

wise absolutely hopeless cases, that one need never hesitate to advise it when the general condition outside of the larynx is favorable.

**THE OPERATION.**—The larynx may be removed in whole or in part; in other words, the resection may be complete or partial. We shall give in this place rather a general idea of the former, feeling that any one contemplating its actual performance would desire to refer to the special literature of the subject.

It has happened in many cases that the exigencies of the condition present have called for a tracheotomy, which has thus been made a preliminary to the more radical extirpation. Thus the question has been raised whether preliminary tracheotomy is not always advisable. Of course, if it have been already made, the question is at once settled, but when the matter can be taken under advisement the writer would be adverse to it, and on these grounds: when undertaken a few days previously, it leaves a certain amount of disturbance and adhesive inflammation, which may complicate subsequent dissection; whereas, if left till the extirpation, it can just as well be merged into and become a part of the latter. The surgeon must, however, be prepared to perform it instantly in case of impending suffocation.

The preliminary skin incision should be a long one, down even to the sternum. By making this long incision one may be spared the necessity for making others at right angles; it is also in the line of safety, and healing takes place much more satisfactorily. From the level of the hyoid bone to a point below the larynx this incision should be deepened, until the entire respiratory tract is exposed, and the deep fascia covering the same divided. Now the cutting edge should be replaced by the handle of the scalpel, or, better still, by a reasonably sharp periosteum elevator, by means of which all the lateral attachments of the laryngeal muscles are separated. Any small spouting vessel must be caught in the hæmostatic forceps; any one of sufficient size to call for it must be ligated twice and divided between the ligatures. The isthmus of the thyroid must also be treated in this way. By this process the larynx is freed anteriorly and laterally. To free it and the upper rings of the trachea, if any are to be removed, from the œsophagus, is perhaps the most difficult part of the operation. This must be done with extreme care. It must be remembered that the anterior wall of the œsophagus commences at the level of the cricoid cartilage.

After the larynx has thus been loosened from all lateral and posterior attachments, the thyro-hyoid membrane exposed, and the hemorrhage all checked, the operator is ready to begin its removal. There has been considerable discussion as to whether it is better to do this from above

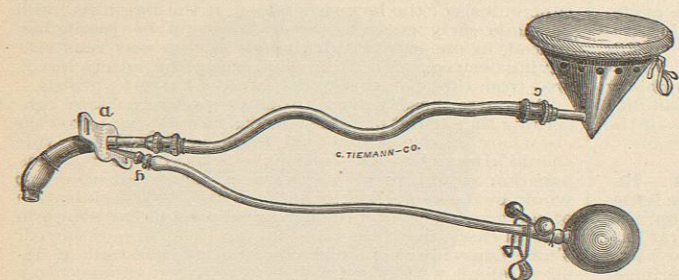


Fig. 3125.—Trendelenburg's Cannula. Easily supplanted by the rubber tube and glass funnel above described.

or from below. The writer's preference, based upon his own experience, is for the latter. It is perhaps a little the more abrupt, but it provides for the proper care of the trachea at once, and the operator may proceed to complete his work with less haste. The height at which division shall be made being first decided on, whether

just below the cricoid, or between some of the upper tracheal rings, as circumstances may dictate, the section is quickly made. The portion above being already loose, may be quickly lifted out of the way, and a tracheal cannula, arranged to suit the operator, may be rapidly inserted; through this, for the rest of the operation, the anæsthetic is administered. A rubber tube large enough to fit into it may be inserted; the outer end of the tube may then be slipped over a small funnel containing gauze upon which the chloroform is thereafter dropped. Everything having been so cared for as to prevent entrance of blood into the trachea, complete removal is now effected. The matter of removal of the epiglottis, if not already settled upon, must now be quickly decided. If diseased, it must of course be removed; but when it is healthy one may easily waver in opinion. Here again the writer advises its removal, since in actual experience he has had cause to regret having left it. It has in many instances been found a detriment rather than an advantage. The thyro-hyoid membrane and also the folds connecting the epiglottis with parts above, as well as any remaining connections, should now be divided, and the diseased mass lifted out.

After this the surrounding tissues should be subjected to a careful examination, and if any are found to be diseased they should be extirpated. Thus, a part of the hyoid bone, base of the tongue, lateral pharyngeal wall, œsophagus, or thyroid, or some of the cervical or other lymph nodes, may, if clearly diseased or even if simply enlarged, be conveniently dissected out without much difficulty. Despite all this cutting the hemorrhage is not likely to be severe, and so long as blood is kept out of the trachea no great difficulty is met with.

