, to a point behind the uvula and beneath or to the side of it. The view will depend on the position of the mirror, as, on account of its size, only a small area is seen at once, the whole picture of the posterior nares and nasopharynx being made up of a series of views. The mirror at first may be held nearly horizontal, so as to show the roof of the upper part of the posterior wall of the pharynx. As the reflecting surface is brought to a more nearly vertical position the posterior nares are seen with the septum dividing them. The septum narrows from above downward. On the outward wall of each side the turbinated bodies appear as pale pearly masses. High up is the superior turbinated, smaller in color than the others and smaller. The middle turbinated is the most easily seen. When the mirror is slightly turned to one side or the other we see the yellowish openings of the eustachian tubes. The orifice is funnel-like in profile. Behind the tube and between it and the posterior wall is a depression known as Rosenmüller's fossa. At the highest point in the cavity there may sometimes be seen the raised collection of lymphoid tissue described as Luschka's tonsil and in the centre of this a depression. The normal color of the nasal and nasopharyngeal mucus membrane is not easy to determine as it varies to a considerable degree in

different individuals and in the same individual at different times. In front the darkest portion is over the inferior turbinated. Behind, the structures are pale grey; in the naso-pharynx, pinkish grey becoming darker towards the pharynx.

Digital examination of the posterior nares and naso-pharynx is sometimes the only possible means of making a diagnosis. More especially is this the case with children, though it is often of use also in adults. The finger is introduced behind the soft palate to feel the septum, nares, roof and walls. If a tumor is found its consistence, tenderness, mobility, place of attachment and vascularity should be determined. In the case of young children it may be advisable to give an anaesthetic.

CHAPTER II.

FUNCTIONS OF THE NOSE AND SUBJECTIVE SYMPTOMS OF DISEASE.

FUNCTIONS OF THE NOSE.—Respiration. 1. Passage way for air in breathing. 2. Warming, moistening and filtering the inspired air.

Olfaction.—1. Perception of odors in inspiration. 2. Perception of flavors in expiration.

Phonation.—1. Resonance. 2. Production of overtones.

Protection.—1. By sensation. 2. By olfaction.

Ventilation. 1. Of the ear. 2. Of the accessory sinuses.

Accuracy of diagnosis requires that the subjective symptoms be considered in connection with the physical examination. It is proposed now to review the various subjective symptoms of diseases of the nose and to associate with them the conditions which may explain these symptoms. The order in which these are considered is purely arbitrary.

1. *Physiognomy*.—This is of some interest and importance in connection with nose disease. Speaking generally it may be said that the thin prominent nose has a tendency to suffer from some form of obstruction, while the small wide upturned nose leads to atrophic rhinitis, pharyngitis sicca and more or less severe laryngitis, the result of abnormal patency.

The so-called strumous physiognomy is present in a certain proportion of the cases of atrophic rhinitis. There is an unusual width of the bridge, alae and osseous framework of the nose. The point of articulation with the frontal bone is depressed, and the nostrils look downward and forward. The nose itself is small and seems to be sunken in the face. The lips are thick, everted and without expression. The mouth is generally closed but may be open, from obstruction of the nose with masses of inspissated secretion. Where partial obstruction exists for any length of time a deep furrow is seen running from the ala to the angle of the mouth. This is probably caused by a constant contraction of the levator labii superioris alaeque nasi, which brings the nostrils more nearly on a level with the inferior meatus and so facilitates nasal breathing. The deformity known as frog face is usually due to intranasal or nasopharyngeal tumors though it is produced temporarily by orbital cellulitis and facial erysipelas. The pressure from intranasal neoplasms such as polypi, fibromata and sarcomata, tends to absorb and separate the outer walls of the nose and to extend into or obliterate the maxillary antrum. Thus the nose becomes widened and flattened and the eyes are correspondingly apart. If the orbit is invaded the eyes may become prominent and even protrude. Collapse of the bridge of the nose is usually an indication of syphilis. The nose falls in from one of two reasons, either from destruction of the cartilage of the alae or the nasal bones themselves, or from destruction of the osseous septum which supports the bridge. When the loss of tissue is accompanied by ulcerating

outgrowths and ulcers, lupus may be the cause and not syphilis. The main point of distinction between lupus and syphilis so affecting the nose is the rapidity of progress. Syphilis will produce a lesion in a few weeks which lupus can develop only in years. The difference in the character of the ulcers and in the tubercular formation is not very marked. It must not be forgotten that syphilis and lupus may co-exist.

There is a combination of facial symptoms which in children invariably point to the existence of adenoids in the post-nasal space. The lower jaw hangs down, the mouth is open and the lips are thick and expressionless. When the nose is examined closely a slight depression on each ala is seen at the angle between the superior and inferior lateral cartilages. Besides the nostrils appear very narrow, while the bulk of the nose is so great that the bridge seems unnaturally wide. These children have a particularly stupid appearance, partly from this physiognomy, partly from the deafness which so often is associated with it, and partly from an intellectual dulness or inaptitude. There is also in many of these cases an enlarged transverse vein at the root of the nose. Where these symptoms are combined with confirmed mouth breathing, post nasal adenoids are certain to be found. Deflections of the septum may cause external deformity, the point of the nose being turned to the opposite side to that affected.

2. *Nasal obstruction and mouth breathing.*—The nose is not merely the seat of olfaction; but is the natural respirator. Air in passing through the nose is warmed, filtered and moistened. However low the atmospheric pressure and temperature, the air is

raised almost, if not quite, to the temperature of the blood, while passing through the nose alone, and before reaching the pharynx; however dry the air may be it is two-thirds saturated with moisture in the nose; and exchanges take place in the nose between the gases of the blood and those of the air in direct proportion to the rise in temperature of the air. When any obstruction exists in the nose, mouth breathing is adopted. There are frequent exceptions to this however. In partial or transient nasal stenosis the mouth may be kept shut and breathing performed through the nose, even until there is evidence of lessened atmospheric pressure in the lungs. In infants the instinct to nasal breathing is remarkably strong. Even when the mouth is open the tongue is closely approximated to the roof of the mouth, and any obstruction in the nose may be the cause of severe dyspnoea, especially during sleep. Laryngismus may be induced by such obstruction. The nasal passages of infants are very narrow and the swelling from a slight rhinitis may be responsible for setting up serious ailments. The patient, however, does not often seek relief from mere obstruction of the nose, for even when the closure is complete he soon grows accustomed to it and may not realize his distress till his attention is called to it. The statement of a patient that he does breathe through the nose should not be accepted without testing. If the nose is sufficiently patent he should breathe through it unconsciously, and whether at rest or exerting himself. If the stenosis is partial he may be able to breathe through it so long as he tries; but when inquiry is made it is found that he snores and wakes in

the morning with his mouth open and his tongue parched. Snoring in children is always a sign of nasal obstruction ; but as is well known, adults very frequently snore where there is no nasal stenosis, and they may not do so where a very considerable nasal obstruction exists. Mouth breathing is sometimes a habit, that is, it exists where no mechanical obstruction is found in the nose or behind it. There is little doubt, however, that it is always produced in the first place by a nasal stenosis and may persist after the cause is removed. The various causes of nasal obstruction are as follows :

(a) Acute rhinitis. In the second stage of this condition there is a turgescence of the erectile tissue which may completely block the passages. As resolution takes place, in the later stages, the tenacious or muco-purulent secretion may also interfere with nasal respiration.

(b) Hay Fever. The stenosis in this is very distressing.

(c) Chronic hypertrophic rhinitis. This is the result of a continual turgescence. It is frequently observed in persons with large prominent noses.

(d) Chronic atrophic rhinitis. In this condition the inspissated crusts accumulate until the whole of the cavity is blocked and the patient is forced to breathe through the mouth.

(e) Polypi.

(f) Granulation tissue at the ostium maxillare in empyema of the antrum or from caries of the ethmoid.

(g) Fibromata and malignant tumors.

(h) Deflections, ecchondroses, exostoses and abscess of the septum.

(i) Foreign bodies and rhinoliths. Obstruction is not often complete but partial from these causes.

(j) Post-nasal adenoids. In this case the obstruction is not in the nose but behind it, in the nasopharynx.

3. *Discharge*.—The discharges from the nose may be from one nostril or both and may take place either anteriorly or posteriorly. They are classified as follows :—

(1). Liquid discharges.

(a) Clear fluid which may come from irritation of the trifacial, or from escape of the cerebro-spinal fluid through a fracture in the cribriform plate of the ethmoid as a result of injury.

(b) Turbid fluid which is present at first in acute rhinitis, and may become mucoid or muco-purulent.

(c) Purulent.

(d) Blood. Epistaxis.

(2). Semi-solid. Such secretion may be taken to indicate a chronic rhinitis.

(3). Solid discharges.

(a) Dry crusts from chronic rhinitis (atrophic) which may be foetid and of a greenish-yellow color.

(b) Rhinoliths or chalky concretions which are usually accompanied by a sanious, putrid discharge.

(c) Diphtheritic membrane.

The normal secretion from the nasal glands is regulated by the sphenopalatine ganglion and the fifth pair of nerves. In health the cilia of the mucus membrane carry the secretions backward to the nasopharynx where they are to some extent, probably, re-absorbed by Luscha's tonsil. When the balance between secretion and its physiological removal back-

ward is interfered with, as in acute coryza, a running from the nose results. The function of the cilia ceases if they are wanting, as they are in some strumous children, or if they are destroyed by improper cauterization or by long-continued inflammation. A thin watery discharge from the nose may be produced by acute rhinitis, hay fever, a foreign body, polypi, and other intra-nasal growths, or the discharge may be the cerebro-spinal fluid escaping from a fracture in the base of the skull. In the latter case there is always the history of a severe accident. A purulent discharge from the nose may be caused by a foreign body, a rhinolith, polypi, caries, necrosis, gonorrhoea, or by empyema of one of the accessory cavities, more especially of the maxillary antrum. It is usually one sided and produces a foetid smell or a nauseous taste. The smell is present only to the patient, or is but very rarely of sufficient intensity to be offensive to his neighbors. The discharge from an empyema of the antrum is frequently intermittent and may flow more freely in one position of the head than another. In some cases it escapes only when the head is held between the knees; or again, with one patient there is a free discharge only when lying down, while with another the reverse is the case. A purulent discharge from the anterior ethmoidal cells or from the frontal sinus is of the same offensive character, and of the same bright yellow color and appears in the nose in the same place,—under the anterior portion of the middle turbinated. It is however constant rather than intermittent as in empyema of the antrum; but it is only by taking into consideration other symptoms that we can differentiate between these conditions.

When the posterior ethmoidal cells or the sphenoidal sinus is the seat of an empyema the pus is discharged into the naso-pharynx. The diagnosis of the latter condition is often extremely difficult. When the discharge of pus into the post-nasal space is associated with exophthalmos, sudden blindness, ptosis and strabismus there is likely to be empyema of one or both of these cavities.

4. *Sneezing*.—This is a reflex phenomenon which is usually caused by some irritation of the branches of the fifth nerve distributed to the nasal mucus membrane. It may also be produced by irritation of nerves in other parts, as, for example, sneezing caused by exposure to a strong light. As a symptom it indicates intra-nasal irritation. Apart from the application of a direct irritant, such as pepper, it occurs in acute catarrh, in hay fever and in hypertrophy of the inferior turbinated body.

5. *Anosmia*.—Loss of the sense of smell and the taste of flavors are of frequent occurrence in disease of the nose. These may occur together or separately. In the latter case it is usually the sense of taste that persists.

6. *Pain*.—This is not a usual symptom in diseases of the nose. A sense of weight in the bridge is often complained of by those suffering from thickening of the mucus membrane of the middle turbinated. In empyema of the sinuses pain and weight are felt in the cheek and in the forehead.

7. *A sensation of something moving* to and fro in the nose on respiration is sometimes met with. This is produced by a mucus polyp or some pedunculated growth.

8. *Affections of the voice*, thickness of articulation, undue nasal resonance, inability to pronounce certain consonants and impairment of the high notes of the singing voice are often mentioned by persons who have nasal diseases.

9. *Deafness and tinnitus* are common indirect consequences of intra-nasal disease. These may arise in two ways, (1) by extension to the eustachian tube and tympanum, and (2) by interference with proper ventilation of the middle ear, in consequence of nasal obstruction.

10. *Reflex Phenomena*.—These are classified as follows:—

(1). Serous or mucus discharge from the nose is frequently of a reflex nature and due to nervous influence on the glands of the nasal mucus membrane.

(2). Sneezing as already mentioned is reflex.

(3). Cough. Sometimes on touching the anterior extremity of the inferior turbinated a hacking cough is produced. The conclusion is that in cases of cough not explained by conditions in the throat or chest a very careful examination of the nose should be made.

(4). *Asthma*.—The removal of polypi or the cauterization of swollen turbinated bodies has cured many cases of asthma either temporarily or permanently.

(5). *Redness and swelling* of the outside of the nose may be due to reflex vessel dilatation, produced by dilatation of the turbinated bodies.

(6). *Itching* of the alae of the nose is frequently associated with intra-nasal irritation.

(7). *Other reflex phenomena* are nightmare, mig-

rane, constant headache, supra-orbital neuralgia, pain in the eyelids, giddiness, epilepsy and chorea. It has not been determined how these originate, or whether in each case a definite part of the mucus membrane is affected.

CHAPTER III.

TAKING COLD.

Most of the diseases of the upper air passage are caused more or less directly by what is popularly known as "taking cold," so it will be well to try to understand the meaning of this term before taking up the different diseases. Various theories have been advanced to explain the phenomena, but no one of these seems to be satisfactory in all cases. It is a well known fact that the human organism must be maintained under all circumstances at a temperature equal to 98° F., otherwise disease will result; and that the source of this heat is within the organism, the expenditure of which by radiation we endeavor to minimize by living in houses and by protecting the surface of the body with clothes. Heat is produced in the organism in two ways; first, by oxidation of food, and second, by the conversion of muscular movement into heat. How and where the oxidation of food takes place we need not discuss here. Muscular exercise produces heat, but the contractile force of the muscles is kept up by part of the food taken into the system. The heat which is generated within the body would be lost by radiation if the temperature surrounding the body was far below the normal temperature of the system, and therefore the

loss is minimized by interposing between the body and the air non-conductors of heat in the form of clothing, not to keep the cold out so much as to keep the heat in. The hygrometric condition of the atmosphere, apart from the temperature, has a great deal to do with the temperature of the body. We feel more chilly in a damp atmosphere than in a dry one of the same temperature, and we can endure a greater amount of heat when the air is dry than when it is filled with aqueous vapor. This fact has not been satisfactorily explained. As a matter of clinical observation we know that colds occur in the spring and fall months, seasons which are characterized by moderately low temperature, but with great dampness of the atmosphere, together with considerable atmospheric motion or high winds. Hence we recognize that there are three external factors at least necessary for the production of a "cold,"—low temperature, air in motion, and moisture. It is also necessary as a rule that one or more of these factors should act for some time. The momentary action of an intense cold or draught or moist atmosphere does not usually produce any morbid change. Thus among the familiar causes of cold may be mentioned sitting in a draught, wearing insufficient clothing, insufficiently protected feet, going from a warm to a cold room and slight exposure while perspiring. Among the various theories advanced as to what takes place in the organism, that of Rosenthal is perhaps the most frequently accepted or, at least, repeated in the text books. This is, that the immediate effect of cold on the surface of the body is to excite contraction in the peripheral vessels by which

the blood is driven in from the surface upon the internal organs and acts there as an irritant, exciting inflammation. This does not explain what goes on when membranes near the surface are involved as in coryza and conjunctivitis.

Schenk arranges ordinary colds into two groups, —those due to bacterial infection and those that are not. In the former there is a period of incubation, in the latter the disease follows at once after exposure. There is a class of cases due to bacteria but in which there is no period of incubation or it is very short. Surveyors and prospectors who sleep out of doors during the whole summer, rolled only in a Hudson Bay blanket, invariably take cold the first night they sleep in a bedroom, due no doubt to the return to civilization and bacteria. Seit's theory is that disorders resulting from catching cold are due to the removal of heat to an unusual extent from the external or internal surface of the body; that this causes some functional disturbance, which in turn gives rise to certain morbid processes in some portion of the body perhaps far removed from the part immediately affected by the cold. That the morbid changes are not due to the immediate or direct effect of the exposure is evident from the fact that, as a rule, some time elapses before the changes set in. This theory is not complete. The true action of cold in producing morbid conditions is probably on those nutritive changes which are constantly going on and by which the animal heat is developed. The direct action of cold is on the surface of the body, but the resultant morbid condition is upon some organ remote from the exposed part. The nutritive

processes going on in the whole economy are governed by the central nervous system and a certain amount of nervous force is expended in the regulation of these nutritive processes. If as a result of exposure these processes are arrested in one portion of the body, the same nervous force being sent out from the central system, it will be understood how the local arrest in one portion is attended by a certain amount of increased nutritive activity in another portion. Now increased nutritive activity means inflammation and this inflammation locates itself at the point of least resistance, that is, where a mild chronic inflammation is going on, this being lighted up into an acute process as a result of a cold. When the body is perspiring the loss of heat goes on rapidly, and a slight exposure is liable to result in far more serious consequences than would occur if the body were not in an overheated condition. There may be a difference however; if the perspiration is the result of violent exercise all the nutritive processes are stimulated to great activity, heat is being rapidly produced and the perspiration is in as a conservative measure to prevent the accumulation of too great heat in the system. If in this condition the body is exposed to cold and the perspiration suddenly checked, very serious results may ensue. But on the other hand, a copious perspiration may be induced artificially when the body is quiet, as by a Turkish bath, where the source of heat is outside the body and the heat producing forces are not disturbed. So the cold plunge while it suddenly stops perspiration does not give rise to any bad effect. A swimmer will remain in water at a temperature of 20° or 30° below

that of the body for some time, but while in the water he is in a state of constant activity and keeps in play the heat producing processes, but, if the bath is too prolonged, there comes a time when the body is not equal to the task of supplying sufficient animal heat to make good the loss, and the bather succumbs to the direct influence of this tremendous drain upon the system. Here the result is not an inflammatory attack, but there is great prostration, violent cramps, weakened circulation, intense venous congestion and the whole system is robbed of its normal heat. In the course of an ordinary cold the interval between exposure and development may be long or short. In the slighter disorders the interval may be only a few hours; or it may be prolonged two or three days when something more serious may develop. As to the so-called liability to take cold, this is no doubt due to an existing chronic catarrhal inflammation, perhaps of so mild a type as to give rise to very trivial symptoms or to pass unnoticed. The renewed attacks consist in a lighting up of the old trouble.

