phenacetins have a double action; they lower temperature and soothe pain. The lowering of the temperature is most noticeable in cases of pyrexia; in fevers, 50 centigrammes of phenacetin lower the temperature by 1° to 2° C., and the antithermic action following such a dose lasts four hours. In certain cases, however, the apyrexial period is more prolonged even from the same dose; it may even reach eight to ten hours, as indicated by Kobler and Hoppe. Misrachi and Rifat suggest that a dose of 50 centigrammes be administered every four hours, to maintain the condition of apyrexia in those suffering from fever; even continued for a considerable time, these doses had never given rise to the slightest accident in fever patients. As with all the antithermics of that class, there is invariably observed abundant sweating, and often a sensation of collapse. Phenacetin, then, in febrile conditions, shows itself superior to antipyrin and acetanilid in producing marked antithermic effects without toxic phenomena. But I would, nevertheless, say that in fevers the dose of 1 gramme should never be exceeded.

But it is above all as an analgesic that phenacetin outrivals its predecessors. While it is quite as powerful as antipyrin and acetanilid, it does not cause the pain in the stomach, or the scarlatiniform rash of the former; nor does it give rise to the cyanosis of the latter. However prolonged may be its administration—and we have given it for months in doses of 1 to 2 grammes per day—we have never observed any bad effect. We have used it for the relief of every form of pain (neuralgias, migraine, rheumatic pains, muscular rheumatism, acute articular rheumatism, the lightning pains of tabes, etc.) and always with the best results. Further, in cases of hysteria, and of hysterical or neurasthenic pains, phenacetin has seemed to produce better effects than the bromides; it calms the excitability of the nervous system, and in some obstinate cases of nervous insomnia it procured sleep. Phenacetin seems therefore to be not only an analgesic but a narcotic.

This double action, as an antithermic and an analgesic, results probably from an effect produced on the spinal cord; and phenacetin may be considered a depressor of the excitability of the medulla, but on this point I cannot speak conclusively till the investigation carried on in my laboratory shall have been completed. Here, as in many other cases, clinical experimentation has preceded physiological research.

I have said that the meta-acet-phenetidin seems not possessed of any therapeutic action, and that only the para- and the ortho-acet-phenetidins have been utilised. The ortho-salt is less active than the para-acet-phenetidin; whilst the latter produces its effects in (daily) doses of 1 to 2 grammes, the former must be given in (daily) quantities of 1.5 to 2.5 grammes.

The insolubility of these substances simplifies to a singular degree their administration. They are best given in *cachets* containing 0.5 gramme to 1 gramme; 1 to 2 grammes of phenacetin may be administered daily, in doses of 0.5 to 1 gramme.

If I might be permitted to draw conclusions from what I have said, I would put them in the following form:

1. In the phenacetins we have excellent antihyperthermic and analgesic remedies.
2. Of the three phenacetins, two only possess therapeutic properties, para- and ortho-acet-phenetidin.
3. The ortho-acet-phenetidin must be given in larger doses than the para-acet-phenetidin. The medium dose of the latter is from 1.5 grammes to 2 grammes per day.
4. These two salts seem to be devoid of toxic properties.
5. They are powerful antithermics and very active analgesics, which ought to be substituted for antipyrin for the following reason: *a.* Because they are non-toxic. *b.* Because they act in doses one-half smaller. *c.* Because they are one-half cheaper. *d.* Because, finally, there is no monopoly in their manufacture.

TREATMENT OF CHRONIC CONSTIPATION BY ELECTRICITY.—Dr. G. M. Hammond, in a paper read before the Medical Society of the State of New York, recommended the use of a mild galvanic current in the treatment of chronic constipation; he introduced the negative pole well within the sphincter, and had thus succeeded in curing obstinate cases which had resisted treatment by cathartics. The faradic current also had been found useful to give tone to the abdominal muscles.

PRESENTATION.—Dr. Manke, of Stanley, has been presented by the students of his ambulance class with a silver-mounted riding whip and a pair of electro-plated spurs.

