A probationary essay on some circumstances to be considered in resorting to the operation of bronchotomy : submitted by authority of the president and his council to the examination of the Royal College of Surgeons of Edinburgh when candidate for admission into their body, in conformity to their regulations respecting the admission of ordinary fellows / by George Stewart Newbigging.

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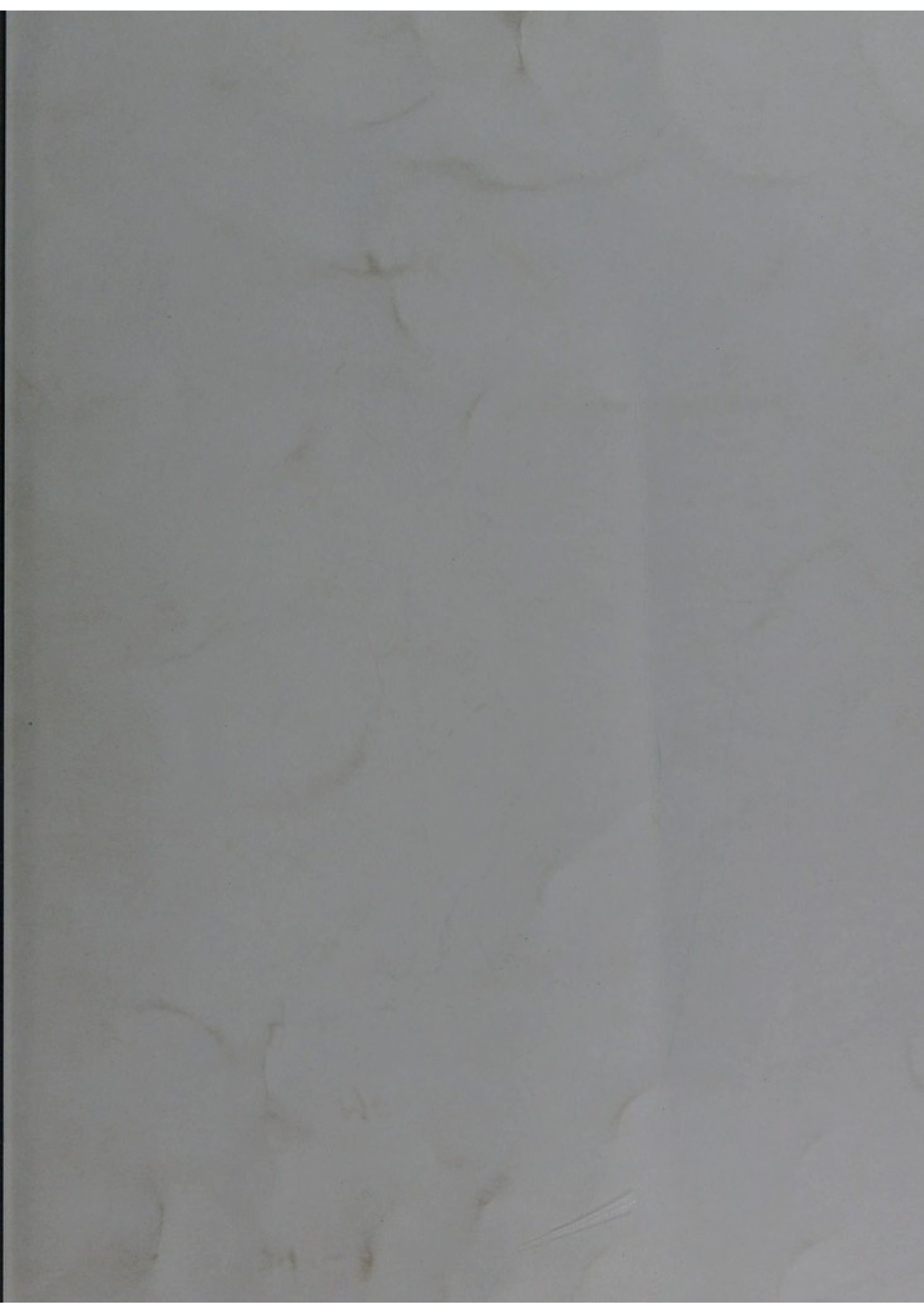