CHAPTER IV.

THE GENERAL ETIOLOGY AND PATHOLOGY OF DISEASES OF THE NOSE.

The nose is the seat of olfaction and the natural avenue for respiration. When diseased, adjacent portions are affected, (1) by direct extension of the morbid process, (2) by loss of the function of warming, moistening and filtering the inspired air, and (3) by reflex induction of certain neuroses. The nasal mucus membrane is roughly divided into an upper or olfactory and a lower or respiratory portion. The latter concerns us the most. The membrane is pink in color and consists superficially of columnar cells with numerous cilia. Beneath this is a mass of adenoid tissue here and there aggregated as lymph follicles. The glands are of two kinds, mucus and serous, the latter being identical in structure to true salivary glands and larger and more numerous than the mucus glands. In this portion there is also a layer of erectile tissue composed of venous sinuses and fibro-muscular trabeculae homologous to the corpora cavernosa of the penis. This is found over the inferior turbinated body and the lower half of the middle turbinated and that part of the septum opposite. As to the normal physiological functions the nostrils offer a double aperture for the admission of air; floating dust and coarse particles are caught by the hairs at the entrance, the moist and ciliated mucus membrane being adapted by its contour and

cilia to catch any finer particles which being deposited act as stimuli to the glands. The cilia work in the direction of the naso-pharynx and it is probable that in health the secretion of the nasal glands is carried to the pharyngeal or Luscha's tonsil and there re-absorbed. When the balance between secretion and its physiological removal backward is interfered with, as in coryza, a running from the nose results. If the cilia are destroyed the function ceases and a chronic inflammation results with hypertrophies and hyper-secretions, atrophies with arrested or perverted secretions, polypi and other tumors. A more important function is to warm and moisten the air. In normal breathing this is done entirely by the nose. When the lower passages, *i.e.*, the pharynx and larynx, are called upon to perform this there is great loss of heat which acts prejudicially on the whole system as well as on the immediate parts affected. In atrophic rhinitis there is an enlargement of the lumen, loss of the cilia and wasting of the membrane and glands and the physiological functions are not performed. The cold dry air impinges directly on the pharynx and produces pharyngitis sicca. Also in time the larynx and bronchi are affected and the eustachian tube and tympanum may be involved. The nasal passages are constantly exposed to changing atmospheric conditions of heat and cold, dryness and moisture. The amount of blood supply and glandular secretion varies with every fluctuation of the barometer, with every breeze that blows and every change in the atmospheric dust. This requires a sensitive regulating mechanism which exists in connection with the speno-palatine ganglion and the

fifth pair of nerves. In every ordinary acute catarrh there is a congestion or erection of the vascular portion of the membrane and especially of the so-called turbinated corpora cavernosa. This erection becomes permanent in the state known as hypertrophic rhinitis as a result of constantly recurring abnormal erections. Changes in temperature, and mechanical irritation as from particles of dust, snuff or pollen of grasses, are among the most common stimuli. The stimulus may be at some other part of the body, *e.g.*, irritation of the sexual organs is a factor. This is explained by reflex action and the bond of union which exists between the erectile tissues of the body. There are some patients who always suffer from coryza after a venereal debauch. When the erection of the turbinated structures is carried beyond the physiological limit the normal process becomes a pathological one and there is chronic congestion, general swelling and proliferation of the constituent elements and this is hypertrophic rhinitis. In time the connective tissue elements increase and ultimately these contract and culminate in fibroid shrinking and atrophy of the membrane and bone. This last stage is atrophic rhinitis. The ciliated epithelium is lost, viscid and fatty secretion is not cleared away, and decomposition takes place. This is ozaena. But the hypertrophic stage does not always pass into the atrophic but may stop at any point; nor conversely, is it a fact that the atrophic form is always preceded by a hypertrophic stage. The atrophy may be the chief factor from the first in strumous subjects. Hypertrophy may also be localized and so give rise to distinct neoplasms. This is probably the origin of polypi.

CHAPTER V.

ACUTE RHINITIS.

The predisposing causes are chronic rhinitis, nasal stenosis, struma, tubercle, syphilis, prolonged mental strain, sexual debility, physical fatigue, and adenoid vegetations in children. The disease is, however, very common among people in all states of health, but those who live out of doors and have vigorous muscular bodies are less liable to this trouble than those who follow indoor occupations and have feeble constitutions. It is not common in old age. The exciting causes are, (1) exposure to cold and wet, (2) mechanical irritation by smoke, dust and irritating fumes, (3) chemical causes. As to the first of these exciting causes, most people consider exposure to cold the cause of their malady, though often unable to determine when the exposure took place. Exposure to cold alone is an over-estimated source of the disease. Some other exciting cause is present at the same time. In the second class of causes, dust is the most common cause. Certain individuals are susceptible to the dust of certain localities or of certain kinds. To some the limestone dust of Kingston is particularly irritating. The dust inhaled on a railway journey will always produce it in others. Coal-dust, wood-dust, flour-dust and tobacco-dust all have their victims. The

well-known rhinitis that follows the taking of potassium iodide is a type of the third class. This is supposed to be due to the carbon dioxide acting on the potassium iodide in the nasal secretions setting free the irritant iodine. Ipecac-dust will cause an acute rhinitis on account of the irritating effects of its alkaloid, emetine. Other chemicals capable of producing coryza by inhalation are chlorine, ammonia, nitric acid, mercury, arsenic, phosphorus, hydrofluoric acid, the bichromate salts and formalin.

Symptoms.—The symptoms vary in individuals and according to the exciting cause. There may be slight prodromal symptoms, headache, fever, vague pains throughout the body, but in a simple cold the local signs are the first noticed. There is a burning, itching sensation that excites sneezing,—evidence of hyperaemia. There follows an excessive flow of irritating serous secretion from the congested membrane. Later the secretions become thicker and even purulent. In the second stage the passages become blocked, partly on account of the accumulation of the secretion and partly because of the swelling of the turbinated bodies. The swelling is likely to be intermittent, with times of almost complete relief. When the nose is blocked the feeling of obstruction produces depression and sometimes a feeling of suffocation. Alteration in speech occurs, varying from a slight loss of resonance to complete deadening of the voice, due to nasal obstruction. In these cases articulation becomes defective. In the severer cases partial deafness, tinnitus, lacrymation and conjunctival redness are present and there are disturbances of smell and taste. The continued mouth breathing

gives the tongue a dry brown coating, and there is often loss of appetite. The mucous membrane of the nose is usually red and congested in the severer cases, but in the milder ones there is little or no change to be seen, so that the increased amount of secretion is the guide in determining how much trouble is present. A variety of acute rhinitis is that occurring in nursing infants, which may be either a simple idiopathic rhinitis or an acute purulent nasal catarrh, or the syphilitic nasal coryza peculiar to infants. The simple rhinitis of infants differs from that of adults in that it may become a serious affection. A little swelling makes it impossible to breathe through the nose, and as the child has not learned to breathe through the mouth, it opens this only when dyspnoea forces it to do so, and after a few gasps closes it again until renewed dyspnoea compels it to open it once more. Nursing and nutrition are interfered with and exhaustion and atelectasis of the lungs may supervene. In a purulent rhinitis the secretion is purely pus from the start. The symptoms are all severe and emaciation is rapid and great. The external nose swells, the nostrils are closed by crusts, removal of which shows a nose full of pus, either creamy or thin and ichorous. In most of these cases the infection can be traced to a condition of the maternal passages, the disease being communicated at birth. It may be accompanied by purulent conjunctivitis, suppurating otitis media and enlarged lymphatic glands.

Complications of Acute Rhinitis.—The nasal entrance and the swollen upper lip are macerated by the constant flow of secretion and may form the starting

point for extensive facial eezema in children. Herpes labialis also occurs and facial erysipelas may start from the fissures on the edges of the nostrils. The inflammation may extend by continuity through the lacrymal duct to the conjunctiva, causing slight conjunctivitis with lacrymation and photophobia. The purulent form may set up suppuration in the lacrymal cyst and canal. The accessory sinuses may be involved in acute rhinitis, but the mucus membrane usually returns to its normal condition when the nasal catarrh subsides. Some involvement of the frontal sinuses is the cause of many of the severe frontal headaches accompanying colds in the head, just as the presence of pain and heaviness in the cheek may mean extension to the antrum of Highmore. These conditions of the antrum may suppurate and go on indefinitely, more particularly in the rhinitis of influenza. Severe colds and suppurative rhinitis have been known to precede cerebro-spinal meningitis, and it is surprising that this does not occur more frequently considering the direct lymphatic and venous connection between the nasal cavity and the subdural and subarachnoid spaces. Pain in the forehead and cheek is not always due to sinus disease as infraorbital neuralgias accompany acute rhinitis. This is explained by the fact that the first and second divisions of the fifth pair of cranial nerves supply the nose with sensation, and their terminal fibres on the surface of the nasal mucus membrane are subjected to strong irritation in acute rhinitis. Acute rhinitis may extend to the nasopharynx and cause enough swelling of its mucus membrane to mechanically close the orifice of the

eustachian tube and stop the ventilation of the middle ear. It may also extend directly to the tube and produce an otitis media, either catarrhal or suppurative. It may occur as an early manifestation of measles or scarlet fever or as part of a general acute disorder.

Prognosis.—An ordinary attack may last a few days or as many weeks. Recovery takes place by resolution. The stage of dryness may last only a few hours, that of free discharge several days, while the third period, that of resolution, is of very variable duration. Recurrence after apparent recovery is common.

Treatment.—The best preventive of acute rhinitis is physical vigor. An out-of-door life, proper attention to nutrition, cold baths, sufficient exercise, with the avoidance of excessive clothing and overheated rooms, all contribute to the prevention of attacks of cold. In spite of the greatest care, however, most people have an occasional cold in the head and individual predisposition seems to count for more than great vigor. Local prophylaxis includes the removal of such obstructions as adenoid vegetations, polypi and septal deformities. The idiopathic variety can be aborted in the first stage by a mixture of Tr. Opii m. 20, Tr. Belladonna m. 10, Aq. Camph. two ounces. The opium contracts the capillaries and the belladonna inhibits glandular secretions and obviates the constipating effects of the opium. Cocaine solutions, snuffs and ointments are useful in the first stage but must be ordered for the patients use with great discretion. For the condition itself there are scores of remedies and new ones are always being

added, but the doctor is not often consulted at the time of an acute coryza. Of the remedies for internal use, the most valuable are the salicylates, which certainly limit the duration and improve the symptoms of an acute rhinitis. For local application, the most soothing and cleansing solution is one of bicarbonate of soda, five grains to the ounce, used warm and freely with a dropper. Then an ointment of zinc oxide to which is added a few minims of tinct. benzoin, may be introduced into the nostrils.

CHAPTER VI.

HAY FEVER.

This is also termed hay asthma, rose cold, June cold, autumnal catarrh, rhinitis hyperaesthetica, catarrhus aestivus and coryza vasomotoria.

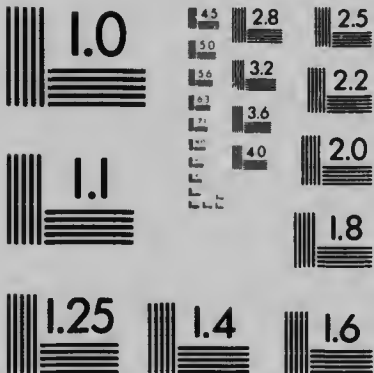
Mention has already been made of those cases of acute rhinitis due to chemical or mechanical irritation of the nasal mucus membrane with reflex vasomotor paresis and hypersecretion. Hay fever is merely a well marked type of this condition. It is an acute catarrhal irritation or vasomotor neurosis of the nasal mucus membrane, the rest of the respiratory tract and the conjunctiva sometimes taking part in it. It occurs periodically, and is characterized by profuse discharge, attacks of closure of the nose due to swelling of the turbinated bodies, and asthma. It is most common in August and September, but may be seen at any time of the year. It is a disease of educated people and of city dwellers.

Etiology.—This requires for its development three factors at least. 1. A predisposing neurotic tendency with debility of vasomotor control. 2. A resulting chronic hyperaemia of the vascular tissue of the nasal passages. 3. An exciting agent varying with the individual and the locality. It may be pollen of grass or flower or some noxious condition of the atmosphere. The predisposing causes are the most im-



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portant. The most common exciting agent is the pollen of *Ambrosia artemesiaefolia* or what is better known as ragweed or hogweed ; and the pollen of *Solidago odora* or golden-rod. These are the causes of hay fever proper, but a similar state is produced by smoke and dust, by exposure to heat and light, by over-fatigue, by the emanations from various flowers, and the pollen of certain grasses, or by the dust of ipecac, salicylic acid, benzoic acid and lycopodium.

Symptoms.—The typical cases are so regular in their annual recurrence that most patients know the date when they will begin to suffer. It usually begins as a severe acute rhinitis. There is tickling and burning in the nose and severe sneezing. The mucus membrane swells rapidly so as to stop the nares and there is an abundant thin secretion. The eyes smart and stream with tears. The conjunctiva is swollen and there is photophobia. The lips and nostrils become excoriated. The sense of smell is impaired or lost. An attack lasts from six weeks to two months, but some are fortunate enough to recover in a few days. Inspection shows the mucus membrane very pale and the discharge more watery than is the case in acute rhinitis. Probing discovers areas of extreme sensibility. The asthmatic form does not differ from ordinary asthma, except that the attacks are worse during the day, while the ordinary asthma is always worse at night. The paroxysms of dyspnoea with dry rales may come on at any time of the day or night, and in many cases this symptom is prolonged over many weeks and is of a very persistent nature.

Prognosis.—About one-third of the cases can be cured by local treatment in the interval between attacks; the others may have the severity of the attack mitigated, but many must expect to suffer more or less, or look to change in climate as the only relief.

Treatment.—Change in climate will give the greatest relief, provided it be to a proper locality. No locality will be found to suit all cases, and some will suffer severely where others have complete relief. Treatment has usually consisted in trying to keep out the exciting cause by confinement to the house, change of residence and plugging the nostrils with cotton wool. The predisposing neurotic condition should be treated by all those measures which tend to diminish the irritability of the nervous system,—nerve tonics, electricity, general douches, massage and attention to diet. The local treatment is either palliative or radical. The palliative treatment must vary with the case, as what gives relief in one case may prove of no assistance in the next. Inunction of the nostrils and eyelids with vaseline, plain or with the addition of atropine or cocaine will help in some cases. A spray of a saturated solution of boracic acid is often grateful. Cocaine in some form gives immediate relief more than any other remedy, but great care must be taken in prescribing it as very serious results have been known to follow its use. The aqueous extract of the adrenal glands, or adrenalin, gives most satisfactory results in some cases; in others it aggravates the symptoms. For some oily sprays are beneficial. The radical local treatment consists of the removal of any hypertrophies or polypi, spurs of the septum or deviations, and the

cauterization of all sensitive areas. The cauterization should be superficial to make a blister only. This must not be done during an attack, but is most successful when instituted a few months before an attack. The asthma is to be treated by the usual remedies.

CHAPTER VII.

CHRONIC RHINITIS.

This term applies to chronic inflammation of the nasal mucus membrane and its results, hypertrophy and atrophy, which may outlast the inflammatory process. It is characterized by moderate or excessive discharge from the nose, or by absence of all discharge, or by drying of the secretions within the nose in the form of crusts. The mucus membrane may be normal in thickness, or subject to intumescence capable of temporary disappearance, or it may be permanently thickened and hypertrophied, or it may be more or less atrophied. Thus the capacity of the nose for the passage of air may vary from complete obstruction to abnormal roominess. The condition offers such extremes of difference that it is hard to realize that they are parts of the same process. The four varieties of chronic rhinitis to be described are simple chronic rhinitis, intumescent rhinitis, chronic hypertrophic rhinitis, and atrophic rhinitis. The first three are really different stages of the same process, while the most recent investigations go to establish the independence of atrophic rhinitis.

SIMPLE CHRONIC RHINITIS.—This is a catarrhal inflammation of the nasal mucus membrane with slight swelling but great irritability and a tendency to acute exacerbations. The secretion may be ex-

cessive and in character is either watery, mucopurulent or purulent. There is no ulceration, but erosions may be present as a result of removing crusts from the nasal entrance by the finger nail. Perforation of the cartilaginous septum may come about in this way.

Etiology.—Anything that keeps the nasal mucus membrane in a state of persistent irritation may lead to some form of chronic rhinitis. The most common cause is frequent colds in the head. The morbid changes resulting from a cold have not time to be removed before a fresh attack replaces them, and the local circulation is so much deranged that a return to the normal is impossible. Chronic rhinitis is to some extent an occupation disease, as millers, stonecutters and those engaged in work in which dust abounds are subject to it. The general predisposing causes are debility, lowered vitality, inactive life, relaxation due to life indoors and lack of fresh air. The local causes are all things that narrow or occlude the passages, such as exostoses, echondroses, septal deviations and excessive size of the turbinated bodies.

Symptoms.—There are itching, burning and tickling sensations in the nose, and sneezing at the slightest provocation. Headache and pain in the eyes are also frequent symptoms. Less frequently there is loss of the sense of smell and partial deafness. Nasal breathing is not obstructed except by accumulation of secretions.

Prognosis.—The condition runs a tedious course, sometimes lasting for years. A few recover spontaneously, others go on from bad to worse and terminate in some other form of nasal catarrh.

Treatment.—Attention to the conditions producing the trouble is the first consideration. For the local treatment the indications are to remove the irritating discharge, to diminish its production, to disinfect the nose if the secretion is purulent or offensive, and to remove crusted material. When the discharge is free and watery it needs no washing for its removal, but when thicker, irrigations or sprays are needed. The simplest method is to use the ordinary medicine dropper and to allow the solution to find its way through by gravity. The nasal douche involves the danger of water entering the middle ear, carrying infective material with it and setting up suppuration. Bicarbonate of soda or the biborate of soda, five grains to the ounce, in warm water is the best solution for the purpose. Dry crusts are best removed by the aid of oily substances, such as vaseline, albolene or olive oil. As a disinfectant it is best to use a solution of permanganate of potash which acts in the very weakest solution, and may be combined with the soda. The ordinary antiseptics, such as carbolic acid or resorcin, to be efficient must be used in such strong solutions as are injurious and irritating. Many remedies have been used to diminish the quantity of the nasal secretion, but none are very effective. The ideal application for this purpose is yet to be discovered. If the astringents do any good it is by creating an active hyperaemia which causes the absorption of the inflammatory exudates in the mucus tissues and reduces the irritability of the mucus membrane. The zinc salts and alum have the reputation of doing permanent injury to the sense of smell. None of the mineral astringents are well

borne in the nose. Suprarenal liquid is effective for many patients. A spray of ten to twenty minims of terebene to the ounce of albolene is fairly effective. Powders are also useful for this purpose. Soziodol of soda, pure, is recommended. The stearate of zinc with aristol is another useful powder. Cauterization may be necessary.