ANATOMICAL AND OTHER FACTS IN SUPPORT OF INTUBATION.¹

By LENNOX BROWNE, F.R.C.S.ED.,

Senior Surgeon to the Central London Throat and Ear Hospital, etc.

WHEN in America last year I had the opportunity of hearing several communications and discussions on intubation at the International Medical Congress, and the additional advantage of several conversations on the subject with Drs. O'Dwyer of New York, Waxham and Ingalls of Chicago, Solis Cohen, and Max Stern of Philadelphia, and others who had had experience of the procedure. I had the further privilege of seeing at Chicago two cases under the care of Dr. Waxham, which made a strong impression on my mind. The first was witnessed fifteen hours after the larynx had been intubated. The patient was a little girl, aged 22 months, and undoubtedly the subject of true diphtheria. The parents, who were extremely poor, occupied with two other children—one at the mother's breast—a single room on the ground floor opening direct on to the street. The apartment was intensely dirty and unwholesome. It was clear to me that in these circumstances tracheotomy, or at least the necessary after-treatment, would have been a hopeless procedure, but the intubated patient was at this early period perfectly comfortable, and in my presence swallowed some milk sop without coughing or difficulty. I have since learned that a good recovery resulted.

The second case was seen by me in conjunction with Dr. Waxham and Dr. Berry on the fifth day after intubation. The child was four years of age, and was the subject of "membranous laryngitis without false membrane visible in the pharynx." The child was dying simply from laryngeal obstruction." The home surroundings were even more miserable than in the previous case, and in addition to sanitary disadvantages, the right hand of the mother was disabled by a knife-wound inflicted by her drunken husband, and the patient was tended only by an elder sister of eight or nine years of age. "The tube had been coughed up on the third day, and the patient made an excellent recovery." She was already convalescent when I saw her.

Such an experience went far to dispel the theoretical objections which I, in common with many other surgeons, had entertained against the operation. I nevertheless determined to examine them and to convince myself if the principles of the treatment were as sound as the results warranted one in believing them to be.

The chief of the objections urged are such as may be considered as either anatomical or mechanical, and are as follows:

1. The calibre of the tubes is so small that respiration is not adequately relieved.
2. The tube is likely to be coughed up or to slip down.
3. The function of swallowing is rendered difficult and even dangerous by means of food, and especially fluids, passing through the tube into the trachea.
4. Membrane is liable to be pushed down during introduction of the tube, and thus induce suffocation at a lower level in the air-passages.
5. The tube is liable to blocking by false membrane and mucus drawn upwards into it on coughing.
6. The vocal cords or some other portion of the air-passages are liable to become injured or ulcerated by pressure of the tubes.
7. The intubators are difficult to remove.

OBJECTION 1.—The Calibre of the Tubes is so Small that Respiration is not Adequately Relieved.—It is perfectly true that almost all authorities from Bretonneau and Trousseau downwards have insisted that for infantile tracheotomy the calibre of the cannula should be as near as possible that of the natural size of the trachea operated on; and one of the most cogent reasons advanced for failure of tracheotomy upon children under three years of age is, that it is difficult to insert tubes sufficiently large. My impression, however, is that no sufficient reason has been advanced in favour of having tracheotomy tubes for infants of the full calibre of the normal trachea, for in adult practice, not only are all tubes of less size than the diameter of the trachea into which they are put, and are quite serviceable for breathing, but as a rule, a moderately small tube is less liable to cause spasm than an unduly large one. I have particularly observed in *post-mortem* examinations of cases of tracheal stenosis that the orifice

¹ Read in the Section of Diseases of Children at the Annual Meeting of the British Medical Association held in Glasgow, August, 1888.