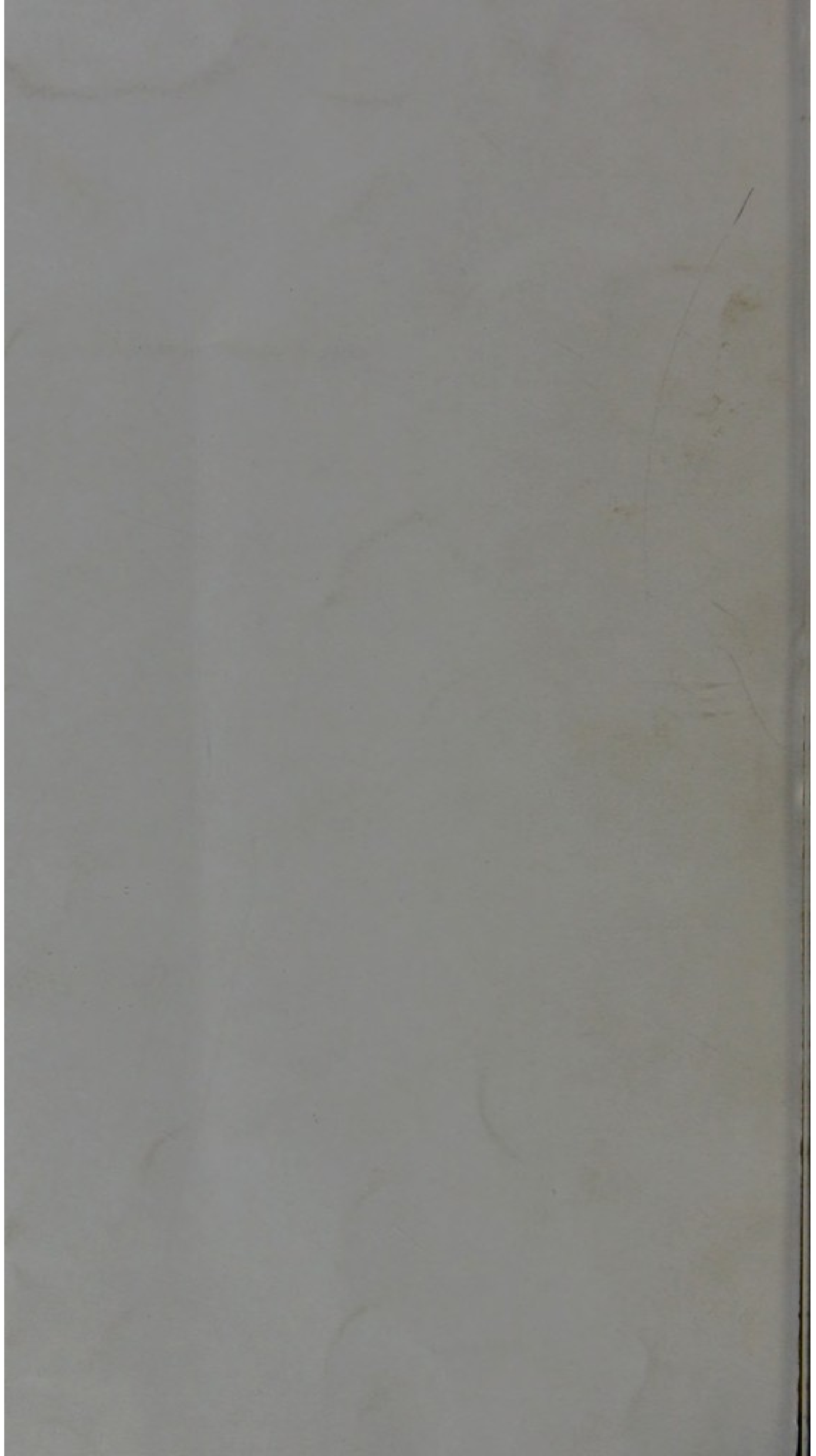

A

PROBATIONARY ESSAY

ON

SOME CIRCUMSTANCES TO BE CONSIDERED

IN RESORTING TO THE

OPERATION OF BRONCHOTOMY;

SUBMITTED,

BY AUTHORITY OF THE PRESIDENT AND HIS COUNCIL,

TO THE EXAMINATION OF

The Royal College of Surgeons of Edinburgh,

WHEN CANDIDATE

FOR ADMISSION INTO THEIR BODY,

IN CONFORMITY TO THEIR REGULATIONS RESPECTING THE ADMISSION
OF ORDINARY FELLOWS,

BY

GEORGE STEWART NEWBIGGING, A.M. M.D.

AUGUST 1837.

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TO

WILLIAM NEWBIGGING, Esq., F.R.S.E.