After the completion of the excision a formidably large wound is left, whose most conspicuous features are the large pharyngeal opening, the upper gaping end of the œsophagus, and the divided trachea. It is necessary first to prevent the trachea from retracting, as it naturally tends to do, by suturing it to the margins of the wound; three silk or silkworm-gut sutures suffice for this. The upper end of the œsophagus is then brought up to the hyoid bone and held there by silk sutures, if possible. It is now rarely the practice to retain the trachea tube; the trachea being united to the skin as described above, access to it from the pharynx is shut off by the attachment of the œsophageal margin to the body of the hyoid. In this way leakage into it from above is prevented. The large wound is now closed with sutures and suitably drained, and dressings are applied above and below the tracheal opening.

**AFTER-CARE.**—The requisite after-care is much the same, so far as surroundings are concerned, as in a case of tracheotomy. The air of the room should be kept moist, and at a temperature not much below 80° F.

The patient is placed in the Trendelenburg position, as after intubation, the foot of the bed being raised to a height of from eighteen to twenty-four inches. In this position he may be fed after from twenty-four to thirty-six hours. At the expiration of from seventy-two to ninety hours his feet may be lowered and his head raised, and by the fourth day he may sit up. Until he can swallow food without much difficulty he may be fed by the rectum.

With a wound thus closed the use of an artificial larynx is not contemplated and the tracheal opening remains. Experience has shown that patients learn to retain air enough within the oropharynx and parts below to whisper plainly or even to speak in an ordinary tone of voice. If desired later, the anterior wall of the larynx may be perforated to permit the introduction of some form of artificial larynx.

**THE ARTIFICIAL LARYNX.**—This most ingenious instrument owes its present perfection more to the genius of Gussenbauer, of Vienna, than to any other individual, though it has been variously modified or adapted to spe-

cial cases by different surgeons. The model of the Gussenbauer apparatus, as the writer had it from him in 1882, is shown below in Fig. 1326.

It consists of a tracheal tube of large size (A) with lobster-tailed rings at its lower end permitting a slight motion, corresponding to the natural flexibility of the trachea. Through its front plate, and through an opening on its upper curvature, passes a second or pharyngeal tube (B), also made flexible (or not, according to the case), with an opening on its lower curved surface so placed that a stream of air may play freely through both tubes, even though the external outlet be closed. The upper end of the pharyngeal tube lodges behind and below the epiglottis, if this have been left *in situ*,

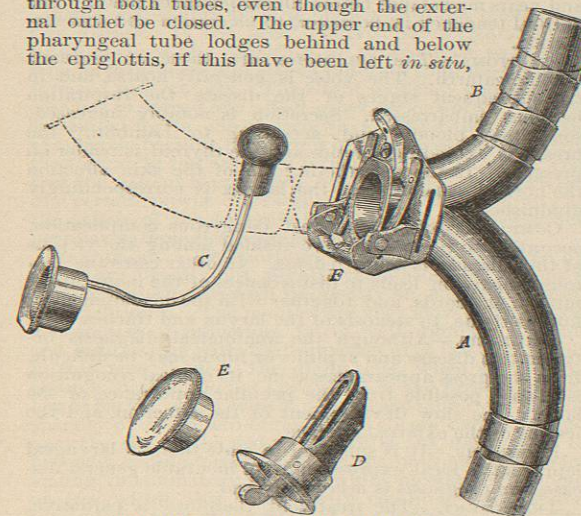


Fig. 3126.—Gussenbauer's Artificial Larynx.

or behind and below the base of the tongue, as the case may be. Around it the œsophagus granulates and closes, so that after the healing process is complete the only passage from the pharynx into the larynx is by way of the metal tube. In order that fluids and solids may not pass through this, an obturator (C) is provided, which is passed through the external opening and up through the tube, so that its rounded upper end plugs the upper end of the pharyngeal opening, thus preventing passage of anything into the trachea. But since this would also shut off air, the obturator is attached below, not to a solid plug, but to a ring, as seen, which fits accurately into the external opening of the instrument, and through it the patient breathes so long as this plug is worn. Except at meal-times the simple stopper (E) is worn, so that the patient breathes through the nose and mouth. After a time, by an instinctive education of the pharyngeal and buccal muscles, the upper end of the tube is protected during the process of deglutition, and patients wearing these instruments learn to swallow readily without the assistance of the obturator.