CHRONIC INTUMESCENT RHINITIS.—This is practically a chronic hay fever. Its characteristic is a persistent swelling of the turbinated bodies, especially the inferior and middle, and sometimes of the mucus membrane of the lower part of the septum. The swelling may be unilateral and may change from one side to the other, or temporarily disappear.

Symptoms.—The chief complaint of the patient is obstruction to breathing through the nose. The symptoms differ from those of simple chronic rhinitis in the exaggerated sensibility of the sensory nerves of the nose. The result of this is a reflex paresis of the muscular coats of the lacunar veins and the muscular elements of the mucus membrane of the turbinals and portions of the septum. This leads to venous stasis and hyperaemic swelling of these parts. The swelling is worse at night as the shallow breathing and the recumbent posture favor venous congestion of the head, so these patients often lie with their mouths open and snore. This mouth breathing causes restless sleep and in the morning headache and listlessness. Sneezing is another nervous phenomenon in this condition. Anything which irritates the nerve ends in the nasal mucus membrane

will bring on a paroxysm of sneezing, Pain is another symptom of this trouble. There is not only the feeling of dryness and stuffiness in the nose itself, but a reflected pain in the neighboring parts, such as neuralgia in the course of the supra-orbital nerve, and in the temples and occipital region, or there may be hemicrania.

Another group of nervous symptoms is referable to the cerebrum. Patients complain of heaviness, dulness or inability to concentrate the mind and loss of memory. This is the condition called aprosexia.

Prognosis.—If untreated these vascular swellings in time become true tissue hyperplasias and result in hypertrophic rhinitis. This is not always the case, and the condition may go on for years with little change and then end in recovery.

Treatment.—The general treatment should be the same as outlined for simple chronic rhinitis. Dust and nasal irritants are to be avoided. As to local treatment, the first indication is to remove any obstruction due to deflection of the septum or outgrowth of bone or cartilage. For the patient's own use oily preparations are generally better than watery solutions. Suitable solutions are albolene with one or two grains of camphor, or one half to one grain of menthol, or three to five minims of oil of cloves, or eight to twelve minims of terebene, to the ounce. The cocaine habit is very easily learnt by these people because the relief given is so delightful. It should not be prescribed. Supra-renal extract applied locally reduces the congestion and swelling by contracting the small blood-vessels. These methods are only palliative. The radical treatment consists

in the destruction of a portion of the swollen tissues by the galvano-cautery or by chemical agents, or by removal by surgical methods of part of the swollen tissue. If an acid is used as a cautery, chromic acid is to be preferred. A few crystals of the acid are fused on the end of an aluminum probe and then allowed to cool. The fused acid is rubbed over the part to be cauterized and then at once it is sprayed with an alkaline solution. Cauterization by chromic acid is followed by a sore that takes longer to heal than that produced by the galvano-cautery; there is more pain and more discharge, while the results are not so certain and the depth of the eschar cannot be so accurately gauged. In using the galvano-cautery the wire should be at a white heat and it should penetrate the soft tissues till the bone is felt grating. Superficial cauterizations accomplish nothing.

CHRONIC HYPERTROPHIC RHINITIS.—In this the chronic congestion of the nasal mucus membrane has led to a true connective tissue hyperplasia, localized chiefly on the inferior and middle turbinals and the septum.

Symptoms.—The symptoms are essentially those of the foregoing trouble, intumescent rhinitis, but the nasal obstruction is always present. It may vary in degree but never disappears entirely. The variations are due to the presence or absence of secretions and of these the patient is likely to complain very much. There is a tendency for the secretion to collect in the naso-pharynx from which it is expelled with great difficulty. Frontal and occipital headaches and the various nervous symptoms described

under the intumescent form may also occur. The surface of the mucus membrane is more or less uneven, sometimes presenting distinct nodules. When the posterior end of the inferior turbinated is hypertrophied it can be seen projecting into the nasopharynx as a rounded swelling not unlike a large raspberry, of a bluish-grey or dark red color. The application of a solution of cocaine is usually a satisfactory means of diagnosis between intumescent and hypertrophic rhinitis, as under the influence of the application everything except actual hypertrophy disappears.

Prognosis.—If left to itself this condition seldom shows any tendency to spontaneous recovery. When the hypertrophy reaches its maximum it remains unchanged indefinitely. In a few cases shrinkage of the affected tissues sets in and continues till atrophic rhinitis with ozaena develops.

Treatment.—Effective treatment of this condition is mainly surgical, with general and local treatment as adjuvants. Chemical caustics are used but are not very effective. Of these, chromic acid is most used, monochloracetic and trichloracetic acids are preferred by many as not so likely to produce adhesions. Other methods are much more rapid. The cold snare is best when it can be applied. It may be used with a needle which has been thrust through the turbinated tissues previously, the wire loop being passed around it. If the loop is tightened slowly it is not very painful and it may be almost entirely bloodless. When the loop cannot be applied some form of scissors or cutting forceps may be used. There are also special forms of ring knives and

spokeshave that simplify the operation by enabling one to remove the tissue quickly at one stroke so that the bleeding which is very free as soon as the first cut is made, does not interfere with the completion of the operation. Electrolysis is another method of dealing with these cases. The great advantage of this is that there is little or no reaction and no bleeding, the objection being the slowness with which results are obtained. If adhesions follow other methods of operating, electrolysis is the best means for their removal as the destruction following its use is not accompanied by the formation of any granulations. Care must be taken not to make the nasal fossae too roomy by operative measures, lest one produce conditions similar to those of atrophic rhinitis, with nasal passages so large that the air is not sufficiently moistened by the diminished mucus surface, and the secretions dry and accumulate.

CHRONIC ATROPHIC RHINITIS.—This is a disease which has for centuries been the subject of much dispute. In ancient times its unfortunate possessor was excluded from the priesthood and in modern days it has sufficed for divorce. It is known under a host of names, such as dysodia, coryza foetida, foetid catarrh, stinknose, rhinitis atrophica and most common of all, ozaena, from the Greek word meaning a stench. This is an unfortunate term, for the condition, ozaena, is not a disease but a symptom of a number of pathological states. It occurs in all ulcerative diseases of the nasal mucus membrane whether from

syphilis, cancer, rhinoliths, foreign bodies, phagedenic or other ulcers and usually accompanies caries and necrosis of the intra-nasal bony framework. It is a complication of nasal and post-nasal growths, and may be a symptom of simple or purulent inflammation of the accessory cavities, and particularly of the antrum of Highmore. In simple coryza it may develop from retention and decomposition of the secretion. A simple inodorous catarrh may become offensive at the menstrual epoch or an existing odor be aggravated at periods corresponding to the menstrual flow. So ozaena is entirely a different term to chronic atrophic rhinitis of which it is only a symptom.

In chronic atrophic rhinitis the mucus membrane and the bony framework of the nasal cavity atrophies. The changes are most marked on the turbinals which shrink away, leaving the fossae abnormally roomy. The secretions become dry and adhere to the mucus surface in the form of crusts. If the crusts be lifted off, their under surfaces are found moist or covered with fluid pus. The crusts may be discrete or line the entire nasal cavity like a cast.

Etiology.—This is at present the subject of controversy. The point in dispute is whether atrophic rhinitis is the last stage of the hypertrophic variety, or whether it originates in other ways. Probably it may originate in several ways, or is the final stage of more than one morbid process. The majority of the patients are children and young adults. The trouble dates either from an attack of measles, scarlet fever or other exanthemata; from a single or series of bad colds in the head; or from a bad blow on the

nose followed by epistaxis. A certain proportion of the patients present the so-called typical strumous physiognomy. The nose is small, the bridge and alae wide, the point of articulation with the frontal bone depressed and the nostrils look forward and downward. The nose appears sunken in the face. The lips are thick and expressionless, everted and the mouth generally closed, though sometimes it is open, indicating that the nose is completely filled with inspissated plugs of secretion. In other cases there is only an unusual width of the alae and osseous framework of the nose.

Symptoms.—The general health of the patient is not impaired. The two prominent symptoms are the horrible odor and the tendency to crust formation. The latter is really the characteristic symptom of the disease. The fetor is so peculiar and penetrating that it needs no description; when once experienced it is not forgotten. The only smell equalling it in intensity is that from syphilitic necrosis in the nose but there is an indescribable distinction. The crusts vary in color from a dirty brownish-gray to greenish-yellow or a pronounced black. They exhibit also various degrees of consistency, from soft, easily friable to tough, leathery masses. They adhere with great tenacity to the mucous membrane and when removed form a complete cast of the region occupied. The senses of smell and of taste are usually impaired and may be entirely lost. On examination the first point that asserts itself is the absence of vibrissae and the next is the abnormal degree of patency in the nasal fossae. So widely separated are the turbinated bodies from the septum that when free from crusts

we can see the posterior naso-pharyngeal walls, and frequently the movements of the orifice of the eustachian tube during deglutition. The mucus membrane is pale unless eroded and bleeding. When sinus disease exists as a complication or cause, distressing neuralgias and headaches often accompany this condition. There are a few cases unaccompanied by any odor. The odor is the result of putrefactive changes or fermentation.

Diagnosis.—This will depend on the exclusion of other affections which cause ozaena. Syphilis of the nose is the condition most likely to be mistaken for ozaena. If the syphilis is active, necrotic bone and ulceration are present. If not active, the defects in the bony septum almost always left by syphilis enable one to make a diagnosis.

Prognosis.—If left to itself it continues for many years, but it does not cause much inconvenience in those over thirty-five. In rare cases the atrophied tissues have been regenerated, but the rule is that the atrophy cannot be remedied.

Treatment.—There are three indications, (1) cleanliness, (2) prevention of inspissation of mucus, and (3) to augment the blood supply. To insure cleanliness the nose must be thoroughly and repeatedly washed by the surgeon himself. This may be done by syringing, by spray or swab of cotton, or by a combination of these. The best solution for cleansing and disinfection is permanganate of potash, from one-twenty-fourth to one-eighth of a grain to the ounce of water. To prevent inspissation of mucus and the formation of crusts there is nothing so effective as the insertion into the nasal fossae of a

tampon of cotton wool so as to fill completely the widened inferior meatus. This acts best if the wool is non-absorbent and it need not be medicated. It prevents nasal breathing for the time, but that may be beneficial. The tampon should be worn for four hours in one nostril and then for the same time in the other. The blood supply may be augmented in four ways, (1) by artificial stimulation, (2) by the physical method, (3) by electricity, (4) by massage. Artificial stimulation may be obtained by powders, by medicated wools, by fluid sprays and by tampons. The powders most in use are made up with sugar of milk as a base, and whatever is added should not cause the patient discomfort for more than ten minutes. The additions to the base are mercuric chloride from one-tenth to one-fifth per cent. ; iodol, twenty-five per cent. ; boric acid, ten per cent. ; aristol, five to eight per cent. ; benzoin or myrrh, twenty per cent. ; berberine muriate, ten per cent. Wool is usually medicated with chloride of ammonia for this purpose. Of the sprays, *Tr. Sanguinaria*, five to thirty drops to eight ounces water is one of the best. The physical method of dealing with these cases is one of the most effective, but it requires the co-operation of the patient. The benefit from it depends on the fact that diminished barometric pressure in the nasal cavities results in increased blood supply to the walls of the cavities. If the nostrils are partly closed by a plug of cotton wool and the patient persists in breathing through the nose in spite of the great difficulty thus produced, the conditions are fulfilled. This forced nasal breathing should be persisted in for two or three hours daily. Almost at the

outset of this labored breathing the mucus begins to flow freely from the dry mucus membrane.

Electricity is used in the form of the constant current and by copper electrolysis. Injections of diphtheria antitoxin have been used for this with temporary benefit.

CHAPTER VIII.

EPISTAXIS.

EPISTAXIS: NOSE-BLEED OR HAEMORRHAGIA NARIUM.—This is a symptom of very common occurrence. It means the rupture of a blood vessel, usually a vein, in the nose, the accessory cavities, or the naso-pharynx. It is the result of injuries, local disease of the nose, general diseases, or it may be vicarious in nature. Injuries include blows upon the nose, forcible blowing and sneezing, picking with the finger, the entrance of foreign bodies, fractures of the base of the skull, and operations in the nose and naso-pharynx. Local diseases of the nose producing epistaxis are atrophic rhinitis, the various forms of ulceration, fibrous tumors of the naso-pharynx, malignant disease of the nose and throat and exostosis and more rarely polypus and hypertrophies. The septum, in any case, is the most frequent site of the rupture of a vessel. Next to it we most often find the bleeding point on the inferior turbinated. It is usually the anterior part of the nose that bleeds.

The general diseases in which epistaxis is a common symptom are of three kinds: (1) The blood itself may be altered in constitution, (2) the vessels may be diseased, and (3) there may be obstruction to the circulation through the lungs, liver, kidneys or other organs, causing a sudden tension or strain of the whole system which gives way at the weakest

point. This is often in the nose where the vessels are very superficial and in places cavernous. Under the first class, or diseases of the blood, the most common cause of epistaxis is haemophilia or the haemorrhagic diathesis. In plethoric children epistaxis is often preceded by a sensation of fullness in the head. The connection between the veins of the nose and the sinuses of the dura mater explains the relief experienced by the bleeding. It also occurs in eruptive and relapsing fevers, diphtheria, scorbutus, purpura, yellow atrophy of the liver and poisoning by phosphorus. In the second class, those due to disease of the blood vessels, are placed the cases of atheromatous degeneration. This is most often met with in elderly people but may be found in the young as a result of syphilis and chronic alcoholism. Under the third class may be placed strain of the vascular system such as produced by lifting heavy weights, violent coughing, vomiting or running or any other excessive exertion. This cause is intensified by any artificial obstruction to the return of the blood from the head, such as might be produced by tight neck wear or by tumors of the neck. Venous obstruction from engorgement of the right side of the heart, emphysema, severe bronchitis, diseases of the liver, kidney and spleen, are all causes of this character. Strong emotion may also be a cause. Lastly it may occur vicariously, taking the place of the menstrual flow in women, or of some periodical escape of blood from the enlarged veins in the rectum, leg or elsewhere.

Symptoms.—In epistaxis from traumatism the blood flows freely from one side of the nose and soon

stops of its own accord. In other cases the blood trickles by drops. When caused by cerebral congestion there are premonitory symptoms such as headache, tinnitus aurium and injection of the conjunctiva. When the bleeding is excessive, syncope is liable to occur and may prove fatal. Examination of the nose in ordinary cases when the bleeding has ceased, will show the erosion or bleeding point. In some cases, however, it is impossible to detect any place which might be a likely source of the bleeding. During the bleeding, wiping away the blood with tampons, if it does not flow too freely, will disclose its source.

Treatment.—Ordinary attacks need no treatment as they soon cease spontaneously. The upright position is the best. When there is a tendency to syncope have the patient seated or lying down. Often the haemorrhage can be arrested by simply closing tightly the bleeding nostril for a few minutes, as in most instances the blood flows from a small point on the cartilaginous septum. Raising the arms above the head to force the blood to mount against gravity, may assist in the formation of a clot. Hot foot baths and mustard to chest, neck and ankles, have derivative action. Stimulation of the vasomotors may be induced by cold applications to the back of the neck, forehead and over the nose. Compression of the facial artery is also recommended. One who is familiar with the use of nasal instruments will prefer at once to plug the nares rather than resort to any form of styptic application. The latter may be used in the form of powders or sprays but may not reach the bleeding point at all in a nasal

fossa filled with clots of blood. The styptics in use are ice water, or very hot water spray, insufflation of tannic acid or alum, or preparations of iron. Adrenalin is one of the latest and best. If the haemorrhage be arrested by any form of local application there is no certainty that it will not return when the surgeon is far away, while a properly applied tampon insures against return of the bleeding till the removal of the tampon. The best material for plugging is absorbent lint cut into strips one-half an inch wide and from one to three feet long. The strips may be impregnated with iodol or bismuth subnitrate, and so be kept aseptic for some days. Absorbent cotton is not a good material for this purpose as it loses its elasticity and bulk, while the strip of lint swells when it becomes soaked. Pieces of the cotton may be lost in the nasal cavities. In the ordinary case it is only necessary to introduce the tampon as far back as the middle of the inferior turbinated, as the blood comes from the anterior part of the septum. In other cases in which the bleeding comes from the posterior part the whole fossa must be filled with the tampon. Posterior plugging may be necessary. Bellocq's canula is an instrument specially adapted for the purpose. A soft rubber catheter, however, is the proper thing to use. It is passed through the nose into the throat and drawn into the mouth with forceps. To this a string with a plug is attached and then drawn through to close the posterior nares. The string should be double, one end through the nose, the other through the mouth to facilitate its removal. Such a plug should not be left in longer than twenty-four hours and should be saturated with some antiseptic before being introduced.

CHAPTER IX.

FOREIGN BODIES.

FOREIGN BODIES IN THE NOSE.—These are most often found in children. In addition to the usual way through the nostrils, foreign bodies may enter by way of the naso-pharynx during the act of vomiting or when food is coughed out of the larynx where it may have been lodged. The variety of foreign bodies found is endless.

Symptoms.—Small, smooth substances of indestructible material may remain indefinitely in the nose without producing any symptoms. As a rule the symptoms are marked but misunderstood and attributed to nasal catarrh. Foreign bodies of vegetable material swell and even germinate, so that the pressure from the increasing size causes pain and irritation. The nervous symptoms may be severe. Intense headache and pain in the cheek and nose occur. The most striking symptoms are unilateral obstruction and discharge of purulent material with an offensive odor. A unilateral purulent offensive discharge in children up to the seventh year almost invariably means a foreign body in the nostril.

Treatment.—Some foreign bodies may be expelled by blowing air into the unobstructed nostril by Politzer's air bag. It is not safe to use water in this way on account of the risk of its entering the middle ear. Many can be removed by means of a small hook, and the various styles of nasal forceps are also

useful. Some can only be removed by the nasopharynx. After treatment is not often necessary.