FORMERLY PRESIDENT OF THE ROYAL COLLEGE OF SURGEONS,

&c., &c., &c.,

THIS ESSAY

IS MOST AFFECTIONATELY DEDICATED

BY HIS SON,

THE AUTHOR.

ON

SOME CIRCUMSTANCES TO BE CONSIDERED

IN RESORTING TO THE

OPERATION OF BRONCHOTOMY.

With the Author's kind regards -

TO

WILLIAM WOOD, Esq, F.R.S.E.,

FORMERLY PRESIDENT OF THE ROYAL COLLEGE OF SURGEONS,

&c., &c., &c.,

THIS ESSAY

IS ALSO INSCRIBED,

IN GRATITUDE FOR PRIVATE FRIENDSHIP,

AND ESTEEM FOR HIS PROFESSIONAL CHARACTER,

BY

THE AUTHOR.

ON

SOME CIRCUMSTANCES TO BE CONSIDERED

IN RESORTING TO THE

OPERATION OF BRONCHOTOMY.

WOUNDS of the windpipe have generally been regarded with a peculiar dread, not only by those whose ignorance on such subjects precluded the possibility of their judging correctly upon them, but not unfrequently also by medical men themselves. That such an impression should have prevailed among the former class of observers is not at all surprising, because it is no uncommon occurrence to find that the less informed an individual is upon a subject, the more liable perhaps is he to form hasty and false generalizations from the too limited knowledge which he possesses of the various bearings of the fact brought under his notice. Thus it was well known to those not versed in medical matters, that in many of the cases where wounds about the trachea had been inflicted, the patients died after the accident, and the windpipe, with the importance of whose function all seem duly impressed, appearing to them to be the most vital organ in that neighbourhood,

the conclusion was at once drawn, that its division or injury must be the sure and unfailing cause of death. The fatal result of such cases, however, is in reality attributable, not to the injury which the trachea has received, but to that done to other important structures in its immediate vicinity, and this, though no recently established fact, gives rise to the question why some surgeons should have for long regarded operations on the trachea as fraught with peculiar danger.

Simple wounds of the trachea are by no means such formidable accidents as they were once thought to be: and indeed they appear to be attended with but little danger. Even when rudely produced, as in those cases where they are the consequence of accident or the attempts of the suicide, they are of themselves seldom fatal, and in general heal kindly if they be not complicated with other more serious injuries. When however they are made with judgment, and by a skilful hand, as in the operation of bronchotomy, they are in a more favourable condition, and their result may be regarded with the same anticipation as that of other wounds of similar extent, in which the same amount of disturbance has been occasioned to neighbouring textures.* Louis, in his valuable memoir on the subject, goes so far in recommending

* Memoires de l'Academie de Chirurgie, vol. iv. p. 459.

the operation as to state, that bronchotomy should cause even less inconvenience than the simple process of blood-letting. Though such an eulogium, however, must be taken with much of the caution due to the statements of all strenuous advocates for a favourite remedy, yet it receives much confirmation from the opinion expressed by other high authorities on the same subject. Among these is Mr. Lawrence, who though not inclined to subscribe entirely to Louis's enthusiastic view, yet considers bronchotomy to be in itself " an operation of little pain, and no danger."* This seems now to be the conclusion arrived at by most surgeons of eminence; and accordingly there would seem to exist some other cause than an intrinsic defect in the remedy itself, which has given rise to the prejudice still entertained against it in the minds of many. Any objection against it will in all probability be found to have existed in some peculiar state of the patient on whom it has been performed; for in all cases where its want of success has been most signally marked, there is good reason for believing that other morbid changes had taken place, sufficient to account for death independently of any bad effect resulting from bronchotomy itself, and to these the fatal consequences ought in justice to be attributed.

* Medico-Chirurgical Transactions, vol. vi. p. 237.

It must be evident, that the indiscriminate recourse to any mode of treatment in medicine is both unsatisfactory and discreditable to the science, and in surgery, in like manner, without due indication for its employment, no operation ought to be undertaken. The surgeon, besides attending to the symptoms which would point to its adoption, should also weigh well those which may tend to discourage him from attempting it. In many cases, it is to be feared, bronchotomy has been resorted to where it could be productive of no real benefit, while in many too it has been omitted, where, in the present state of pathological science, there is ground for believing that it might advantageously have been performed. It may be argued that in the catalogue of unfortunate cases, where it has been tried, the surgeon at least gave the patient a chance of life, which at the time was fast ebbing, and must at any rate have sunk; but it should be kept in mind, that by thus having recourse to an operation without the existence of a favourable prospect of success, there is attached to the remedy an opprobrium which must ultimately prejudice the public against its adoption under any circumstances, and thus by using it where success cannot reasonably be anticipated, greater difficulty will be encountered in obtaining its performance in those other cases

whose history would hold out a fair prospect of a favourable result. The surgeon should by no means refrain from the measure where the slightest chance of life can be gained for his patient; but before he recommends the operation, he should weigh well the physiological action of the organs more indirectly concerned in the disease, as well as those which it more directly involves, and ascertain, if possible, how far the condition of the former holds out a prospect of recovery.