The feature of greatest interest about this apparatus is the vocal part. It will be remembered that the vocal cords have nothing to do with articulation, which is all performed above the larynx; they furnish only tone or sound. Possibility of articulation, then, not being interfered with, we have only to find a substitute for the vibrating cords. In the simple mechanism shown at D we have such a substitute—namely, a metallic reed, like a melodeon reed, playing freely in a movable slotted bar, and fitted inside of a stopper. This movable bar carrying the reed has an external lever, by means of which the wearer is enabled, with a touch of his finger, to throw it into or out of the air current, and thus, as it were, voluntarily to open or close his glottis. Placing this part of the instrument *in situ*, and throwing the reed into the air current, the metal strip vibrates as it does in the jew's

harp, and the sound thus produced is converted, by the articulating parts above, into something more than a whisper—into *distinct speech*. To be sure, the voice is now a monotone, but it is nevertheless a true spoken voice.

Various modifications of this apparatus have been devised by different surgeons to meet the indications in individual cases.

Patients display very different degrees of toleration of these instruments. Some find them excessively inconvenient, others cannot use the reed, and still others wear them continually without much discomfort. A patient of Gussenbauer's, who was known to the writer, wore his apparatus without apparent inconvenience; he was almost continually in the saddle as a riding-master, and still kept up his reputation as the best rider in Bohemia.

**RESULTS.**—The modified operation, as here described, affords, considering its severity, a usually satisfactory relief in otherwise desperate and fatal cases. Recovery may be expected in about two out of five cases, or even in a larger proportion if the operation is *done early*. Speech in some form is retained, and thus a great theoretical objection is removed. But, as in operations for cancer elsewhere, we get our best results here in cases which have not progressed too far.

**PARTIAL OR UNILATERAL LARYNGECTOMY.**—Inasmuch as laryngeal cancers are more often confined to one side, at least at first, it may be possibly indicated to remove the affected half. Thus, of one hundred and nineteen cases of cancer of the larynx, including the epiglottis,

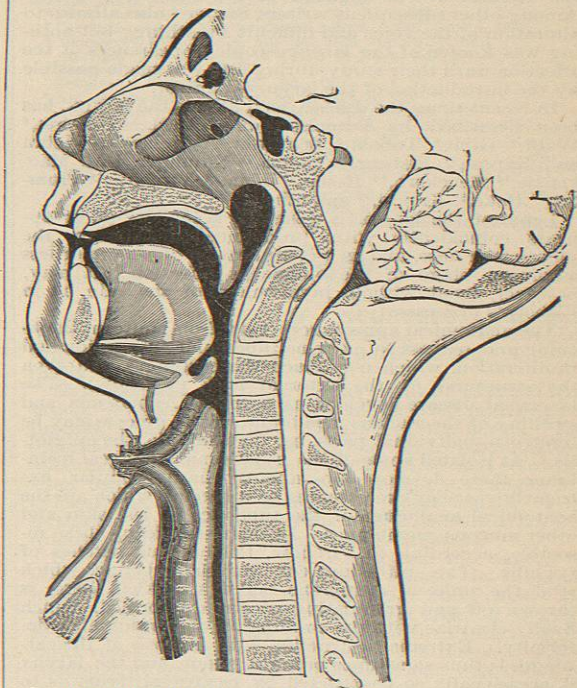


Fig. 3127.—Gussenbauer's Artificial Larynx in Position.

there were sixty-nine in which the disease was unilateral. That partial resection is feasible, some of the earlier cases have abundantly proved. Thus, in Billroth's third case he removed only a lateral half, and still the patient was thereafter able to phonate without mechanical aid. Hahn has advised, as the method of operating in such cases, that by an angular incision the larynx be first exposed, and then split open for examination. If only one-



pharynx. We may say, as a rule, that the local alterations consist usually of inflammation, with a tendency to hyperplasia, and that hyperæsthesia in atrophic conditions of the mucous membrane is extremely uncommon. One finds, generally, on examination, a granular condition of the posterior pharyngeal wall, which is due to hyperplastic inflammation of the lymphoid tissue in that vicinity. Gentle contact with the probe is exceedingly apt to excite laryngeal contraction or cough. In such individuals, we find usually either anæmia or neurasthenia, representing one type, or plethora or gout constituting another well-marked class.