at the point of constriction is often quite sufficient for the entrance of air, according to one's experience with tracheotomy tubes, and that death has probably resulted in these cases not so much from organic stricture as from spasm. Such a circumstance is in accordance with the views of Brown-Séquard, who long ago demonstrated that very slight constriction of the trachea with a thread is sufficient by simple interference with rhythmical respiration to produce embarrassing and even fatal results. To satisfy myself on this point of calibre, I have procured specimens of the larynx and trachea of children of various ages. Several of them are on the table, and I hand round diagrams of the results. It will be seen that while at birth the diameter of the glottis is only one-eighth of an inch, it is no more than half an inch at the age of 14 years; and further, that whereas the diameter of the trachea at the third ring at birth is three-sixteenths of an inch, at 14 years it is three-eighths of an inch. It is also well known that the narrowest part of the larynx is immediately beneath the vocal cords, where, by reason of the rigid wall of the cricoid cartilage, it is also least dilatable. It is clear, therefore, in view of these facts, and on inspection of my specimens, that an intubator cannot be made either to the full extent of the supra-glottic or of the tracheal calibre. Comparison of the calibre of the cannulae employed for children at various ages for intubation with the diameter of the normal glottis will show that the tubes for this operation have been constructed on much more scientific principles than those regulating tracheotomy tubes, and in my opinion it would be difficult to employ them larger. In the only case in which I have had the opportunity of performing intubation the child was 3 years old almost to the day. I found it impossible to introduce tube No. 3, adapted for children between the ages of 3 and 4, but I could readily introduce the next smallest size. As is shown on my diagram (Nos. 6 and 11), there may be considerable variations in the diameter of the glottis, not only in the different sexes but at advanced ages.

Since commencing these investigations, I have had the pleasure of reading a paper by Dr. O'Dwyer, in the *New York Medical Journal* of June 30th, 1888, in which he combats most effectively this objection, and on this head of calibre pertinently says: "It is only necessary to state that the diameter of the lumen of the trachea at a year old is scarcely a quarter of an inch, and, furthermore, an adult can breathe comfortably while at rest through an opening of this size. I have at present a man under my care who has been wearing a cannula in the trachea for the last seven months, the bore of the inner tube being exactly one-fourth of an inch in diameter. During part of this time he was obliged to breathe exclusively through the artificial opening. Nature supplied this patient, who is of large stature, with a breathing-tube at least seven-eighths of an inch in diameter, and the surgeon substituted one having a breathing capacity of something less than a twelfth of this. In other words, the area of a cylinder seven-eighths of an inch in diameter is little more than twelve times that of one a quarter of an inch in diameter. Had the surgeon who operated in this case placed himself on record, he must have taken extreme grounds in favour of small cannulae." These anatomical facts are amply borne out by figures, and it would be almost enough to answer this, one of the main objections against intubation, by the statement that it has been especially successful in very young children—in that very class, indeed, in which tracheotomy has most signally failed. According to Stern's statistics, while only 3 per cent. of patients have recovered from tracheotomy performed on children under 2 years, 12 per cent. on those between 2 and 2½ years, and 17 per cent. between 2½ and 3½ years; the recoveries from intubation performed on children of the same ages have been respectively 15.62, 19.46, and 30.00 per cent. Dr. Waxham has operated in 50 cases under 3 years of age with 10 recoveries.

OBJECTION 2.—The Tube is likely to be coughed up or to slip down.—The frequent ejection of the tube by coughing constituted the strongest argument against the small and short tubes of Bouchut, who in 1858 was the first to perform intubation. It was also one of the earliest difficulties encountered by Dr. O'Dwyer. It has been remedied first by lengthening the tube, secondly by weighting it, and thirdly by a bulging in the external wall, which prevents the tube rising beyond the constricted and non-dilatable infraglottic region to which reference has already been made. The tube has been prevented from slipping down the larynx by increasing the size of the head.