It is not my intention in the following remarks to enter upon the consideration or description of the operation of bronchotomy, which, in whatever manner it be performed, is but a simple one, though requiring considerable coolness on the part of the operator, and in many instances great adroitness of manipulation. I propose rather to notice, first, some of the circumstances which would contra-indicate its being performed;—and, secondly, those which would incline us to adopt it, keeping in mind, in both investigations, the important fact that disease will often so alter circumstances, by its influence on the respiratory or other organs, as to render the operation hazardous which at first might otherwise have appeared safe and beneficial.

I. In considering those circumstances which con-

tra-indicate the operation of bronchotomy, we must carry along with us a just impression of the important functions discharged by the parts concerned. In order to the maintenance of life, it is essentially necessary that a constant and ample supply of atmospheric air have ready access to the venous blood circulating through the system, and however variously the arrangement for this purpose may be modified in different classes of animals, still the same essential anatomical conditions of the organ is to be found in all. In man, and the higher animals, the structure necessary for the discharge of the function of respiration would seem to be a mucous surface to which air is freely applied, while the blood to be arterialized ramifies in the vessels distributed on the membrane. To promote this approximation of the blood to the air, the respiratory muscles of the chest are constantly in action, and as the demand for a supply of arterial blood to the body always exists, so we find that the facility and regularity with which the respiratory movements are performed are in proportion to the freedom with which air is transmitted through the lungs. Should any impediment however occur to the due arterialization of the blood, the system, as it were, immediately takes alarm, and by the laboured and hurried action of the subsidiary muscles of respiration, endeavours to compensate by

the extent and frequency of their movements for the diminished quantity of air allowed to reach the lungs at each inspiration. This diminution may be the effect of obstruction to the transmission of air situated either in the larger air tubes or in the trachea itself, and checking its passage at its very entrance; or it may be caused by impediments situated in the smaller divisions of the bronchi, where the air, though it has reached thus far, cannot complete the process of decarbonization. The mucous membrane, for instance, which has been already mentioned as constituting an important part of the respiratory apparatus, may be so thickened by disease, or so covered by a redundancy of its own secretion, as to prevent that near approach of air to the blood circulating around the air-cells, which is necessary to secure its arterialization. It is of great importance that the nature and seat of these obstacles be ascertained, in order to decide on the probable success of surgical interference in mitigating the symptoms of suffocation attending all such affections.

It is evident that where the arterialization of the blood is prevented in the air-cells by well marked disease of the pulmonary parenchyma itself, or any other strictly local impediment, an increased supply of air through the trachea cannot be attended by any benefit; inasmuch as none could reach the minuter

ramifications of the bronchi, however free the space for its entrance might be made. No one accordingly would ever suggest the propriety of opening into the trachea in those cases where the lung has been indurated by inflammation or infiltrated with pus, because such degeneration of the organ must necessarily prevent the due application of air to the membrane, and the usual changes in the blood cannot therefore be produced. Nor upon the same principle would any one recommend the operation, where the lung had been compressed into a useless mass by air or fluid in the cavity of the chest. These are conditions, however, in which its employment is too plainly contra-indicated to leave doubt as to its propriety, but there are other affections in which, on a superficial view, there may seem to be good reason for anticipating benefit from the operation, where, on a more mature consideration of the physiology of the parts, such a procedure would be no less forbidden than in the others. Of this description are those cases in which, while the complaints of the patients are limited chiefly to the larynx or upper part of the trachea, there is reason to suspect that the disease is not confined within such narrow bounds. It may extend continuously from the point marked out by the feelings of the patient; or, he may be correct in his insulating description as regards the

trachea, while the disease has been propagated in patches as the bronchi descend into their branches ;— or, again, there may be a healthy interval of considerable extent, but the lesser ramifications of the air tubes may at the same time present some complication in addition to the disease situated in the trachea.