In hysteria and hypochondriasis the cause is to be sought in functional disturbances of the central nervous system. In such individuals, the act of swallowing often produces marked discomfort, and patients sometimes complain of a noise which they perceive during the act of swallowing, and which arises from the rubbing of the calcified portions of the larynx on each other.

Neuralgia of the larynx is referred to by various authors as a well-defined affection. It is difficult, however, in many cases to exclude the possible existence of some pathological alteration elsewhere, which may cause the pain. In a case which came under the writer's observation, a severe intermittent, neuralgic pain, extending from the base of the tongue on one side downward in the direction of the cricoid cartilage, was complained of for many years. A true neuralgia was, for a time, considered to exist, but careful inquiry elicited the fact that there had once been a deep-seated abscess in the throat which ruptured externally, the slight scar being completely hidden by a heavy growth of beard. As a rule, such pains do not appear spasmodically, or follow the direction of a definite nerve. Many other causes of laryngeal hyperæsthesia may be enumerated, such as swelling of the veins at the base of the tongue and enlargement of the lingual tonsil. Smoking is also a frequent cause, particularly when strong tobacco is smoked either in a cigar or in a pipe. This condition is found usually in men who are otherwise strong and well, except, perhaps, for certain neurotic tendencies. Such hyperæsthesia is generally associated with symptoms of paresthesia.

**Prognosis.**—This depends upon the causative factor. In the catarrhal cases, and in those in which anæmia alone exists, the prospect of relief or recovery is naturally better than in those due to hysteria or hypochondriasis.

**Treatment.**—This is naturally determined by the etiology. In cases of hyperæsthesia dependent upon or associated with hyperplastic alterations of the mucous membrane, much may be done for the patient by appropriate local treatment. Relief may often be afforded by encouraging the patient to tolerate local applications to the back of the pharynx, which can be carried out at home. The application of Mandl's solution (iodine 0.5 to 1, glycerin 10), on a cotton-tipped probe, may be advantageously practised several times a week. In the case of hysteria and hypochondriasis, general treatment by the family practitioner and neurologist is directly indicated.

**Paresthesia** occurs in the form of subjective sensations of constriction, heat, pricking, etc., in the throat, and is usually associated with hyperæsthesia. It is not uncommon as the result of the penetration of foreign bodies into the mucous membrane of the vicinity, and persists often after the foreign body has been removed. In such cases, either as the result of the efforts of the patient to dislodge the foreign body, or in consequence of manipulative efforts of the physician, the mucous membrane of the larynx is often acutely inflamed, particularly in the region of the epiglottis, and this inflammation is almost invariably accompanied by acute lingual tonsillitis. In such cases, it is difficult to determine which region of the throat is responsible for the persisting symptoms of discomfort.

The treatment of such conditions follows closely the lines laid down for hyperæsthesia. In addition to such general measures as will suggest themselves to every physician in the way of diet, hygiene, and appropriate

tonics, much relief may be obtained from local treatment. A frequent application of Mandl's solution in cases characterized by hyperplasia of the lymphoid tissue is serviceable. When the pain is very severe, Gottstein recommends the application to the neck of cloths wrung out of very hot water. The prognosis in cases not due to the entrance of a foreign body is undoubtedly less favorable than in hyperæsthesia.

**Anæsthesia.**—Diminution of sensibility in the larynx may be partial or total. In the first instance, the condition is called hypæsthesia, in the second, anæsthesia proper. These conditions are to be distinguished from loss of the sense of pain, or analgesia. In the diagnosis of anæsthesia, it is often difficult to determine the boundary between normal degrees of tolerance and pathological conditions. In certain individuals it is possible to introduce laryngeal instruments without previous anæsthetizing of the parts, and yet no evidence exists pointing to any abnormality, either general or local. A frequent cause of anæsthesia is to be found in diphtheria, and this may at times be associated with anæsthesia of the soft palate and uvula. There seems to be no relation between the severity of the infection and the degree of paralysis present. The time of onset of such nervous alterations in the larynx ranges from two to six weeks after recovery from the diphtheria, but it may extend to from two to four months. Paralysis in this affection is probably due to alterations produced in the nerves by the diphtheria toxin. Syphilis of the central nervous system may produce anæsthesia in the larynx. Ott observed anæsthesia of the right half of the larynx in a case of paralysis of the right vocal cord, due to syphilis of the central nervous system. The roots of the vagus showed no medullary nerve fibres. Schrötter has reported a case of malignant lymphoma of the throat in which individual tumors extended up the left side of the neck between the mastoid process and the ramus of the lower jaw. In addition to paralysis of the left vocal cord, there was also anæsthesia of the left half of the larynx. In this case the root of the vagus must have been subjected to pressure before giving off its individual branches, since, in addition to paralysis of the left laryngeal muscle, there existed also an acceleration and irregularity of the heart's action.