RHINOLITHS.—These are cretaceous masses which usually owe their origin to the lodgement in the naris of some foreign substance upon which calcium phosphate, calcium carbonate and other mineral substances are gradually deposited from the secretions. Blood clots may give rise to these masses. They are comparatively rare, but are more serious as regards symptoms and difficulty of removal than foreign bodies. They tend to grow to a large size, may occupy both lower and middle meatus, and may perforate the septum. Their shape is usually irregularly ovoid while a few are smooth. Their color is grayish brown or yellowish, greenish, dark brown or dark green, and they are often friable or brittle. The symptoms are those of a foreign body, only greatly intensified. Swelling of the nose and cheek on the same side as the rhinolith is sometimes present.

Treatment.—It is often necessary to break up the mass before attempting its removal. This can be done with forceps, or a lithotrite may be had for this purpose. Some may be pushed into the nasopharynx, but if this is done care must be taken that it is not drawn into the larynx.

MAGGOTS IN THE NOSE.—Nasal disease due to the invasion of the nasal cavities by the larvae of certain species of flies, though common in tropical countries, is quite rare in temperate latitudes. There is, however, an extensive literature on the subject. The flies liable to deposit eggs in the human nares belong to the genus *oestrus*, or gadfly, and the

muscidae or house fly. The oestrus larvae live in the human nasal passages without causing any destruction of tissue, but simply irritate the surface of the mucosa. The *muscidae*, however, cause the most frightful destruction of the nasal interior. Both varieties are likely to enter the noses of sleepers in the open air in the daytime, and more particularly those of persons with offensive discharges. The symptoms rapidly follow the deposit of eggs, as they hatch in a few hours and the larvae rapidly grow to their full size. At first there are irritation and tickling with slight discharge, but the tickling increases to unendurable formication, with violent sneezing. Pain begins when the larvae begin to burrow. Persistent headache, rapidly increasing to agonizing intensity, is a prominent symptom. The maggots may even enter the sinuses. The face swells presenting the appearance of erysipelas on one or both sides, while abscesses appear, burst and discharge pus and maggots. Severe and repeated epistaxis marks the course of the trouble and helps to exhaust the patient. The pain is so great that delirium sets in and some attempt suicide. Meningitis is a frequent termination. Sepsis and pyaemia may come in the later stages. The rarity of the affection will lead the doctor to think of every disease but maggots in the nose till inspection brings the worms to view or some of them are seen in the discharge. Early recognition is of the utmost importance.

Treatment.—The destruction of the maggots is best accomplished by the use of chloroform vapor, or the solution itself may be syringed into the nasal cavities. In the less severe cases the maggots may be picked out one by one with forceps.

CHAPTER X.

NASAL POLYPI.

NASAL MUCUS POLYPI.—These are not myxomata, but the word mucus is used to distinguish them from fibrous and malignant growths. They occur often in great numbers in the nasal fossae, and are apt to block the passages completely. They are either pedunculated or sessile and in most cases give rise to a free mucus discharge.

Etiology.—It is probable that these growths are the result of an acute or chronic rhinitis, and represent a hyperplasia in a state of oedema. During the progress of the inflammatory condition one point becomes oedematous, then pedunculated and pendulous. Other cases originate in granulation tissue, the polyp being merely an enlarged granulation. Polypi are found in people of all ages, and may be congenital, but they are rare in childhood and old age. There is a hereditary predisposition.

Pathology.—The typical polyp is attached to its base by a slender neck or peduncle, and is of varying shape, but usually pyriform or globular, and varies in size from a small pea to a large walnut. It shows a smooth and glistening surface, and is of jelly-like translucence. Fine blood vessels are seen entering the peduncle and spreading over the surface of the growth. It may be firm and opaque if connective

tissue predominates in its structure. When the epithelium is exposed to the air or to irritation, as when they are located in the nasal vestibule or nasopharynx, it becomes like epidermis and covers the surface with an opaque white coating. The shape of the larger ones is influenced by the nasal passages in which they grow. They may be very numerous but the average number is from six to ten. The source of origin is usually the lower border of the middle turbinated, but they may grow from any part of the mucus surface, even the septum, the lower turbinated and the floor, but these are rare. They are sometimes found attached to the openings of the accessory sinuses. Nasal mucus polypi are connective tissue growths. In the typical polyp this forms a delicate reticulum of fibres resembling embryonal connective tissue.

Symptoms.—They cause no symptoms as long as they are small. As they grow larger they give rise to mechanical irritation and a discharge of a serous or purulent nature. The purulent secretion stimulates the mucus surface to the production of more polypi, and in fact the discharge from sinus disease or other nasal suppuration may originate the growths. There is often a perpetual sniffing and frequent and unsatisfactory attempts at blowing the nose. Anosmia and deafness are common. A sense of pressure and fulness in the nose is often felt, and neuralgic pains radiating into the various branches of the first and second divisions of the fifth cranial nerves are frequent. Reflex asthma is caused by polypi. Damp weather causes them to swell because of their hygroscopic qualities. If after remov-

ing a polypus we weigh it and then immerse it in water for an hour we find it increases its weight by half as much again or more. When examined by anterior rhinoscopy they present themselves as translucent, glistening, greyish bodies of an appearance so characteristic that they form an easy object for diagnosis. Those used to rhinoscopic appearances will hardly mistake polypi for any other condition, but a malignant growth, such as sarcoma or epithelioma, has sometimes the appearance of a polypus. In such a case an attempt to remove the mass will result in free haemorrhage and the structure is found to be friable. Polypi persist for years. They have no tendency to spontaneous recovery. In prognosis the most important point is recurrence after operation.

Treatment.—There are various antiquated methods of removal seldom now adopted. Hippocrates removed these growths by means of a sponge forced through the fossae. The application or injection of the growths by caustics or astringents is one of the older methods but is unsatisfactory. Some surgeons still use the polypi forceps. The operation most in favor is removal with the cold wire snare, while a few prefer the galvano-caustic wire. Local anaesthesia is employed and no after treatment is needed. To prevent recurrence, the pedicle or base may be cauterized or that portion of the bone from which the polyp springs may be entirely removed.

CHAPTER XI.

DISEASES OF THE ACCESSORY SINUSES.

EMPHYEMA OF THE MAXILLARY ANTRUM. — Inflammation of the lining of the antrum of Highmore may be acute or chronic. It is accompanied by a discharge of a serous, mucus, muco-purulent or purulent nature often offensive. In some of the acute cases there is no secretion from the lining of the antrum, the symptoms being caused by swelling of the mucus lining.

Etiology.—This often accompanies acute rhinitis and influenza. The acute infectious diseases are frequently causes, especially pneumonia, typhoid fever, measles, scarlet fever, diphtheria and small-pox. Inflammatory disturbances in the neighborhood are liable to involve it by extension; this is especially the case in disease of the teeth of the upper jaw. Decay opens the pulp cavity, clearing the way for infectious germs to follow the root canals, to the periosteal lining of the socket of the root of the tooth. Here an abscess may form around the root, and if the lamella of bone separating it from the cavity of the antrum be thin, or, as in some cases, wanting, infectious material finds its way into the antrum and sets up an acute inflammation. The septic material may also find its way through the bone, which becomes inflamed as a sequel to the periostitis. In this way an incisor tooth may be the cause of an

empyema. Disease of the roots of the first and second molars is most liable to be followed by inflammation of the antrum. Chronic empyema is found associated with atrophic rhinitis, though in some cases it is to be regarded as a sequel to the empyema.

Symptoms.—These may be mistaken for those of neuralgia of the superior dental, supra-orbital, or infra-orbital nerves accompanying an acute cold in the head, and it is probable that antrum disease is often not recognized because of its obscure symptoms. In the milder cases of the acute inflammation there is very little distress, but in the severer cases there is moderate fever and perhaps severe pain. The first sensation is of weight and distension in the upper jaw, gradually changing to pain. The discharge may appear at once in the nose or only after several days. When decayed teeth have caused the disease the discharge is very offensive from the first. Acute inflammation of the maxillary sinus lasts from one to three weeks, unless it merges into the chronic form. It may involve both antra and one attack may be followed by others. The chronic form of empyema may be latent, the discharge not having noticeable characteristics, while there are no subjective symptoms. In a typical case the chief complaint is of the discharge, generally pus or muco-pus. The position of the outlet of the antrum near the top, makes drainage of the cavity imperfect, so that in the upright position it has to fill to the level of the ostium before discharge of secretion can occur. If a patient lie on the healthy side or invert his head or bend forward, the fluid contents of the antrum may for mechanical reasons,

discharge more freely. The discharge may be so free that it comes drop by drop, or so scanty that it dries in crusts. The discharge flows into the middle meatus, and from here may spread forward and downward upon the nasal floor or back into the nasopharynx. The putrid odor and taste of the secretion are disgusting to the patient, and keep him hawking, spitting and blowing the nose, and if swallowed, the pus may nauseate him and cause vomiting. The patient is haunted with the stench, though it is seldom so intense as to be offensive to his neighbors. In chronic empyema pain is not a prominent symptom. There may be a local aching and feeling of weight, but usually these are absent, while neuralgic pains are felt in the teeth, temple, eye, forehead or one-half of the head. Reflex eye symptoms also occur—pain in the eyeballs, lachrymation, weakness of accommodation, and diminution of the acuteness of vision. When the suppuration extends to the orbit, great swelling of the lids, chemosis, exophthalmos, and partial or complete blindness occur.

Diagnosis.—It is sometimes difficult to be positive in diagnosis. We must base an opinion chiefly on the situation of the discharge as it is seen in the nose. When we see an opaque canary-colored, purulent discharge lying in the cavity of the middle turbinated which discharge is renewed at once after being wiped away, we need not hesitate to open the antrum. A valuable aid to diagnosis is transillumination which consists in the insertion of an electric incandescent lamp into the mouth in a darkened room or under a photographer's cloth. A five volt lamp is used. When the lips are tightly closed a rosy red

light suffuses the face, the cheeks and lips being the most brilliant. When there is pus or a solid tumor in the antrum that side of the face is less bright than the other. In cystic disease that side is the brighter. This method is not always positive. In atrophic rhinitis and where from any cause there is thickening of the walls of the antrum the cheek may be dark and yet no empyema exist. Other methods of investigation are probing the antrum, insufflation, irrigation and aspiration. To pass a probe through the normal opening of the antrum is possible in a few cases. When the opening is found with the probe, pus will sometimes flow out beside it. A fine silver tube may then be introduced in the same way and connected with an insufflator to blow secretion from the cavity. If this is successful, it may be joined to a syringe and the antrum irrigated to wash out the pus. If the normal opening cannot be found, a sharply curved trochar and canula or a hollow needle may be thrust in through the middle or lower meatus.

Treatment.—The antrum offers four points of approach for therapeutic measures: The natural opening or its neighborhood in the middle meatus, the inferior meatus, the socket of a molar tooth, and the anterior wall of the antrum through what is usually called the canine fossa. In recent cases, irrigation through the natural opening or through the artificial one made in the neighborhood may be tried. It is well in any case to clear the natural opening of all obstacles, as, if the opening is made elsewhere, and this is not done, there is a return of the trouble as soon as the artificial opening is allowed to close. Access to the normal opening can be had usually

after removal of the anterior end of the middle turbinal. This is done by scissors and snare. The same preliminary operation must be done in cases of ethmoid and frontal sinus disease. If it is impossible to irrigate in this way or if the irrigation is not effective, then an opening may be made through the socket of a tooth. If there is a bad tooth it should be drawn as it may be the cause of the empyema. The socket of one of the molars or of a bisuspid may be chosen, but in the latter case there may be a difficulty in getting through. The opening is to be made with a drill of any kind, and a drainage tube should be used. The best for this purpose are made of soft rubber with a flange on each end to keep it in place. The radical operation is to open through the anterior wall, where an opening can be made large enough to properly explore and curet the whole cavity. The corner of the mouth is drawn upward by a broad blunt hook and an incision is made through the mucus membrane and periosteum where the cheek joins the upper jaw, in a line above the prominences caused by the roots of the teeth, and extending from the canine to the second molar tooth. The soft tissues are then pushed up and the bone exposed. The antrum is then opened by a chisel, using one about half an inch wide. The opening may be enlarged by the same chisel or by small bone forceps until the little finger can be passed into the antrum. This may be used to search for foreign bodies, tumors, carious bone, projecting roots of carious teeth, displaced wisdom teeth and other causes of suppuration. Septa should be broken down and granulation tissue and oedematous folds of mucus membrane removed

by a sharp curet. Afterwards the cavity is to be packed lightly with gauze and treated on general surgical principles.

INFLAMMATION OF THE FRONTAL SINUS. — The frontal sinus is in intimate relation with the foremost of the anterior ethmoidal cells, and for this reason an inflammation of the frontal sinus almost invariably involves some of the ethmoidal cells.

Etiology.—The common cause is acute coryza and influenza. Chronic inflammation is apt to result from an acute attack.

Symptoms.—The most marked symptom is pain, varying from a sense of weight in the region of the sinus to an intense aching, radiating to the eye and other portions of the head. The pain is throbbing and is worse when bending forward and after coughing and sneezing. When the outlet of the sinus is closed, absorption of the air in the cavity takes place with the production of negative pressure, or the secretions accumulate until they produce hydrostatic pressure on the mucus surface. The pain is apt to be periodic and worse in the morning. In the chronic form the pain is not so severe, but exists with varying intensity for months or years. Dilatation of the frontal sinus may take place as the result of distension from the retained secretions.

Prognosis.—Most of the acute cases recover, a few become chronic, and in very rare instances a septic process extends beyond the sinus leading to serious complications.

Treatment.—The acute form usually yields to the measures used for the relief of the coryza producing

it. The septic form requires the opening of the sinus from in front. In the treatment of the chronic cases the first aim is to clear the opening in the nose from obstructing hypertrophies and polypi. If the sinus prove to be accessible, irrigation may be enough to cure. Boracic or normal salt solution is to be used. In opening the sinus from without, the incision should be made in the eyebrow along its lower border, and extend from its middle to the centre of the nasal bridge. The sinus should be opened near the angle of the orbit with drill, chisel, trocar or trephine. The opening should be large enough to admit the little finger, and it must be thoroughly cleaned out by curetting if necessary. Communication with the nose is to be re-established.

EMPYEMA OF THE SPHENOIDAL SINUSES.—This is rare, or, at least, the diagnosis of the condition is rarely made. Acute inflammation of this cavity is the result of an acute infectious rhinitis.

Symptoms.—As in inflammation of the other sinuses, pain is the most marked symptom of the disease in both the acute and chronic forms. In the acute variety there is a history of a severe cold accompanied by great pain in the forehead, occiput and deep in the skull. A feeling of pressure from behind is felt in one or both eyes. In the chronic form there is an abundant discharge in the nose or naso-pharynx, and it may have a foul odor.

Diagnosis.—In order to make the sinus accessible it is often necessary to remove the anterior end or all of the middle turbinated. If a probe is passed from

the lower border of the nostril upward and backward across the centre of the middle turbinal parallel to the septum, it will reach the anterior wall of the sinus. When softened by disease, the probe will readily enter the sinus by its normal entrance or by perforating the mucus membrane and softened bone. If the probe enters, the patient should be told to close the opposite nostril and forcibly blow through the one on the affected side, when pus and blood will be aspirated into the naris. This generally gives immediate relief. The important object is to get a free opening for drainage. If the probe is passed as described, it should be followed at once by the use of the syringe and euret.

SUPPURATION OF THE ETHMOIDAL CELLS.—This is in many cases secondary to suppuration of the frontal or maxillary sinus. It may arise from the same causes as produce suppuration in the other sinuses.

Symptoms.—The pain is perhaps more intense than that due to disease of the other sinuses. It is felt at the root of the nose, the lower and inner part of the orbit, the upper part of the cheek, and the region of the frontal sinus. When the anterior cells are affected, pus will appear in the middle meatus, coming from the hiatus semi-lunaris. When the posterior cells are diseased the pus appears in the olfactory region between the septum and the middle turbinal, and flows back over the body of the sphenoid into the naso-pharynx, appearing as flakes and crusts.

Prognosis.—A great number of cells form the ethmoidal labyrinth so there may be hidden foci of

suppuration that are badly drained, and the dangerous region they occupy makes vigorous operation risky. For these reasons, rapid recovery is not the rule. The disease may extend over many years, and nothing more than improvement of the condition may be looked for.

Treatment.—It may be necessary to remove the whole of the middle turbinal. The cells should be explored with a probe, and this can be followed by a sharp spoon. Care must be taken not to penetrate the orbit or cranial cavity.

CHAPTER XII.

AFFECTIONS OF THE NASAL SEPTUM.

DEFLECTIONS OF THE NASAL SEPTUM. — These are simply a departure from normal anatomy and not pathological, but they lead to grave symptoms and to pathological states. They are very common. Sir Morrel Mackenzie examined 2,152 skulls with the bony septum entire and found 76.9% presented more or less deviation. The percentage is even larger than this as quite a number of deformities are confined to the triangular cartilage. The septa of children are practically straight, and deflections do not become troublesome till adolescence.

Etiology. — The common cause is disproportionate growth of the septum and the bones which frame it. The upper jaw is apt to be asymmetrical and the septum becomes too large for its setting, and as the individual grows this disproportion is so great that it causes the septum to buckle and fill one naris or even obstruct both. In a simple deflection the thickness of the septum is even and normal throughout, but it is common to find ridges, spurs, or exostoses. The quadrangular cartilage is the place in which deflections are seen most frequently and in their greatest development, and the variety of shape is so great that each case is peculiar.

Symptoms. — These are the usual ones of obstruction and they may appear only when an acute or chronic rhinitis causes swelling of the meatus. When the deflection is great, a prominent symptom is twisting of the nose to one side, usually of the opposite the

convexity of the septum. The voice may have the peculiar dead quality and lack of resonance due to nasal obstruction.

Treatment.—Most of the evil results of deflection may be removed by suitable operation. The operation most frequently done is that of Ash. With the instruments specially devised for this purpose, a crucial incision is made in the region of greatest convexity. The segments are then broken at the base by the finger or forceps so as to destroy the resiliency of the septum, which is then straightened. Tubes or plugs are then introduced to keep the septum in place, and these may be worn for some time. Other operations are described, but all depend on cutting through the septum and overcoming the deflection by overlapping the flaps so made.

ECCHONDROSIS AND EXOSTOSIS OF THE NASAL SEPTUM.—These occur in the form of sharp spines or spurs and as longer ridges and crests. The symptoms are those of deflections just described. They may be large in size and exert great pressure on the outer wall, and so excite pain and various nervous symptoms. The excessive tissue must be removed by operation.

PERFORATION OF THE NASAL SEPTUM.—Among the causes of perforation of the septum are syphilis, tuberculosis, lupus, malignant growths, abscess, haematoma of the septum and operations. Many idiopathic perforations are caused by picking the nose and are due to the extension of little erosions and ulcers caused thereby.