OBJECTION 3.—The Function of Swallowing is rendered Difficult and even Dangerous by means of Food, and especially Fluids, passing

through the Tube into the Trachea.—Undoubtedly the enlargement at the head of the tube, while obviating the risk of the tube slipping down the trachea, may slightly impede deglutition, and swallowing can possibly be somewhat more easily effected by tubes with a small head. The explanation of this difficulty in swallowing is, however, not so much that the tube with the larger head prevents the epiglottis from falling backwards to cover the glottis, as that it impedes the action of the ary-epiglottic folds and the general constriction of the laryngeal vestibule, which, as explained by Mr. Carmalt Jones, has much more to do with the prevention of food passing into the glottis during swallowing, especially in children, than is generally admitted. This specimen of the larynx of an infant, aged 17 hours, specially demonstrates this point. The experiments of Majendie and others, and daily clinical experience of cases where the epiglottis has been destroyed by syphilis, have demonstrated that the lid action of the epiglottis is by no means necessary for the protection of the larynx during deglutition, even in adults. I am, therefore, not disposed to consider the artificial epiglottis first introduced by Waxham as an absolutely necessary adjunct to the intubator, although it certainly affords some additional protection. I learn that Dr. O'Dwyer has recently invented one which can also be used to facilitate the extraction of the tube—a process far more difficult than its introduction. I have not yet seen the instrument, and am informed that this novel arrangement is only adapted to the adult tubes. The practical point to be observed by the surgeon with regard to deglutition is that whereas in the early after-treatment of tracheotomy it is advisable to administer liquid food, after intubation it is preferable to give it thickened, or of semi-solid consistence. In the only case in which I have had the opportunity of performing intubation, I found by observance of this hint no trouble in overcoming the objection now under consideration. Dr. Waxham's hint as to the position in which the child is to be placed when fed after intubation still further modifies the force of this objection.¹

OBJECTION 4.—Membrane is liable to be pushed down during Introduction of the Tube, and thus induce Suffocation at a lower Level in the Air-passages.—While, on the one hand, the fact that the small calibre of the tube may be held to conduce to the lodgment of mucus, on the other—as O'Dwyer has pointed out—a diminished area is necessary for effective coughing, and the power to expectorate is impaired in proportion to the increase beyond the limit necessary for perfect performance of the respiratory function. It is, moreover, probable that, given the stimulus of retained mucus or membrane at a "cough spot," the rigid tube in the glottis may actually favour expectoration by causing reflex irritation. In many of the cases recorded by O'Dwyer and Waxham it is noted that introduction of the tube was promptly followed by active cough, and expectoration through the cannula of large pieces of membrane; and Dr. Bleyer, of New York, tells me that he frequently introduces, removes, and reintroduces the tube for the very purpose of setting up this same reflex irritation. The practical points to remember are, first, where—as should always be the case—optical evidence is afforded of the local condition, the larynx should be cleared of all membrane or mucus obstructing the laryngeal orifice; secondly, that if the patient become cyanosed, the tube must be removed, cleaned, and reintroduced with the same promptitude that is so essential in like conditions with a tracheotomy tube. In my own limited experience I found after death no obstruction of the tube by mucus or membrane, although the disease had extended from the tracheal bifurcation. The child never suffered from dyspnoea after the introduction of the tube, and died simply from asthenia seventeen hours after the operation.

OBJECTION 5.—The Tube is liable to blocking by false Membrane and Mucus drawn upwards into it on coughing.—This is an accident that, of course, may be liable to happen, but would be quite as probable in the case of tracheotomy. Treatment would consist in removing the tube and cleaning it and the trachea by long forceps or feather, as just indicated in my answer to the previous objection. Where there is great exudation or mucous secretion, Dr. Bleyer recommends at least daily removal and cleansing of the tube, followed by prompt re-introduction.

OBJECTION 6.—The Vocal Cords or some other Portion of the Air-passages are liable to become ulcerated by Pressure of the Tubes.—This objection touches on the ground of liability of all wounds inflicted during the course of a diphtheria to take on a diphtheritic process. My own experience leads me to believe that such a circumstance is of great rarity in the case of a tracheotomy

¹ See JOURNAL, vol. II, 1888, p. 716 et seq.

wound inflicted on a diphtheritic patient, and I do not think it is likely to be more common by the presence of the intubation cannula within the air-passages, if only the precautions of O'Dwyer be observed as to the absolutely careful bevelling of the margins of the inferior orifice of the tube. On this point Waxham has suggested that neglect of so important a precaution will account for some deaths otherwise unexplained. The elliptical shape of the tubes and the other improvements of O'Dwyer's over those of Bouchut satisfactorily prevent any ulceration of the supra-glottic portion of the larynx. The tubes of Bouchut and the earlier ones of O'Dwyer were only three-quarters of an inch long, whereas the length of the cannula now in general use varies from $1\frac{3}{8}$ to $2\frac{1}{2}$ inches.