Both anæsthesia and hypæsthesia occur in hysteria, although they are rare manifestations in this disease. The anæsthesia may be total or unilateral, and may be associated in the latter instance with unilateral cutaneous anæsthesia. Unilateral anæsthesia has been reported in cases of hemiplegia, although this is less common than cutaneous anæsthesia; it has been noted also in association with unilateral lesions of the medulla, bulbar paralysis, tumors of the base of the skull, gummata, progressive muscular atrophy, railway spine, and tabes. Krause reports a case of tabes in which there was anæsthesia of the laryngeal mucous membrane with, however, well-preserved reflex excitability, as shown by probing, which caused closure of the glottis. In another patient, the reflex irritability disappeared, while sensation was preserved.

When the anæsthesia is complete, there is a marked tendency for food and drink to enter the trachea, with the production of glottic spasm or cough. It has been stated that the epiglottis in this condition is more erect than usual, owing to paresis of the thyro- and aryepiglottic muscles, which are said to be supplied with motor filaments by the superior laryngeal nerve.

The prognosis of laryngeal anæsthesia is dependent upon the etiology in each case. In diphtheria the condition usually passes off spontaneously. In the functional nervous diseases the prognosis may or may not be good, according to the underlying general disease.

In organic diseases of the nervous system the same is true, so that it is useless to formulate any definite statements. Treatment consists in that which is appropriate to the general underlying cause. It is important to prevent food from entering the larynx, and it may be necessary to feed the patient through a tube.

**SPASMODIC AFFECTIONS.**—*Spasm of the Glottis.*—Glottic spasm may affect the abductors as well as the adductors. But a single case, however, of the former condition is known, namely, one reported by Pitt as occurring in a patient with hydrophobia, in whom the glottis remained wide open for several seconds during the attack. Almost universally the term spasm of the glottis is employed to designate spasm of the adductors. It occurs most commonly in children, and is then usually dependent upon or related to rachitis. As contributing causes we may mention general disturbances of nutrition, improper feeding, and acute local inflammations. In adults there is usually an associated chronic laryngitis, although new growths have been observed to produce such attacks. Lichtwitz has described hysterogenic zones in the larynx, contact with which excites glottic spasm. The laryngeal surface of the epiglottis seems to be especially sensitive. Spasm of the glottis is common in tabes, and may be an initial symptom. It may also occur in association with chronic catarrhal inflammation of the parts, particularly in alcoholics. Lesions of the naso-pharynx, particularly those of a hyperplastic nature, often give rise to a spasmodic contraction of the nerves. Tetanus has been occasionally found to exhibit this condition. The symptoms vary according to the degree and duration of the attack, as well as to the underlying cause. The attack is ushered in usually by cough, with simultaneous sensation of contraction in the throat, followed by cyanosis and even unconsciousness. In a few seconds, a spasm may be interrupted by deep inspiration, which is followed by another contraction. The patient experiences marked anxiety and a sense of impending dissolution, and sometimes a fatal termination may actually ensue. Examination of the larynx shows a close approximation of the vocal cords throughout their whole length, although at times their cartilaginous portions may remain open, producing a triangular cleft posteriorly. The ventricular bands may also share in the contraction. The epiglottis may be depressed, but usually stands erect.

The diagnosis is readily made from a consideration of the symptoms, although the condition must be differentiated from that following secondary contractions which take place in paralysis of the postici.

Prognosis is usually favorable, but is dependent upon the underlying cause and the treatment. In children, the condition is more serious, and a considerable number of fatal cases have been reported.

**Treatment.**—The first indication during an attack is to produce relaxation of the contracted muscles, which may be effected by the inhalation of chloroform, ether, bromide of ethyl, sudden application of hot water to the neck and back, or of cold water to the epigastrium. Tracheotomy has been found necessary at times. For the prevention of the attack, appropriate general measures must be instituted. In children this is particularly important. Heroin in small doses has been found particularly serviceable. Schrötter recommends the introduction, in hysterical cases, of a hard-rubber tube.