Symptoms.—The progress of the disease causes so little annoyance that the patient is made aware of

it is by the crusts which occlude the nostril and lead to injury with the finger nail. Epistaxis is common. The most important result is the deformity, but this is rare when only the cartilaginous septum is affected. If the vomer or the perpendicular plate of the ethmoid be destroyed, the nose is almost sure to recede below the nasal bones. After these perforations have healed, they present smooth, sharp borders, generally healthy in appearance.

Treatment.—This consists in making suitable applications to heal any ulceration that may be present. It is not worth while to try to close the opening.

HAEMATOMA OF THE NASAL SEPTUM.—This is a collection of blood under the muco-perichondrial covering of the septum. It does not often involve the bony septum. It is almost always the result of violence to the external nose. The effused blood shows no tendency to absorption.

Symptoms.—At the time of the injury there may be some nose-bleed. The pain soon subsides, and it is only the discomfort of the obstruction that forces the patient to seek advice.

Treatment.—The proper treatment is by incision, and the opening should be large, as it tends to close quickly. The cavity should be packed with gauze.

ABSCESS OF THE NASAL SEPTUM.—This is usually the result of haematoma. Perichondritis is the basis of all abscesses of the septum not traumatic. The difference between haematoma and abscess can only be determined by an exploratory puncture and aspiration. Simple abscess does little damage, but those due to syphilis result in very great destruction. The treatment is that for haematoma.

CHAPTER XIII.

ANOSMIA AND PAROSMIA.

These are in most cases only symptoms but they deserve separate consideration. Anosmia is absence, hyposmia is diminution in the sense of smell. Anosmia is divided into respiratory, essential, and central, according to the seat of the lesion. In the respiratory form the olfactory region is intact, but shut off from the air current by obstacles so the odors cannot reach it. If the obstruction is removed the sensation returns. The essential form is due to inhibition of function, destruction or atrophy of the nerve branches of the olfactory nerves or the olfactory cells. Acute catarrhal inflammations may injure the ciliated ends of the olfactory nerve cells enough to cause temporary anosmia. The function may be temporarily suspended by applications of cocaine, morphine and atropine. Strong astringent applications will create anosmia and are therefore to be avoided. Excessive irritation by strong odors may cause total anosmia. Pus or crusts in the olfactory region will inhibit the sense of smell. It may also follow diphtheria and influenza. The removal of the Gasserian ganglion is followed by marked diminution in the sense of smell, the reason for this not being understood. Central anosmia may be caused by atrophy of the olfactory bulbs or by their injury in

fractures, such as those of the cribriform plate. Intracranial diseases may produce it by pressure on the olfactory bulbs, and tumors, meningitis, extravasations of blood, or subdural abscesses are causes. The treatment must be guided by the cause. In the central cases the prognosis is bad except they be due to syphilitic gummata.

HYPEROSMIA.—There are great variations in the acuteness of the sense of smell in different individuals, so that its intensification can only be considered pathological when it becomes an annoyance to the individual. The condition may be one of increased irritability of the individual rather than of increased acuteness of smell, so that odors which do not disturb and may even please others, are disagreeable to him. This explains why the basis of hyperosmia is often neurasthenia, hysteria, anaemia and pregnancy. Toxic hyperosmia is produced by the local application of strychnia to the olfactory mucosa, and may also follow its general use.

PAROSMIA.—In this there is perversion of the sense of smell. Odors are not perceived correctly, or else the individual is conscious of an odor which does not exist. Those cases of nervous origin occur in neurasthenic, hysterical or pregnant persons, and often in those mentally diseased. The subjective odors are usually disgusting or disagreeable. It may follow influenza. Parosmia may be due to disease of the olfactory bulb or tract, the gyrus occipitotemporalis, the gyrus hippocampi, and the pes hippocampi major.

CHAPTER XIV.

NASOPHARYNGITIS AND ADENOID VEGETATIONS.

ACUTE NASOPHARYNGITIS.—This is a common and an important condition because of the aural complications. In many individuals a cold in the head or a sore throat always appears in the nasopharynx. It is probable that exposure to cold merely diminishes the local resistance to infectious germs which find the lymphoid tissue of the nasopharynx a favorable place for invasion. In children the condition is likely to confine itself to the post-nasal space, while in older persons it is usual to find an extension by continuity into the nose and into the throat.

Symptoms.—These are modified by the presence or absence of Luscha's tonsil, and as this is practically a structure of childhood, the symptoms in early life are essentially different from those of adults. In the case of children there is fever as in a general infection. The fever may be continuous and last for a few days or a few weeks. At the same time the child becomes a mouth breather; there is snoring and noisy respiration during sleep, and often a rattling sound due to the secretion in the nasopharynx mixing with the air current. Otitis media is a very frequent complication. The disease may terminate in permanent enlargement of Luscha's tonsil, or so-called adenoid

vegetations. In adults the condition is a local process. There may be malaise, headache, loss of appetite, but rarely any elevation of temperature. Swallowing causes pain. The secretion is profuse and sticky and is only removed with difficulty through the mouth.

Treatment.—In little children local treatment is difficult but something can be done. The secretions can be removed by dropping into the nose a warm solution of bicarbonate of soda, five grains to the ounce, the head being thrown back. The general condition is modified by an antipyretic, such as ammonol. After the secretions are removed some oil may be introduced also through the nose by means of a dropper. In adults the soda solution may be used, or if the discharge is purulent a solution of permanganate of potash strong enough to have a light pink color. An oily spray should follow this. Internally salol and soda salicylate are of distinct value.

CHRONIC NASOPHARYNGITIS.—This is associated with a similar inflammatory condition in the nose or oropharynx.

Etiology.—This is the condition spoken of by the laity as "catarrh" and is much advertised by quacks to terrorize the ignorant. It is so much more frequent in America that Mackenzie called it American catarrh. It is common between the ages of twenty and fifty, and probably originates in repeated attacks of the acute condition. Among the remoter causes of the condition are living in badly ventilated, dusty rooms, breathing an atmosphere of tobacco

smoke, and abuse of the voice. It is frequently seen in climates subject to sudden and extreme changes in temperature. Too little moisture in the inspired air produces it by causing a drying of the secretion on the mucus surface which results in a chronic irritation.

Symptoms.—There is a constant feeling of dryness and a raw sensation in the nasopharynx which is intensified by swallowing. The patient complains of a sensation of secretion dropping from the nasopharynx to the oropharynx, and of a constant desire to hawk and clear the throat. This desire persists even when no secretion is present as the mucus membrane is hyperaesthetic. In some cases there is deafness and tinnitus aurium. Inspection of the nasopharynx will show the glue-like secretion flowing down the posterior wall and coating it like a varnish.

Prognosis.—The disease may extend over a period of years, but is not dangerous to life, and there appears to be no tendency for it to extend downward or to pass into tuberculosis. When it has lasted many years it is doubtful if it can be cured.

Treatment.—In the local treatment the matter of first importance is the complete removal of secretions and especially crusts. This is best done by post nasal syringe or spray, or an irrigating tube. The solution may be any mild alkaline wash. In addition to cleansing it is usual to make astringent or stimulating applications. For excessive secretion terebene, ten minims, in albolene one ounce, sprayed freely is one of the most effective remedies.

HYPERTROPHY OF THE PHARYNGEAL OR LUSCHA'S TONSIL.—This is more commonly termed adenoid vegetations. This condition has a most important bearing on the health of the individual.

Etiology.—One or more attacks of nasopharyngitis is the common cause. It is a disease of childhood; it may occur as early as the first month, but is not common till after the second year and up to the tenth or twelfth. It may persist into adult life, but does not originate after puberty, as the pharyngeal tonsil normally atrophies at that period. In most cases enlargement of the faucial and pharyngeal tonsils co-exist, and it is more usual to find the pharyngeal tonsil enlarged and the faucial ones normal than the reverse. There are certain anatomical conditions which predispose to the condition. These are anterior stenosis in the nose with enlargement of the erectile tissue, a V shaped upper jaw, and deflected septum. The exanthemata are exciting causes.

Symptoms.—The most striking symptom is the obstruction to nasal breathing. These growths are by far the most common cause of mouth breathing. In milder cases the mouth breathing occurs only at night during sleep; in the severer ones the mouth is held open in the daytime, and the child acquires the stupid and listless expression known as the adenoid face. The second important symptom is snoring. This may attract more attention than the mouth breathing and be loud enough to annoy and distress the parents. The oppressed breathing causes nightmare, so that these children are subject to nocturnal terrors. The reason why the cases are worse at night is that the mucus collects in the inferior meatus and

there is swelling of the posterior ends of the inferior turbinals. The third important symptom is deafness. This is the result either of the mechanical obstruction, or of the invasion of the tube and tympanum by the catarrhal process. The pressure of the growth prevents the proper ventilation of the middle ear. If there is no air supply, a partial vacuum is soon produced in the tympanum, the drum head is driven in and hearing is impaired. The senses of taste and smell are impaired also. Another important symptom is change of the voice. This applies to those sounds requiring an open nasal and nasopharyngeal passage, such as m, n, and ng. The adenoid voice has a peculiar, dead non-resonant quality, which is quite different from that due to obstruction of the anterior parts of the nose. Another symptom is aprosexia, or inability to fix the attention or to think clearly, or to comprehend what is read or heard. This is equivalent to mental dullness. The other subjective symptoms are post-nasal catarrh, cough of a dry tickling character, chronic rhinorrhoea anterior, producing excoriation of the skin around the nose and lips, and disturbances of nutrition. Objective examination of these patients usually begins with the ear. There is always more or less depression of the drum head. It is dull in lustre, and the pyramid of light is shortened from the base upward. This is due to want of ventilation of the middle ear. The oxygen of the air is exchanged for carbonic acid and this is dissolved to some extent in the mucus secretions, and so some of the pressure on the inner surface of the drum is removed. Therefore the external atmospheric pressure on the drum drives it inward. Ex-

amination of the nose results in finding the passages clear though often narrow and the anterior nares partly collapsed. In the throat the faucial tonsils are often but not invariably enlarged. Probably enlarged faucial tonsils never of themselves cause buccal breathing, this being due to the concomitant post-nasal growths. There are two methods of examining the growths themselves; by obtaining an image of them in the post-rhinal mirror, and by digital exploration of the cavity. The usual color is a pale pinkish gray duller and less transparent than polypus tissue and lighter in shade than the mucus membrane to which they are attached. Concomitant conditions are enlarged faucial tonsils, chronic pharyngitis and laryngitis, chronic rhinitis and pigeon breast. The latter is due to the disturbed equilibrium between the external and the intra-pulmonary air pressure.

Prognosis.—This is satisfactory from the point of view of treatment, and, in a limited sense, in the natural course of their history. That is to say a certain number of cases are attended by no symptoms whatever and as the patient approaches puberty there is a tendency to spontaneous atrophy. However the worst cases present themselves after puberty. When there are no symptoms and the patient is in good health it is not necessary to operate. If there are definite symptoms, the prognosis depends on the age of the patient and the duration of the symptoms. Thus if there is serious ear trouble, the result of prolonged presence of adenoids; when there is otorrhoea or extensive ear disease; when there is chronic pharyngo-laryngitis, then we must give a guarded prognosis.

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Treatment.—The entire removal of the growths is the only proper treatment. For this we may use (1) the ring knives or curets of Gottstein, (2) forceps, (3) the finger shield or artificial nail, and (4) the finger nail. The curet is the most useful, forceps being used in older patients where the growth has become fibrous. Many operate without even a local anaesthetic, but chloroform anaesthesia in the primary stage is the proper thing for all the younger patients. The only instruments necessary are the mouth gag, curet and sponge holder. Haemorrhage is sometimes profuse but not enough to demand the use of styptics. It may rarely be necessary to plug the vault either in the usual way or with a long strip of gauze passed through the nares. This can be saturated with adrenalin, pushed through to the pharynx and then packed tightly with the finger. No after treatment is necessary in ordinary cases. The snoring may be worse at first from the clots and swelling. The ears may require subsequent treatment. Means may be necessary to promote the habit of nasal breathing, and voice training to overcome the faulty speech.

CHAPTER XV.

PHARYNGITIS.

ACUTE PHARYNGITIS.—As the pharynx has a double function of air and food tube it shares in the affections of both the digestive and the respiratory tracts. The common cause is exposure to cold and wet or to sudden changes in temperature. It may be epidemic or contagious but is then due to some septic infection. The pharynx is a huge culture tube for all sorts of bacterial growth. More than one hundred different species of the lower organisms have been found. Under normal conditions they are harmless, but lowered vitality from any cause means lessened resistance to germ growth. Many acute febrile diseases, such as scarlet fever, measles, small-pox, erysipelas and typhoid are ushered in or accompanied by acute sore throat. Other causes are injuries, such as scalding, use of strong acids or alkalies, ingestion of highly seasoned food or irritating liquors or vapors; also after the use of certain drugs, such as atropine, antimony, potassium iodide, and mercurials, and after abuse of tobacco and improper use of the voice. The predisposing causes are conditions that impair the general health, such as disturbances of digestion, assimilation and circulation; constitutional diseases such as syphilis, rheumatism and tuberculosis; also the existence of chronic catarrhal troubles in the nasopharynx, hypertrophy of

the tonsils and anything that leads to mouth breathing. There is an inherited tendency to catarrhal affections, and also an increased sensitiveness of the pharyngeal mucus membrane, especially in those of sedentary habits who take little outdoor exercise and who are prone to chronic constipation, also in those who live in overheated houses and continually breathe a vitiated atmosphere, and in children whose overcareful parents bring them up like hot-house plants.

Symptoms.—These depend on the severity and extent of the process. The oropharynx, uvula and soft palate alone may be affected, or the naso-pharynx may take part. There is a rise of temperature at first, in children often very high. If there is a rheumatic tendency the whole neck is sore, stiff and painful to the touch. The throat is hot, dry and painful, or may be so only on deglutition. Speaking is painful and difficult and the voice is dead. There may be a nasal twang or even regurgitation of fluids through the nose. When the secretion becomes free the pain ceases. The secretion is a greyish viscid mucus and later becomes mucopurulent; either expectorated, discharged through the nose or swallowed. By collecting on the pharyngeal wall it causes retching or even vomiting. The breath is offensive. Hoarseness and a hacking cough is frequent. Locally on examination the mucus membrane is found deeper in color, from a slight flush to a deep scarlet. It often becomes rough and velvety and sometimes superficial erosions are present. The course is usually short, resolution coming in four to eight days. If neglected it may terminate in a subacute or a chronic inflammation.

Treatment.—This may also be aborted by the draught recommended for acute rhinitis. Diaphoretics are useful in the form of hot baths and hot drinks. Strict attention must be paid to the bowels and the least tendency to constipation checked. The fever does not require medicine usually, but phenacetine gives great comfort if headache be present. The great dryness of the throat can be relieved by pilocarpine, 1/10 to 1/16 by the sublingual method. Aconite is valuable for children. A cold pack for the neck, or Leiter's coil, and small pieces of ice in the mouth may give relief. Fomentations and gargling with hot water or hot milk, or hot claret, gargles of soda, borax, chlorate of potash, or tannin. Inhalations of vapors, either steam alone or medicated with benzoin are very grateful.

ACUTE PHLEGMONOUS PHARYNGITIS.—This is the same form just described but with intensified symptoms, great swelling, and general disturbance. The type of inflammation is distinctly septic.

ANGINA ULCEROSA or ulcerated sore throat.—This is without doubt of bacterial origin. It is found in hospital nurses, in pathologists, and in medical students who spend too much time in the dissecting room. There is an ulceration of the superficial mucus membrane with a fibrinous exudation mixed with pus. The treatment is to remove from such surroundings as might be the cause of it. The indications are to give iron, quinine, whiskey and nutritious diet. Locally use disinfectant sprays and gargles. Permanganate of potash makes one of the best.

CHRONIC HYPERTROPHIC PHARYNGITIS.—This is

seen in those who are debilitated or anaemic. Those subject to frequent attacks of acute pharyngitis may finally be left with the hypertrophic form. Improper and excessive use of the voice is a very common cause. The constitutional conditions with which it is most frequently associated are rheumatism, disorders of digestion, congestion and cirrhosis of the liver, cardiac hypertrophy, valvular disease of the heart that produces obstruction to the return circulation, and those diseases of the lungs which tend to prolonged and excessive coughing, such as chronic bronchitis, emphysema, asthma and tuberculosis.

Symptoms.—There is a sensation of fulness in the throat, and the presence of a thick tenacious secretion. This accumulates on the posterior wall of the pharynx at night, and in the morning is found to adhere so firmly that the efforts of hawking often result in vomiting before the mucus can be dislodged. There are disorders of digestion, the tongue is coated, the appetite is poor, and the acuteness of taste is much lessened. Chronic laryngitis is frequently associated with it. The speaking voice is hoarse, and the patient usually finds that he is unable to sing. On examination the mucus membrane is seen to be red, swollen, has a velvety appearance, and the blood vessels, specially the veins are distended and tortuous. The thick whitish mucus can be seen over the surface.

Prognosis.—The disease is likely to run a rather long and tortuous course. The difficulty is to correct the constitutional conditions and the mode of life.

Treatment.—Unless the general conditions mentioned are first corrected very little benefit will come from local treatment. A wash must be given to remove the viscid secretion. Once a day the patient

may apply with a brush a solution of iodine, ten to twenty minims to the ounce of glycerine, and once a week a ten per cent. solution of nitrate of silver may be applied by the surgeon.

CHRONIC GRANULAR PHARYNGITIS.—This is often called clergyman's sore throat. It is practically the same condition as hypertrophic pharyngitis, but there is in addition an increase in the size of the lymph follicles. The granules are found to be masses of lymphoid cells, varying in size from a pin's head to a pea. There may be only a few of these or there may be so many that they touch each other and completely cover the posterior wall. Dilated veins can be seen running from these masses.

Symptoms.—The most distressing symptom is a cough and a tickling sensation as of a hair in the throat. This is most marked at night. The cough produces a hoarseness and tends to keep up a chronic congestion of both the pharynx and larynx. Efforts at speaking tire the throat very greatly and singers cannot control the flexibility of the voice, false tones are produced, and the voice breaks.

Treatment.—The essential part of the treatment is to destroy the granulations, and this is best done by the galvano cautery.

CHRONIC ATROPHIC PHARYNGITIS.—This condition is often called pharyngitis sicca and is a chronic inflammation resulting in atrophy of the mucus membrane of the pharynx. It sometimes follows hypertrophic pharyngitis, but is more frequently the result of a chronic rhinitis. It may occur in persons who are extremely anaemic, without any previous history either of hypertrophy or of atrophy.