OBJECTION 7.—The Intubators are Difficult to Remove.—This is perfectly true in some cases, but it is one which skill and experience will in time overcome; it is also important to mention that in very many instances the tube is naturally ejected so soon as it has done its work. Dr. Roe, of Rochester, New York, told me that this had occurred in every case, 11 in number, on which he had operated successfully. I find that in 15 out of 41 recoveries in a gross number of 151 intubations recorded in Dr. Waxham's admirable monograph, the same event is mentioned as having occurred. In two the tube was, on being coughed up, swallowed, but was in each case passed *per rectum* after an interval of two days, and without complication. The same accident and satisfactory termination has occurred four times in Dr. Bleyer's practice.

Having thus answered some of the most frequent objections of general surgeons to the operation of intubation, I would, with all respect, advance a few on my own account from the point of view of the laryngoscopist. It is unfortunate, and yet, in a sense, a tribute to the merit of intubation, that the most successful results have hitherto been obtained by practitioners not laryngeal specialists, or even by the class known in this country as pure surgeons. It has thus resulted that the operation has, for the most part, been performed on the interpretation of subjective symptoms rather than on observation of objective signs. With the gag in the mouth it is perfectly possible to see the glottis by aid of the laryngoscope or by Dr. Bleyer's traction hook, which exposes the epiglottis, and it is certainly more easy and rational to introduce the tube by means of the eye than by the sense of touch, especially as by introduction of the hand there is greater risk of increased suffocation as well as of injury to the soft and

inflamed parts by oedema or ulceration. Moreover, to learn the knack of introducing an instrument by sight requires no more practice than the guiding of it by the sole aid of the finger.

It has been advanced by the advocates of intubation, and with absolute justice, that assent of the parents is more easily obtained for intubation than for the far more terrifying operation of tracheotomy; and yet I have heard it vaunted that intubation is not advocated at an earlier period than would be permissible for the external opening of the windpipe. Why should it not be? It is probable that the laryngeal mirror not having been used, in the majority of cases, for the purpose of forming an exact diagnosis of the condition of things, the operation has often been performed for mere spasm, and before membrane has extended to the glottis. It, of course, is equally likely that the same has occurred at least as frequently in regard to tracheotomy—not that I deprecate such a procedure; on the contrary, I would urge the earlier adoption of intubation on these very grounds, and I would further advance the proposition that, in cases in which the practitioner is not *au fait* with the laryngoscope, he should, on the indication of a rise of temperature accompanying progressive dyspnoea, pre-suppose laryngeal extension, and promptly perform intubation. For those who use the laryngeal mirror I would recommend the procedure so soon as the epiglottis becomes invaded, for I have never seen a case in which the membrane has been exuded at that spot without its having speedily extended to the glottis.

Although beside the question of intubation, this discussion being occupied with the general surgical treatment of diphtheria, I would remind the meeting that it is now many years since I advocated the excision of enlarged tonsils and uvula during the acute stage of diphtheria when those organs were clearly accessory to impeded respiration. I have several times adopted this measure with the greatest benefit, and have never had occasion to regret it.

PRESENTATIONS.—Mr. John A. Morris, M.R.C.S., on the occasion of his leaving Caerleon (we regret to hear in consequence of ill-health), has been presented, by his friends and neighbours, with a gratifying testimonial and a purse of £65, as a mark of affectionate esteem and regard.—A number of the officers in Her Majesty's Customs, Belfast, recently presented Dr. Richard J. Purdon with a valuable dining-room clock as a token of their esteem, and in recognition of his professional services to them and their families.