**Chorea of the Larynx.**—True laryngeal chorea is characterized by a choreic movement of the vocal cords, in association with a true general *chorea minor*. The designation "chorea of the larynx" is superfluous, since the laryngeal muscles move in sympathy with the general muscular system. Onodi therefore proposes to drop the name "chorea laryngis" and recommends, in cases of choreic movement of the cords, without general chorea, that the term "choreiform movement of the cords" be used. Cases of nervous cough upon which chorea supervenes are to be termed "chorea minor, with nervous cough." The name "chorea laryngis" is therefore inapplicable to many cases of nervous, reflex cough, which have been described by various authors under that designation.

**Nervous Cough.**—By this term is denoted a cough which arises without demonstrable alterations in the mucous membrane, and is occasioned by reflex irritation from without, or by an increased irritability of the central

nervous system. Although no macroscopic alterations may be found on examination, it is possible that the condition is due to some previous disease, such as acute inflammation or new growths. Among other external sources of irritation, we may enumerate diseases of the nose and pharynx, particularly chronic follicular pharyngitis. The condition under these circumstances is closely allied to that which exists in hyperæsthesia of the larynx. Reflex irritation due to the presence of wax or foreign bodies in the external auditory meatus is somewhat frequent.

Among the factors associated with increased excitability of the central nervous apparatus, we find, first, anæmic conditions, secondly, hysteria. A form of cough which occurs in tabes may also be included here.

**Symptoms.**—The attack of coughing is usually preceded by sensations of tightness or constriction in the throat, which cause a desire to clear the parts. The cough may occur only once or be repeated, and there may even be spastic contractions of the abductors, associated at times with energetic contraction of the diaphragm. The character of the cough varies, but it is usually dry and tight, although at times there is a rough or bellowing quality. There is little or no expectoration. The prognosis and treatment depend upon the underlying causes.

**MOTOR PARALYSES.**—These may be divided into three general classes as follows: 1. Paralysis of the closers of the glottis, namely, the lateral crico-arytenoid muscles (or adductors proper), the thyro-arytenoid (or internal tensors of the vocal cords, which also aid in closing the glottis), and the interarytenoid muscle. 2. Paralysis of the abductors or posterior crico-arytenoid muscles. 3. Paralysis of all the muscles supplied by the recurrent laryngeal nerve. Paralysis of the laryngeal muscles are occasioned either by disturbances of the nerves which supply the organs, namely, the recurrent laryngeal and the superior laryngeal, or by lesions of the vagus and the accessorius, from which these nerves arise. These we term peripheral disturbances. Paralysis may also arise in consequence of intracranial diseases affecting the nuclei of the roots of the vagus and the accessorius, giving rise to central paralysis. Finally, we distinguish myopathic paralyses, produced by diseases of the muscles themselves. These paralyses are scarcely separable from the peripheral, inasmuch as their etiology and manifestations are as yet imperfectly understood. In view of the long course of the vagus and its exposed situation, it may experience a variety of injuries through lesions of the structures in the vicinity. Among these we may enumerate traumatism, pressure from mediastinal tumors, enlarged bronchial glands, aneurism of the innominate and subclavian arteries on the right side and of the arch of the aorta on the left, carcinoma of the œsophagus, and enlargement of the thyroid. Diseases of the pleura and of the right apex may produce paralysis of the recurrent nerve. Paralysis of the vocal cords have also been observed in consequence of the pressure of malignant tumors on the accessorius, within the cranial cavity. Remak has described traumatic paralysis of the sympathetic, hypoglossus, and accessorius. In diphtheria paralysis of the superior laryngeal nerve has been found, though it is extremely rare.

Among the peripheral paralyses we include those of myopathic and neuropathic nature, which affect usually only individual muscles, and arise in consequence of overexertion. These are most frequently due to catarrhal diseases. Certain infectious diseases are followed at times by more or less complete paralysis on the part of the laryngeal muscles. We find this particularly in diphtheria, typhoid fever, smallpox, scarlet fever, and erysipelas. These are due probably to the action of the toxins upon the nerves in question. Those paralyses which occur in consequence of tuberculosis and syphilis are, on the other hand, usually due to alterations of the tissue in the vicinity, rather than to a toxic action. Lead and arsenic poisoning have been observed to occasion laryngeal paralyses. Rheumatism has been cited frequently as a cause of laryngeal paralysis. Bäumlér de-