Pathology.—The normal subepithelial tissues are replaced by connective tissue. Some of the glands

atrophy and disappear, while those that persist have their functions altered, so that they secrete a scanty, thick and tenacious mucus. This accumulates in the form of dry crusts.

Symptoms.—There is an intense dryness and burning in the throat. The irritation of the dry mucus produces considerable reflex coughing to clear the throat. The voice is husky. From the decomposition of the crusts there is a bad odor to the breath. On examination the posterior wall is pale, dry and covered with a thin crust of mucus, or, in the bad cases, with the , dark brown or blackish crusts.

Treatment.—This is a condition that is practically never recovered from. All that can be done is to lessen the discomfort. A spray should be used to soften and loosen the mucus. Chlorate of potash, ten grains to the ounce, is one of the best. To stimulate the glands to greater activity we may use boroglyceride, or some preparation of menthol.

RETROPHARYNGEAL ABSCESS.—This is a collection of pus in the connective tissue under the mucus membrane of the pharynx. It is a condition frequently overlooked, but should be borne in mind whenever a child is seen suffering from difficulty in breathing and swallowing. It is important because it may rapidly prove fatal from rupture and aspiration of pus into the larynx.

Etiology.—In most cases it is impossible to trace the cause. It is essentially a disease of childhood, though a few cases are reported as occurring in adults. Tuberculosis, rickets and inherited syphilis predispose to the disease. Injuries and caries of the cervical vertebrae are causes.

Pathology.—In infancy a few lymph glands are found beneath the mucus membrane of the pharynx, opposite the second and third cervical vertebra. It is believed that suppuration occurs in these glands.

Symptoms.—In infants there is a sudden refusal of the breast, with a snuffling cry, dysphagia and dyspnoea. In older children there are the usual symptoms of sore throat with fever, and there is no difficulty in making a diagnosis by inspection. The danger previous to rupture is from oedema of the larynx causing asphyxia. Pulmonary complications may arise, or death may come from septic absorption.

Positive diagnosis is made by the exploring needle and syringe to get pus.

Treatment.—The abscess should be evacuated. If the cause is necrosis of the vertebra an external incision may be made. Otherwise, the incision is to be made through the mouth, and should be in the median line as nearly as possible. After the incision is made the child is to be inverted or placed in such a position that the pus will flow into the mouth.

HAEMORRHAGE FROM THE PHARYNX. — An abnormal vascular condition of the pharynx is sometimes seen, consisting of large and pulsating vessels. The vessel usually affected is the ascending pharyngeal artery. Dissections have shown that when the ascending palatine artery is small the ascending pharyngeal is correspondingly large.

Haemorrhage from the pharynx may arise from three sets of causes:—

1. Trauma, as from a foreign body, violent hawking, and operations.
2. Changes in the blood composition, or in the walls of the vessels.

3. Ulcerations of various kinds, suppuration and varicose veins.

The importance of these facts lies in the anxiety of the patient and his friends whenever blood appears from any part of the throat. If examination of the lungs, heart and large vessels reveals nothing abnormal, it is usual to refer the bleeding to the general indefinite region of the throat, and to regard the trouble as of minor importance. However, a throat haemorrhage should not be assumed as existing unless a clot or bleeding point is found.

Treatment.—Apply some coagulating agent to the bleeding point if that is possible. Cocaine, suprarenal solution, antipyrin 4%, silver nitrate, the cautery point, ice pellets, Mackenzie's gargle, (gallic acid one part, tannic acid four parts, water four parts) may all be tried.

Mycosis.—This is a growth of leptothrix. It may appear at any part of the posterior pharyngeal space. Small white or yellow growths are seen projecting above the mucus membrane and attached to it, and in this way they are to be distinguished from tonsillar concretions which are seen to occupy the lacunae. It has a fungoid appearance and cannot be removed by a probe as it penetrates the mucosa. The cause is obscure but the microscope reveals the leptothrix buccalis. No conspicuous symptom is produced by the disease, in fact, the trouble is usually discovered by accident and the patient being alarmed, applies to have the masses removed. The tendency is not to spontaneous cure. The only way to cure is to remove every particle of the growth by the galvano-cautery.

CHAPTER XVI.

UVULITIS AND TONSILLITIS.

ACUTE UVULITIS.—This rarely occurs alone, but is part of a composite process in which the pharynx and fauces take part. It may be caused by traumatism, such as the use of the galvano-cautery on the neighboring tonsil, the ingestion of irritating food, the prolonged use of the voice, and it is also the result of sepsis.

Symptoms.—The local discomfort varies from a slight impediment to respiration and the feeling of a mass in the fauces to a pain of considerable severity. The constitutional symptoms are very slight or entirely absent. The voice has a muffled sound.

Treatment.—Hot alkaline gargles and an astringent mouth wash are enough for the mild cases. Where there is much oedema and distress it is necessary to scarify or puncture the uvula. It is not usual to amputate it during an acute attack.

CHRONIC UVULITIS.—This is more frequently termed elongated or hypertrophied uvula. The use of the voice during an acute attack is one of the most common causes. A simple elongation is due to relaxation of the soft palate produced by some catarrhal condition. There is loss of muscular tone in the azygos uvulae and palatal muscles, allowing the uvula to drop on the base of the tongue. Gastric derangement and immoderate smoking and drinking

are causes. Cerebral affections and diphtheria by causing paralysis of the soft palate, may cause the uvula to appear elongated.

Symptoms.—These are of all grades of severity and do not necessarily correspond with the amount of enlargement. Some present no symptoms at all even with considerable enlargement, but most complain of a tickling, irritating sensation, with a hacking cough, retching on slight provocation and vomiting. During sleep the tip of the uvula may come in contact with the entrance to the larynx and the patient wakes with a sudden laryngeal spasm. The constant cough may cause rupture of some of the superficial vessels so that blood streaks appear in the sputum. This and the exhaustion consequent on coughing may lead to a suspicion of pulmonary disease. Singers who have this condition experience a loss of vocal range, early fatigue, and sometimes an annoying tremolo on the attempted production of any forced tone.

Treatment.—Ablation of a portion of the uvula is the only satisfactory treatment. About three-eighths of an inch is the proper length of the normal uvula and at least so much should be left. The operation is best done with forceps and scissors under cocaine anaesthesia. A uvulotome may be employed.

ACUTE TONSILLITIS.—This is an acute inflammation of the parenchyma of the tonsil and of the lacunae or crypts. The two may be equally involved or one or the other may predominate. This has led to the subdivision of acute inflammation into acute parenchymatous and acute follicular or lacunar tonsillitis. We will discuss them together.

Etiology.—The most important predisposing factor is the rheumatic diathesis. The climatic and hygienic conditions which tend to produce rheumatism will therefore act as predisposing causes in tonsillitis. It is more common in those who have enlarged tonsils, and one attack predisposes to another. The common exciting cause is exposure to cold and wet. At times the trouble is so common that it would seem to be infectious. It is often associated with disturbance of the stomach.

Symptoms.—An attack of tonsillitis is usually ushered in with a chill, the temperature rising to 103° or even 105° . The patient complains of headache and pain in the back and limbs. There is a sense of fullness in the throat, quickly followed by pain in the tonsil itself. The pain radiates to the ear. Dysphagia and a constant desire to swallow are present. The tongue is coated, the breath foul and the bowels constipated. Cough may be present, and there is a nasal twang to the voice. In the parenchymatous variety the symptoms are more severe. The symptoms last from three to seven days. On examination the tonsil will be found enlarged, the crypts distended, and a white or yellowish secretion filling their mouths. A cheesy material may be spread over the surface of the tonsil and may resemble a membrane. This can be wiped away with a swab of cotton, leaving an unbroken, but red and inflamed surface. The secretion is limited to the tonsil. The glands in the neck below the angle of the jaw are enlarged.

Differential Diagnosis.—Acute tonsillitis may be mistaken for mycosis and for diphtheria. The non-

inflammatory nature of mycosis is enough to distinguish it. Between tonsillitis and diphtheria there may easily be confusion, and in slight forms only a bacteriological examination will determine the true nature of the case. There are also the following clinical points to help in a positive diagnosis. In tonsillitis there is sudden onset, a chill, a high temperature (103° to 105°), vomiting is not common, and albumen is rarely found in the urine. In diphtheria there is a gradual onset, no chill, temperature not so high (101° to 103°), vomiting is common and there is albumen in the urine. On examination in tonsillitis the tonsils are enlarged, the exudation or pseudomembrane is in spots, not adherent but easily wiped away, leaves no bleeding surface, does not reform, and is limited to the tonsil. On examination in diphtheria the tonsils are not enlarged unless chronic hypertrophy previously existed, the exudation is a thick membrane, very adherent, removed with difficulty and only with the forceps, leaves a bleeding surface, the membrane reforms in a few hours, and is found on the pillars of the fauces, the soft palate, and the posterior wall of the pharynx. In the bacteriological examination of tonsillitis only the staphylococci and streptococci are found; in diphtheria the Klebs-Loeffler bacillus.

Treatment.—Calomel is to be given first of all. Then, five grains each of ammonol and salol, or phenacetine and salol, till three doses are given. For the local treatment, it is best to use a direct application by a swab, as gargling is painful and a spray will not reach the parts effectively. Equal parts of rectified spirit, glycerine and listerine, or

one of the listerine type of preparations will be very effective. When the patient is subject to frequent attacks it is advisable to cauterise the tonsils with the galvano-cautery in the interval between the attacks.

PERITONSILLAR ABSCESS.—This is the condition to which the term quinsey is properly applied. It frequently follows an attack of acute tonsillitis, where the patient has exposed himself to cold and wet before having fully recovered from his previous tonsillitis. Where a patient has once had an attack of peritonsillitis, each subsequent inflammation is likely to result in abscess. The pus is found in the connective tissue external to the tonsil. The symptoms are those of tonsillitis but are more severe. At the end of forty-eight hours it is often impossible for the patient to open his mouth more than a quarter of an inch. Deglutition is so painful that no nourishment can be taken by the mouth. Thick tenacious mucus collects at the posterior portion of the mouth and causes great distress because he can neither expectorate nor swallow it. Saliva dribbles from the mouth. There is snoring at night, mouth breathing, dyspnoea, and a full thick guttural voice. On examination the swelling can be seen if the mouth is opened wide enough. The finger may be introduced to find the point of greatest softening or fluctuation. It is often difficult to say in any given case whether pus is present or not.

Prognosis.—This is favorable though the patients are usually much alarmed. A few cases are on record where the abscess has burst during sleep, pus entered the larynx and death occurred from strangulation.

Treatment.—An early incision must be made even though pus is not present. The opening is to be made at the point of greatest swelling, which is usually high up above the tonsil. When pus is found and the odor is very offensive, the cavity is to be washed out with some antiseptic solution, and it may be advisable to pack the cavity with gauze. When the patient has completely recovered from the attack, he should be carefully examined for any diseased condition of the tonsil, and if found it should be treated. Eradication of the tonsillar tissue often does away with attacks entirely.

CHRONIC HYPERTROPHIC TONSILLITIS.—This is a chronic inflammation of the tonsil with an increase in the size of the organ.

Etiology.—Many of the cases cannot be attributed to any assignable cause. There is such a thing as a lymphatic diathesis, but the underlying factors are not understood. Some of the cases give a history of repeated attacks of the acute form. After puberty enlarged tonsils show a tendency to atrophy.

Symptoms.—Enlarged tonsils are in a sense foreign bodies, so that they produce a series of physical symptoms, as well as those referable to the system, the outcome of disturbed physiological processes. There is also to be considered the associated adenoids, and it may be impossible to determine whether a given symptom is due to one or the other. Physically all the functions of the surrounding parts are interfered with. A common symptom is an irritable hacking cough. Disorders of digestion and loss of appetite is common. The breath is foul, and these patients expectorate every few days little, round,

yellowish masses of cheesy material having a bad odor. Those who have hypertrophied tonsils are more susceptible to attacks of acute tonsillitis than are others. Inspection shows the enlarged tonsils, while gagging brings them more prominently into view. There is no difficulty in diagnosis, the only possible confusion being with malignant disease of the tonsil in adults.

Treatment.—The treatment consists in removing as much of the hypertrophied tissue as possible. This may be done in several ways. First, by the tonsillotome; second, by the galvano cautery electrode; third, by the snare, either the cold wire or the galvano cautery snare. Chemical caustics are used by a few. Those of use are chromic acid, orthochlorophenol, and nitrate of silver. Enucleation by the finger nail was practised by Celsus and is recommended by some at the present day. The snare is used to prevent haemorrhage, a considerable length of time being taken to remove the tonsil. There are five possible sources of dangerous haemorrhage after excision of the tonsil: 1. Haemophillia. 2. Anomalous ascending pharyngeal artery. 3. A large artery in the anterior pillar. 4. A venous plexus at the lower border of the tonsil. 5. One or several large and patulous tonsillar arteries. The last is the most common cause. A large proportion of serious haemorrhages have been secondary. It is, therefore, well to prohibit the use of the voice, to insist on fluid diet, and to restrict exercise for four or five days after operation. Singers and public speakers often hesitate to have enlarged tonsils removed for fear of impairing the voice. This is an entire misconcep-

tion. Large tonsils interfere with the free action of the faucial muscles, cause vocal fatigue, and invite fresh attacks of inflammation. There are some cases on record where removal has been followed by the loss of one or two of the highest notes in the scale, but there is always improved quality and lessened fatigue.

CHRONIC ENLARGEMENT OF THE LINGUAL TONSIL.—This may occur alone, or be associated with enlargement of the faucial tonsils. It is more common in the middle period of life. There is a constant feeling of a foreign body in the throat, or other uncomfortable sensation, spasm of the oesophagus, and frequently impairment of the voice, and a dry, irritating cough. Treatment consists in removal of the tissue by a suitable guillotine, or by the use of the galvano cautery.

CHAPTER XVII.

LARYNGITIS.

ACUTE LARYNGITIS.—As a simple affection this is so common that the physician is not often consulted except in the case of professional voice users. It is a complication of many systemic states and general fevers. In addition there are acute forms of laryngitis caused by syphilis, tuberculosis, and diphtheria.

Etiology.—The predisposing causes are indoor occupation, malnutrition or defective excretion, excessive use of stimulants or tobacco, measles, scarlatina. The exciting causes are exposure to wet and cold or to draughts of cold air, to irritating dust, vapors or fumes from chemicals. The introduction of foreign bodies, or the application of caustics, will produce an acute inflammation. Another cause is improper use of the voice in the open air. The condition may also extend from the pharynx.

Symptoms.—If constitutional symptoms are present they are of the very mildest. There may be slight fever and moderate general malaise. Rarely there is a chilly sensation or a distinct chill. In the throat there is a feeling of fullness and discomfort, followed by a sense of tickling and a dry irritating cough. After the first day there is a sense of rawness in the larynx, sometimes extending down the median line as far as the middle of the sternum. The most

obvious symptom and the one giving the patient most concern is the partial or entire loss of the voice. The hoarseness may be the result of the mechanical interference with the function of the cords, owing to the swelling of the interarytenoid region of the larynx, or it may be due to inflammation of the muscles interfering with the proper contraction of these and the consequent imperfect approximation of the cords. There is usually very little difficulty in respiration experienced by adults with acute laryngitis. When the oedema and infiltration are excessive, there is a feeling of tightness in the larynx, with a sense of difficulty in breathing which may amount to a dyspnoea. On examination the mucus membrane is seen to be reddened, the surface vessels being plainly visible and distended with blood. In the mild cases the redness is limited to the epiglottis, ventricular bands, and the aryepiglottic folds, the vocal cords being perfectly normal in appearance. In the more severe cases they are light pink in color, with here and there a dilated vessel. In the very severe cases the cords are so reddened as to be scarcely distinguishable from the ventricular bands. Ordinarily the cases run from three to twelve days.

Treatment.—The constitutional treatment is the same as for acute rhinitis or pharyngitis. For the annoying cough there is nothing better than codeine or heroin. The local treatment consists, first of all, in rest of the voice. Counter-irritation over the larynx and upper portion of the chest gives great relief. Cold compresses over the larynx are also valuable. Direct applications of astringents may be made, the most useful being adrenalin. Sprays and vapors

may also be used, and in the severe cases steam inhalations are employed.

Acute laryngitis in children is modified on account of the structure of the mucus membrane of the larynx of a child differing from that of the adult in that the connective tissue in the region of the ventricular bands and below the cords is very loose, and when infiltrated becomes more oedematous than in the adult, and this oedema causes relatively a greater obstruction to respiration than is seen in adults. The cough is croupy. This will be considered in connection with diphtheria and croup.

CHRONIC LARYNGITIS.—This may be either hypertrophic or atrophic, the hypertrophic form being divided into (1) a diffuse form, (2) a subglottic form, and (3) chondritis nodosa, or trachoma of the vocal cords. Sometimes the condition is primary, but more frequently it is the result of repeated attacks of acute or subacute inflammation. Excessive use of tobacco and the constant inhaling of irritating dust or particles of metal, such as occurs in the case of metal grinders, millers, grain shovellers, and others, are causes. Over use of the voice especially in the open air, and when one is suffering from acute laryngitis is likely to produce it.

Symptoms.—In some cases the symptoms are not marked and the patient complains only of something wrong in the larynx, with hoarseness and more or less distress after exposure. These patients often expel small pellets of mucus. Ordinarily there are no constitutional disturbances but there may be emaciation, fever and night sweats. The voice tires easily and if fatigued becomes harsh and unnatural. The

mucus membrane of the fauces and pharynx is relaxed and more or less congested, and that of the larynx is red and slightly swollen either uniformly or in patches. The larynx may appear granular from small nodular excrescences especially on the vocal cords. Flakes of more or less discolored mucus can be seen adhering to the cords.

Treatment. — Remove the cause as far as possible. The parts involved should be placed at rest. Shouting, singing and excessive use of the voice must be prohibited. Prolonged systematic treatment with applications of a stimulating character may be necessary before the disease can be cured.

CHAPTER XVIII.

HAEMORRHAGE, OEDEMA, FOREIGN BODIES.

LARYNGEAL HAEMORRHAGE.—This is not very common, but it is most important to make a diagnosis of the condition when it does occur. It may be seen in severe cases of laryngitis. It may be an early symptom of tuberculosis of the larynx, antedating any actual ulceration. It may accompany any form of leukaemia. It is sometimes caused by a spasm of whooping cough. In women it is sometimes vicarious. It is observed in those diseases of the blood in which there is marked alteration in its constituents, as in malaria, chlorosis, purpura and scurvy.

Symptoms.—The amount of blood is seldom very large, usually not more than enough to break the expectation. The only other symptom is a tickling in the larynx followed by the cough. If the larynx can be examined one or more haemorrhagic areas can be seen. The prognosis, of course, depends on the cause.

Treatment.—When the amount of the blood is small no treatment is needed, as it soon ceases of its own accord. When profuse the patient should be put to bed, and the coughing controlled by morphine if necessary. Cold applications over the larynx will help to control the bleeding. A spray or a direct application of adrenalin is the best local treatment.

ŒDEMA OF THE LARYNX.—This is also commonly called oedema of the glottis. The local causes of the condition are the application of caustics in the neighborhood of the glottis ; the lodging of foreign bodies in the supraglottic region ; swallowing hot liquids or inhaling steam or irritating smoke ; prolonged or excessive use of the voice ; the inflammation of the larynx that accompanies erysipelas, diphtheria, influenza, measles, scarlet fever, and whooping cough. The ulcerative processes that are seen in tuberculosis, syphilis, and malignant disease are frequently accompanied by oedema. Perichondritis of the larynx, abscess of the larynx, and peritonsillar abscess produce it. The constitutional causes are Bright's disease, diabetes, and the cardiac lesions producing general anasarca. The administration of iodide of potash may cause it in those who are susceptible to the drug.

Pathology.—The loose areolar tissue in the ary-epiglottic folds, on the ventricular bands, around the epiglottis, and beneath the cords, is infiltrated with a pale, colorless transudation from the blood vessels in the neighborhood.

Symptoms.—It usually occurs quite suddenly. The severity of the symptoms depends on the amount of the swelling and the mechanical interference thus produced with the functions of the larynx. Deglutition is often difficult. The dyspnoea may be so great that cyanosis may develop in a few hours, and unless the mechanical obstruction is removed, death comes from asphyxia. The examination will show the large pale swellings.

Treatment.—In cases of moderate severity, suck-

ing and swallowing pieces of ice, and the external application of cold, often afford relief. When the dyspnoea is severe no time should be lost in scarifying the oedematous tissue. Applications of cocaine and adrenalin may be made first. Should the scarification not reduce the swelling promptly then intubation is to be done.

FOREIGN BODIES IN THE LARYNX.—A great variety of small substances have been found in the larynx, such as buttons, beans, pins, needles, pieces of wood, particles of food, and coins. The usual method by which these things enter the larynx is that they are being held in the mouth, and the patient's attention is suddenly taken by something else, when an inspiration, such as precedes coughing, laughing or sneezing, takes place, and the foreign body is drawn into the larynx with the inspired air. Very small bodies may lodge for a time in the larynx and then fall or be pushed into the trachea and drop into the bronchi. Large chunks of food and foreign bodies that completely fill the glottis produce asphyxiation, and unless removed at once, death takes place in from two to five minutes. The smaller bodies produce only dyspnoea, the amount of this depending on the size of the obstruction. The voice is hoarse and aphonic, but pain is not common. The cough is very severe and annoying, being spasmodic in character and often persisting after the removal of the foreign body. Every one has experienced the sensation produced by a crumb or a drop or two of liquid entering the larynx, and will have noticed the length of

time that the cough and irritation lasts after the removal of the offending particles. On account of the persistent reflex cough patients often insist for some days that there is something yet remaining in the larynx. If an examination can be made the foreign body can usually be seen.

Treatment.—Some can be gotten rid of by inverting the patient and slapping him on the back. If the foreign body can be seen it should be caught with a pair of forceps, though it is often easier to see it than to take hold of it. Tracheotomy may be necessary, and sometimes thyrotomy for removal.

CHAPTER XIX.

TUBERCULOSIS OF THE LARYNX.

TUBERCULOSIS OF THE LARYNX.—This is usually secondary to pulmonary tuberculosis, but a few cases occur where no other lesion can be found. It is common in adults between the ages of twenty and fifty. The tubercle bacilli gain access to the laryngeal tissues in three ways, (1) through the lymphatics; (2) through the entrance of the bacilli into the blood stream and so being deposited in the tissues of the larynx; and (3) through an abrasion in the epithelium of the mucus membrane. There must be in addition a peculiar receptivity of the tissues which may result from any one of a large group of factors, including heredity.

Pathology.—The pathological process is the same, whether the lesion is primary or secondary. The first effect of the introduction of the tubercle bacilli beneath the mucus membrane of the larynx is the production of a round-cell infiltration and the formation of tubercle and the giant cell. Where the proliferation of these cells is very rapid they crowd upon each other, so as to interfere with their nutrition, and cloudy swelling and cheesy degeneration of the cells in the centre of the tubercle take place. The tubercles may be scattered evenly beneath the mucus membrane, or piled on top of one another, so as to

form a well defined tumor. When pus producing bacteria gain access to the degenerated cells, necrosis and suppuration ensue, and the second stage, or that of ulceration, will be found. The first stage may pass unnoticed, and during this time no symptoms are referred to the larynx. The ulcers are usually superficial, irregular in outline, having a "mouse-nibbled" appearance. Oedema of the arytenoids is very frequently seen. The ulcers may be found on the aryepiglottic folds, the epiglottis, vocal cords, the posterior wall of the larynx between the arytenoids, and the ventricular bands.

Symptoms.—These depend on the stage of the involvement, whether that of tubercle or that of ulcer. In the stage of tubercle the most noticeable symptom is the change in the voice which is hoarse and very variable. A few words may be spoken clearly, then there is a break. After clearing the throat the voice may come back to its normal tone. The changes in the voice may be due to the mechanical interference with the action of the vocal cords; to the presence of the tumor in the interarytenoid region; or to the difficulty in approximating the cords, owing to the oedema in the aryepiglottic folds; or tubercle may be found on the vocal cords and prevent their approximation; or thick, tenacious muco-pus may be deposited on the vocal cords; or the muscles of the larynx may be infiltrated by the tubercle, so that their contraction is interfered with; or paresis of the cords may be the result of pressure on the recurrent laryngeal by pleuritic exudate at the apices of the lungs. Also in advanced lesions of the lungs the volume of air in the thorax may be much less than

normal, and in the weakened condition of the system generally there is not sufficient force given to the blast of expired air to cause the cords to vibrate, so the voice is weak and feeble. Unless the oedema is severe there is no interference with respiration. Cough is always a symptom, but may be due rather to the pulmonary condition, from which also the expectoration comes. In the stage of ulceration there is an increased amount of secretion and a greater tendency to clear the throat. Much of the secretion may come from the ulcer, and it is usual to find it streaked with blood. Deglutition becomes very painful where the ulcer is on the epiglottis or the epiglottic fold. The patients will go for twenty-four hours without food rather than bear the great pain caused by swallowing. The voice is worse than in the stage of tubercle. In addition to these there are the general symptoms that occur with tuberculosis in any part of the body—fever, sweats, emaciation, anorexia, rapid pulse and the others. An examination of the larynx in the stage of tubercle will show the mucus membrane to be very pale, with small areas of congestion. Such an appearance always warrants an examination of the sputum for the tubercle bacilli. A pale, pear-shaped swelling of the arytenoids is characteristic. The tubercles may be massed together and often form a warty-like growth. If an ulcer is present it can usually be seen without difficulty. It will be covered with a thin grey or yellow exudation, and surrounded by more or less thickening or oedema. When the cords are ulcerated they are irregular and serrated.

Differential Diagnosis.—Tuberculosis of the

larynx is to be distinguished from syphilis, lupus, and neoplasms, benign and malignant. The finding of the tubercle bacilli is the most important point, though one negative examination should not be held sufficient to exclude tubercle.

Prognosis.—Where the laryngitis is secondary the prognosis is bad, as the patient may succumb in a few weeks. This is sure to be the case if the pulmonary condition is at all acute. Where the condition seems to be primary the average duration of the case is two years.

Treatment.—The hygienic and constitutional treatment is the same as where the larynx is not involved and will not be discussed here. The local treatment is not satisfactory. The infiltrations are best let alone. If large enough to produce dyspnoea they may be scarified and curetted. Lactic acid, 25% of the pure acid, is greatly praised by some and yet it has very little effect. When ulceration is present the most that can be done is to make the patient comfortable, and one often fails to do even that. The remedies for this purpose are cocaine, orthoform, chloretole and morphia.

CHAPTER XX.

LARYNGEAL TUMORS AND NEUROSES.

TUMORS OF THE LARYNX.—These are either benign or malignant. The varieties of benign growths are papillomata, fibroma, cystoma, myxoma, lipoma, angioma, adenoma, enchondroma, lymphoma. The malignant growths are either sarcoma or carcinoma.

In the majority of the cases no cause can be assigned for such growths. Some seem to be due to strain, others to cold, some follow the eruptive fevers. The symptoms are due to mechanical obstruction, and vary with the size, location, and hardness. If located on one of the cords there is dysphonia or aphonia. Dyspnoea occurs when the growth is large enough to diminish the lumen of the glottis; dysphagia, when the tumor interferes with the closure of the epiglottis. Cough is not usually present. It is only in the malignant tumors that any pain is found. The treatment is to remove the growths by cutting or crushing forceps. Sometimes intubation or tracheotomy has to be done. The internal form of operation is to be done if possible.

NEUROSES OF THE LARYNX.—These affect sensation and motion.

The paralyzes of sensation are anaesthesia, hyperaesthesia, paraesthesia and conditions of neuralgia.

Anaesthesia, or loss of sensation is due to loss of function of the superior laryngeal nerve. This may

be due to alteration of its structure at its origin, as in bulbar paralysis, or from diffuse cerebral lesions, affections of medulla, locomotor ataxia, or local neuritis from diphtheria. There is danger of choking from accumulation of secretion or food as there is loss of the reflex.

Hyperaesthesia may be a symptomatic rather than an independent lesion. It is sometimes due to a catarrhal state, and is especially common in laryngeal tuberculosis and in carcinoma.

Paraesthesia refers to abnormal sensations in the larynx. The most common are a feeling of a foreign body, tickling, and desire to swallow. Most of these are referable to some lesion above the larynx, that is, higher up in the respiratory tract, the reflex irritation being referred to a lower level.

Neuralgia of the larynx may be caused by rheumatism, gout, anaemia, malaria, and ulcerative processes. Sometimes no cause is apparent. The agents which are used for neuralgia elsewhere are to be employed.

The motor neuroses are either spasmodic or paralytic. The spasmodic form will be discussed in connection with croup.

Motor paralysis may be limited to one side of the larynx,—unilateral paralysis; or it may involve both sides,—bilateral paralysis. It may also be limited to one muscle or pair of muscles, or involve several at once. The causes may be divided into four classes:—

1. Disease or injury of the brain, involving the cerebral portion of the nerves which supply the larynx.
2. Injury of, or pressure upon these nerves after they have left the cranial cavity.

3. An abnormal condition of the muscles themselves preventing contraction.

4. A systemic dyscrasia, through which the laryngeal muscles are debilitated so as to be unable to respond to the nervous impulses.

The causes of laryngeal paralysis of central origin are, syphilis, tumors, apoplexy, multiple sclerosis, and progressive bulbar paralysis.

The length of the pneumogastric nerve and its relative position causes it to be greatly exposed to pressure as soon as vessels or glands undergo a temporary or permanent increase in size. Enlarged cervical glands, tumors, bronchocele, including the nerve in ligature during an operation or cutting it, are causes of laryngeal paralysis. Lesion of the pneumogastric just below the cranium inducing paralysis of both superior and inferior laryngeal nerves, means complete cessation of all motion, and partial loss of sensation on one side of the larynx. If the lesion is below the origin of the superior laryngeal, the paralysis is confined to the muscles supplied by the inferior laryngeal and there is no loss of sensation. The superior laryngeal is seldom affected because of its short length and position. An aneurism of the internal carotid, tumors in the pharynx or enlarged glands may press upon it. Lesion of the superior laryngeal causes partial loss of sensation, and paralysis of the thyro-cricoid, thyro-epiglottic, and ary-epiglottic muscles. The epiglottis is only partially closed and extension of the vocal band is prevented. Lesions of the recurrent laryngeal are the most common. Aneurisms are a frequent cause, and on the right side, the proximity of the nerve to

the apex of the lung, furnishes another source of compression through expansion and thickening of the parenchyma. On the left side the nerve is not so close to the lung, but it is more likely to suffer from pressure of bronchial glands and other mediastinal growths. Enlargement of the thyroid glands, or bronchocele, may produce bilateral paralysis. Paralysis of laryngeal muscles may be brought about by changes in the muscles themselves,—an inflammatory infiltration. In such cases the voice becomes monotonous in the true sense.

CHAPTER XXI.

IDIOPATHIC CROUP.

IDIOPATHIC CROUP.—This is a pseudo-membranous inflammation of the larynx of a non-infectious nature which exhibits local rather than constitutional symptoms. The local signs are to some extent like those of diphtheria. In former days all cases of acute laryngitis associated with dyspnoea were called croup; more recently the tendency has been to call them all diphtheria, and many authors still deny that there is such a thing as true croup. The bulk of evidence is in favor of the view that there is a simple exudative laryngitis. The exudation is a coagulated fibrin which covers the surface of the mucus membrane and is confined most frequently to the larynx. It may be found in the trachea, the bronchi, and rarely in the nose. It may be a primary disease or it may be secondary, produced by intense inflammatory reaction which destroys the epithelial layer. Thus it appears in various kinds of traumatism, such as occurs by caustics or the galvano-cautery. It has been produced in animals by a few drops of liq. ammonia in the trachea. Hot steam and irritating gases also produce it.

The condition belongs to childhood, being seldom seen before the twelfth month and not often after dentition. It is said to be epidemic or endemic but this

is doubtful. If it be due to a germ it is one of very little vitality and essentially different from the Klebs-Loeffler bacillus. When a number of cases come together in the same house or district, an explanation is afforded by the existence of similar climatic, atmospheric, and constitutional causes.

Symptoms. - Change of voice is usually the first symptom. The hoarseness is at first catarrhal, then the voice is raised in pitch and has a metallic sound. Embarrassment of respiration is the most serious and distinctive evidence of croup. This may come on in a few hours, or it may not come for two or three days. Each inspiration is attended by a stridor which is shrill, metallic, sibillant and wheezing. The cough is also distinctive in character, being brassy or laryngeal, and once heard is speedily recognized again. Laryngoscopic examination is rarely possible. As to the general symptoms, the pulse is first quick and full, then strong and bounding. The temperature is high at first and abates as soon as the exudate is poured out. Thirst is a very common symptom. There is a general dryness of the skin, the face is flushed and swollen, and the conjunctiva is injected. The dyspnoea gradually becomes excessive, the child is restless and excited and makes constant efforts to grasp the throat as if to remove the obstruction. When the paroxysm comes on the head is thrown back, the accessory muscles of respiration are brought into play, and the difficulty of breathing becomes extreme. Unless relief is given by expulsion of the membrane, the suffering soon becomes continuous, the voice and cough lose all tone, the prolonged inspiratory stridor is followed by

an equally long expiration; the dyspnoea is extreme, and cold sweats break out on the body and livid face; cyanosis with coma comes on and the child dies unconscious from suffocation. If the membrane is expelled and no extension into the trachea and bronchi occurs, the symptoms are all changed for the better, breathing is freer, the cough is metallic but gradually becomes softer with the expectoration. This disease may end fatally in twenty-four hours or may continue for five or six days.

Diagnosis.—Idiopathic croup may be confounded with diphtheria, spasmodic laryngitis, and laryngismus stridulus. The greatest difficulty is in distinguishing it from diphtheria. The culture to show the special bacillus is the only absolute test. Diphtheria in the larynx is frequently preceded by membrane in the pharynx, or accompanied by it.

Mortality from croup has always been very great. Death may be the result of (1) apnoea, i.e. by convulsions during the paroxysm of dyspnoea, (2) asphyxia, (3) deposit of fibrin in the heart, (4) exhaustion, (5) coma, (6) secondary lung complications.

Treatment.—This should be active from the first. An emetic is to be given for three reasons. (1). Irritation of the gastric portion of the vagus may play some part in predisposing to true croup as it does in false. (2). It relieves an overloaded stomach, favors a prompt alvine evacuation, brings on diaphoresis, increases diuresis, and lessens the fever generally. (3). Should membrane be formed an emetic favors its detachment and expectoration. Ipecac. wine alone one dram. or ipecac gra. ʒ with tartar emetic ʒ 1/4 gr. for a child from two to five years.

Apomorphia, $1/20$ to $1/10$ hypodermically, and yellow sulphate of mercury are highly recommended. Calomel has long been used as a specific, and it certainly increases the secretions. Inhalations of steam and vinegar are grateful. Vapor of slaking lime is also useful. In doubtful cases antitoxin should be injected. When the dyspnoea is serious intubation or tracheotomy is to be done.

CHAPTER XXII.

DIPHTHERIA.

DIPHTHERIA.—This is an acute infectious and contagious disease, characterized by the exudation of a fibrin on or in mucus membranes, or on the surface of wounds, constituting the so-called pseudomembranes. The term should be restricted to those cases of sore throat in which a false membrane is found to contain the Klebs-Loeffler bacillus. It was in 1875 that Klebs discovered the bacillus, but not much credence was given to it until it was demonstrated by Loeffler in 1883.

Dissemination.—It is usually transmitted from the sick to the well by the moist or dry discharges from the nose or throat of the affected. The transmission may be direct or indirect in so many ways that it is not always possible to trace an individual case to its source. The vulnerability of the mucus membrane in children, the frequency of nasal and pharyngeal catarrh, the narrowness of the nose, the large size and softness of the tonsils, the frequent fermentation of food in the mouth, the sucking of the soiled little fingers, the constant intercourse of children with each other in large families and in densely populated houses and districts, and in schools and on playgrounds, are all predisposing causes. The vitality of the germs is persistent and may extend over

years. They cling to solid and semi-solid bodies, are imported in milk, cling to walls and floors, to toys, to curtains, towels, clothing and bedding, to carriage cushions and car seats, and there is no doubt that horses, chickens and cows have diphtheria and spread it. The fact is that in an epidemic there is nobody not exposed to it, and everybody is subject to it under favorable circumstances. One in good health may carry about the bacteria in the mouth and throat indefinitely until a slight inflammation or an abrasion provides the suitable soil for its development.

Symptoms.—These are constitutional and local. The constitutional symptoms are due to the absorption of the toxins and the effect that these have in the perversion of the functions of the various organs. The local symptoms are due to inflammation of the various parts of the upper respiratory tract in which the exudate is found, and to the mechanical obstruction produced by the exudate. We will discuss the pharyngeal, nasal and laryngeal types separately.

THE PHARYNGEAL TYPE.—In an ordinary case the child is ailing for a day, being listless, without appetite, and often vomits. On the second day sore throat is complained of; temperature is from 101° to 103° and the pulse rapid. The urine is scanty, high colored, and slightly albuminous. The glands at the angle of the jaw are slightly enlarged. In the severe form the child is suddenly prostrated, and passes into a semi-comatose condition from which it is aroused with difficulty. If seen early, an examination of the throat will show a membrane upon some part of the throat,—the tonsils, the uvula, the pillars

of the fauces, or the posterior pharyngeal wall. The membrane may be in spots but these tend to coalesce. It seems to be slightly elevated above the mucus membrane, and is surrounded by a zone of deeply congested mucus membrane. If the membrane is torn away it leaves a bleeding surface and is re-formed in a few hours. At the fourth to the tenth day the membrane is seen to melt away, or to become loosened at the edges and curl up and then is detached.

THE NASAL TYPE.—It is unusual to find membrane in the nose without at the same time finding it in the throat. The symptoms peculiar to the nose are severe. There are recurrent attacks of epistaxis, and a discharge of mucus that is blood-tinged and excoriates the nostrils and lips over which it flows. There is mouth breathing and a very offensive odor, the glands of the neck are very much enlarged, and earache and suppurative otitis media are common. The examination of the nose shows it to be completely filled with a thick grayish membrane covering the inferior turbinal and septum. A complete cast of the nasal cavity is often brought away as a recovery is taking place.

The Laryngeal Type.—This is usually secondary to the pharyngeal form. Membrane is, however, found in the larynx without any appearing above it. The cough is croupy, gradually becoming tighter. Dyspnoea becomes a serious symptom, and unless relieved, cyanosis soon develops. There is aphonia. There is a sinking in, above and below the clavicles, and above and below the sternum with each inspiration. The child becomes very restless; convulsions and spasms may come on, and passing into coma the

little one soon dies. An examination of the larynx cannot be made.

Sequelae.—The common sequelae are otitis media, suppuration of the glands of the neck, acute nephritis, and the diphtheritic paralyses.

Differential Diagnosis.—The conditions with which it may be confused are acute tonsillitis, streptococcus sore throat, the mucus patches of syphilis, and mycosis of the pharynx. The first of these has already been discussed. The streptococcus membrane can only be distinguished by the bacteriological test. The other two conditions will be known by their chronic course at least.

Treatment.—This is preventive, local and constitutional. Immunity is produced by the injection of diphtheria antitoxin in doses varying from 200 to 2000 units according to the age. This immunization does not last for more than a month during which it gradually wears off. The injection may be repeated without any harm. Any diseased condition of the throats of children should be remedied when there is no diphtheria about. Especially enlarged tonsils and adenoid hypertrophies should be attended to. Those in attendance on diphtheria cases should use an antiseptic spray or gargle and a wash for the nose, but care must be taken not to irritate the mucus membrane. A mild soda solution for the nose is best, and for the throat, bichloride of mercury, 1 to 5000, care being taken not to swallow much of it. Isolation, absolute and complete, should be insisted on, and maintained until a bacteriological examination shows that the bacteria are no longer in the mouth and throat. The local treatment, in the way

of antiseptic sprays or mouth washes should be continued for the same length of time.

The regulations of the New York Health Department, in reference to diphtheria are clear, concise and to the point.

“If possible, one attendant should take the entire care of the sick person, and no one else beside the physician should be allowed to enter the sick room. The attendant should have no communication with the rest of the family. The members of the family should not make or receive visits during the illness.

“The discharges from the nose and mouth must be received on handkerchiefs or cloths, which should be at once immersed in a carbolic solution (made by dissolving six ounces of pure carbolic acid in one gallon of hot water, which may be diluted with an equal quantity of water). All handkerchiefs, cloths, towels, napkins, bed-linen, personal clothing, night clothes, etc., that have come in contact in any way with the sick person, after use should be immediately immersed without removal from the room in the above solution. These should be soaked for two or three hours, and then boiled in water or soapsuds for an hour.

“In diphtheria and scarlet fever great care should be taken in making applications to the throat and nose, that the discharges from them in the act of coughing are not thrown into the face or on the clothing of the person making the applications, as in this way the disease is likely to be caught.

“The hands of the attendant should be always thoroughly disinfected by washing in the carbolic solution, and then in the soapsuds, after making ap-

plications to the throat and nose, and before eating.

“Surfaces of any kind soiled by the discharges should be immediately flooded with the carbolic solution.

“Plates, cups, glasses, knives, forks, spoons, etc., used by the sick person for eating and drinking must be kept for his special use, and under no circumstances removed from the room or mixed with similar utensils used by others, but must be washed in the room in the carbolic solution and then in hot soapsuds. After use the hot soapsuds should be thrown into the water-closet and the vessel which contained it should be washed in the carbolic solution.

“The room occupied by the sick person should be thoroughly aired several times daily, and swept frequently, after scattering wet newspapers, sawdust, or tea-leaves on the floor to prevent the dust from rising. After sweeping, the dust upon the woodwork and furniture should be removed by damp cloths. The sweepings should be burned, and the cloths soaked in carbolic solution. In cold weather the sick person should be protected from draughts of air by a sheet or blanket thrown over the head while the room is being aired.

“When the contagious nature of the disease is recognized within a short time after the beginning of the illness, after the approval of the health department inspector, it is advised that all articles of furniture not necessary for the immediate use of the sick person, especially upholstered furniture, carpets and curtains, should be removed from the sick room.

“When the patient has recovered from the disease

the entire body should be bathed and the hair washed with hot soapsuds, and the patient should be dressed in clean clothes (which have not been in the room during the sickness) and removed from the room. Then the health department should be immediately notified, and disinfectors will be sent to disinfect the room, bedding, clothing, etc., and under no conditions should it be again entered or occupied until it has been thoroughly disinfected. Nothing used in the room should be removed till this is done.

"The attendant, and any one who has assisted in caring for the sick person, should also take a bath, wash the hair, and put on clean clothes, before mingling with the family or other people after the recovery of the patient. The clothes worn in the sick room should be left there, to be disinfected with the room and its contents."

Local Treatment.—The local treatment employed has been for the purpose of either directly destroying the pseudomembrane, such as nitrate of silver, carbolic acid, the actual cautery ; or to dissolve it, such as the alkaline carbonates, the chlorides, steam, and papayotin ; or to act as astringents, such as lime water, and the chloride and sulphate of iron ; or to disinfect, such as potassic chlorate, chloral hydrate, turpentine, carbolic acid, mercury, sulphur, bromine, iodine, iodoform, chlorine water, and peroxide of hydrogen. The methods of application have been direct local application, gargles, sprays, injections, and inhalations. In mild cases where there is very little secretion at the back of the throat it is not necessary to use any local treatment. Many young children object very strongly to the use of swabs and

sprays, and struggle violently when they are employed. The exhaustion produced and the extra taxation of the heart more than counterbalance any good accomplished in this way. Loeffler's solution is highly thought of by many. It consists of alcohol 60 parts, toluol 36 parts, tincture of iron sesquichloride 4 parts. It is however not any better than others, has a bad taste, is objected to very strongly, and gives rise to exhausting struggles. The normal salt solution, boracic acid solution, or lime water will do as much as any of the others. When the nose is affected, irrigation may be practised. To do this properly the child should be wrapped from head to foot in a sheet or blanket, with the arms down at the sides, so that struggling cannot take place. The child should be laid on its side on a table covered with a rubber sheet. A douche bag with a long tube and a glass nozzle, is filled with saline solution, and the nozzle introduced into the upper nostril. The solution is allowed to flow freely to clear out as much of the membrane as possible.

In laryngeal diphtheria the first danger is from suffocation, and as this is easily recognized, the indications for the treatment by mechanical means are easily found. From the beginning of dyspnoea steam must be used, and calomel may be sublimed, but as soon as there is any real distress intubation should be practiced at once. Tracheotomy may be done in place of intubation, but the results are not so satisfactory. As to intubation, we may properly discuss it here. The object is to introduce a tube into the larynx, by way of the mouth, the shape and weight of the tube keeping it in place as long as it is nec-

essary to use it, that is until the swelling subsides or the membrane is thrown off. The tubes are of different sizes to fit the larynx at different ages. The operation being decided upon the first thing to concern the operator and the nurse is the preparation of the patient. When a child is first seen in this condition it is usual to find the neck and chest covered with several layers of flannel, and perhaps a large poultice is also over the throat. These should all be removed so that nothing remains but the night dress. The child is then pinned in a sheet or blanket, with the arms extended by the sides. There should be no folding of the sheet to make a roll or bunch under the chin. The more care taken in this preparation the easier will be the holding of the patient and the less likely any delay at a critical moment. To select the proper sized tube it is necessary to know the age of the patient. In each set there are six tubes, and a gauge to show the proper size for a given age. A piece of strong linen thread is put through the eye in the head of the tube, and when double should be from ten to eighteen inches in length. It is not usual or necessary to sterilize the tubes before using them, but, of course, they are very carefully cleaned afterwards. The obturator, introducer, and mouth gag are the other instruments needed. The nurse is expected to hold the patient, and assistance is rendered in holding the head by a second nurse or another doctor. When holding the patient the nurse should be seated on an ordinary backed chair; the child is firmly grasped by the elbows and brought into such a position that its head is above the left shoulder of the nurse and on the same level as her

head. If the child is of any size, or say four years and upwards, its legs must be firmly held between the knees of the nurse. The other assistant stands behind the nurse and patient, and grasps the head firmly between the hands, having the third and fourth fingers under the jaws. The head must be kept in the middle line and erect, the assistant holding it as though he were stretching the neck. The back of the patient's head may be steadied against the assistant's chest to prevent the child from throwing itself suddenly backward. If no second assistant can be had, then the child is to be placed so that the back of its head rests upon the left shoulder of the nurse who places her left arm firmly across the chest and the right hand upon the forehead of the child, the legs being held as before. The operation is also sometimes done with the patient in the recumbent position on the table or bed, the reason for this being a weak heart or a moribund condition. The doctor standing in front of the patient introduces the gag between the teeth on the left side. When in place the handles lie against the cheek and the assistant who is holding the head should place the left index finger between the jaws to keep it in position. The operator then inserts the left forefinger into the child's mouth, feels for the epiglottis, lifts it up to a vertical position, then passes the tube into the mouth and on until the point of the tube rests on the epiglottis with the finger. The handle of the introducer is raised at the same time the finger is pushed on behind the larynx to steady it while the tube is going through. When the tube is almost in place the finger is raised to the head of the tube and it is pushed home, at the same

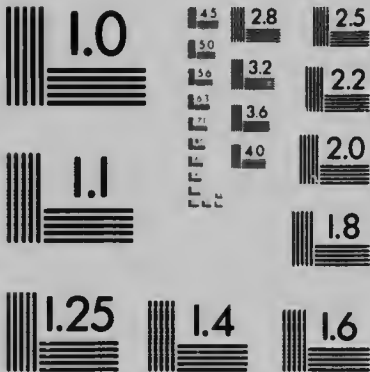
time the obturator is freed from the tube and it and the introducer withdrawn. The string is kept in the tube for a few minutes to watch the effect of the intubation. When the tube is properly in position, one or two coughs will be given; the child's respiration, which was croupy, becomes quiet; the cyanosis clears up, and the child quickly falls into a quiet sleep. The operation takes a long time to describe, but is done in a few seconds. The nursing and the feeding of the patient are of the utmost importance.

Constitutional Treatment.—The use of diphtheria antitoxin has become almost universal, and there can be no doubt as to its value. The earlier it is administered the more valuable it becomes. It may be given no matter how late the case is seen, but the best results may be looked for if it be used before the third day. The dose should be from 1000 to 3000 units, hypodermically. In severe cases one half the maximum dose may be repeated in twenty-four hours. A rash often follows its use, but it soon passes off and does no harm. Before antitoxin came into use almost every remedy in the pharmacopoea had its advocate as being most valuable in diphtheria. Only two have survived,—calomel and tincture of iron. Calomel in one quarter grain tablets should be given at the onset of the attack and continued till the bowels are moved freely. During the course of the disease it is well to repeat this. Sublimation of calomel fifteen grains every twelve hours, is practiced while a tube is being worn. The tincture ferri chlor., one part; glycerine, four parts; fifteen drops of which may be given to a child one year old, every two hours, and thirty drops to a child over two years, is an old and really useful



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remedy. The condition of the heart must be watched from the first. It is well to give some stimulant from the beginning of the attack, as heart failure may make its appearance early. The treatment of the sequelae need not be discussed here.

CHAPTER XXIII.

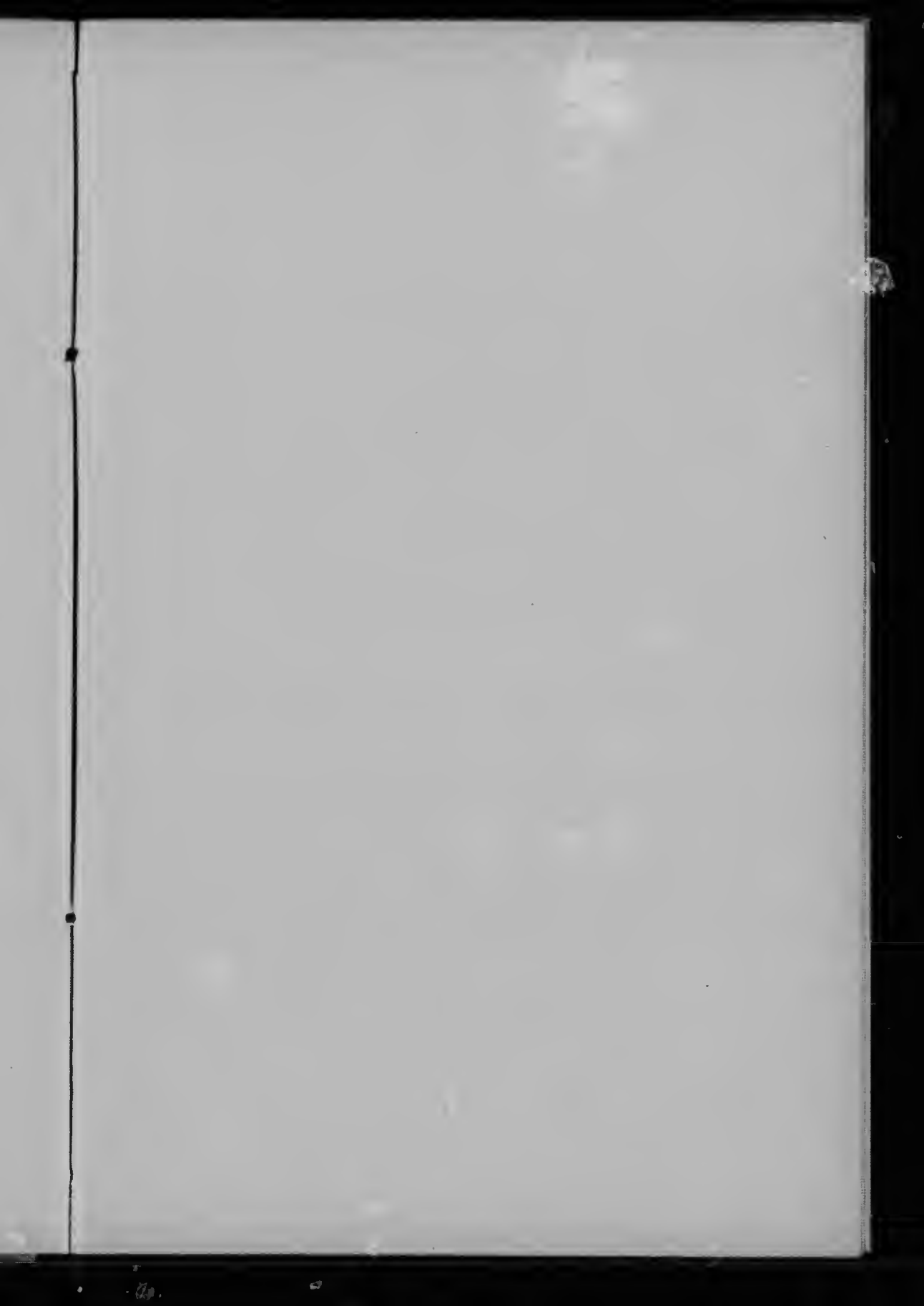
SPASMODIC LARYNGITIS.

SPASMODIC LARYNGITIS.—This is also called spasmodic croup. It takes an intermediate place between idiopathic croup and laryngismus stridulus. It is a catarrhal laryngitis associated with spasm of the glottis, and almost exclusively affects children. The child goes to bed in good health, or perhaps with a cold in the head or a slight hoarseness. During the night the croup-cough is heard, hard, metallic and barking. This may be repeated, and with it a certain amount of stridor. This is the single symptom. The child is apparently well in the morning. These attacks may occur for several nights and then disappear.

Very simple treatment is necessary. A drink of hot milk may give relief. Small doses of paregoric and ipecac will help the cough and relieve the spasm.

LARYNGISMUS STRIDULUS.—This is also commonly called spasm of the glottis. It is a spasmodic closure of the glottis due to tonic spasm of the adductor muscles of the larynx. It is strictly a neurosis and may have a central or a peripheral origin. It may be a local convulsive attack. It is an affection of young children, but is sometimes seen in adults. Dentition is a cause, and digestive derangement is often present. It may be due to a foreign body or

pressure on some motor nerve. The opinion generally held is that it is a reflex irritation of the larynx from some remote disturbance. The symptoms come on at night suddenly. The child breathes with difficulty and with a peculiar inspiratory stridor. Convulsions or opisthotonos may occur. This passes off in a few minutes with a loud inspiration, which is the end of the spasm. It may result in asphyxia. Attacks recur at intervals of weeks, months or years. There is no fever or coughing. When the spasm is over the child is perfectly well. The treatment is directed first to arrest the paroxysm, and second, to prevent recurrence. For the first, plenty of fresh air should be admitted to the room, the feet may be plunged into cold water, the clothing loosened, the head lowered, cold compresses to the head, or cold water dashed into the face. Mustard plasters may be applied to the back of the neck, and morphia with atropine, injected. Ammonia and chloroform inhalations will help, if respiration is not completely arrested. Emetics are not of much use. Intubation may be done if there is time. Between attacks the system must be built up by hygienic measures, good ventilation, open air, nourishing food, proper clothing and the daily cold bath. If the act of nursing causes a spasm, feeding must be managed with a spoon. As the condition is closely allied to eclampsia, the bromides, chloral hydrate, and antipyrin are suitable remedies.



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