In many instances experience and the history of the case can alone serve the practitioner, and these too may often prove insufficient for guiding him in his diagnosis: but in others he can derive much assistance from the information afforded to him by auscultation. The comparatively recent improvements in this mode of investigating thoracic disease, may be one reason why so little notice has been taken by surgical authors of the information which it may convey contra-indicating the use of bronchotomy, and yet the symptoms which it may unfold are of such importance, as, when present, should make the operator very averse to cutting into the trachea, however urgent may be the uneasiness produced by the impeded transmission of air through that organ. In many cases, the disease in the larynx or trachea will impart such vibrations to the air entering through them, as to render stethoscopic examination extremely difficult, and may sometimes so mask the sounds within the chest, as to frustrate any attempts to ascertain the state of

the lungs. This, however, is not always the case, for though occasionally requiring some experience and very careful observation, it is in general possible to discover the presence of disease within the thorax; the surgeon, therefore, should be on his guard not to limit his attention to the affection of the windpipe, but to investigate carefully the whole respiratory apparatus. Should he detect inflammation of the substance of the lung, or of the lesser bronchi, he will be cautious how he holds out a favourable prospect to the friends of the patient, in the event of its being deemed expedient to give him the chance, such as it is, afforded by performing bronchotomy.

The objections against performing this operation, when bronchitis to any extent is present, are founded on the impossibility, in some cases, of affording relief to the patient, while there is reason to fear that in others, even where temporary relief may appear to follow it, the fatal termination may be hastened by such a measure. Inflammation of the bronchi is attended by a morbidly increased secretion of mucus, and in many cases also of a puriform fluid, which so long as its quantity or consistency does not wholly interrupt the access of air to the bronchial cells, may not be followed by any serious consequences. When, however, it has gone on to the extent that air can no longer penetrate through

the quantity effused, the blood cannot become arterialized, and the patient necessarily dies asphyxiated. The inflamed state of the cells themselves may also give rise to similar effects, and their lining membrane may, besides being coated by this morbid secretion, be so thickened as to interrupt the progress in the change upon the blood normally produced in them. Now, in such cases of laryngeal affection as are complicated with bronchitis, though the trachea be opened, we in no manner relieve what is after all perhaps the more urgent affection of the two. The air may after the operation certainly penetrate into the bronchi, but cannot serve the end of oxygenating the blood, because in consequence of the muco-purulent infarction of the lesser air tubes, it can never reach the surface where that process is completed. The patient's symptoms may, on the contrary, so far from being relieved, become aggravated. The secretion will still go on and increase, and if he found any difficulty in expelling it before the operation, there is reason for believing that he will now find it impossible to do so with such readiness as to prevent suffocation from supervening.

A simple forcible expiration would, in many cases, seem to be sufficient for expelling the redundant mucous secretion from the bronchi; but when this has been affected by disease, both in reference to quantity

and quality—its increased effusion extending down to the smallest branches, as is the case in bronchitis of any extent—this simple effort is no longer sufficient for cleansing the air tubes. To secure this effect, recourse must be had to the more violent exertion of coughing, and the conditions necessary for its performance should be attended to.

Coughing is by no means a simple act, but depends on different, though closely associated movements of the parts concerned in respiration. Its first stage seems to consist in a deep inspiration, during which the rima glottidis is kept open, and the chest expanded to its full extent. After the lungs have been thus filled with air, a violent expiratory effort is made to expel it, while its egress is at the same time time prevented by the action of the constrictor muscles of the larynx: and on the withdrawal of this obstacle by their sudden relaxation, the air is hurried through the air passages with a velocity proportioned to the perfection in which these movements are performed. The impulse thus given to the air is necessary for the expulsion of the mucus which has lodged in the bronchi, more especially when that secretion is much increased, and extends into the lesser ramifications of the air tubes. Were it to pass through the bronchi with more moderate velocity, as in an ordin-

ary forcible expiration, the impulse might sometimes be sufficient for detaching the mucus adhering to the membrane and carrying it forward into the mouth, if it were loosely attached and moderate in quantity; but bronchitis will cause such changes in regard to both these conditions, as to require the more violent exertion of coughing for its expulsion. In such a state of the lungs, the propriety of performing bronchotomy seems extremely doubtful. The patient, if he cannot relieve himself by coughing, will perish from the suffocation caused by the accumulating mucus; and the opening in the trachea deprives him of the power of making this effort. It must, in adults frequently, and in children always, invalidate the possibility of shutting the outlet of the air tubes synchronously with the action of the expiratory muscles, and without the resistance in this manner made to their contraction, violent expiration to a certain extent may, but coughing with forcible expectoration, cannot be accomplished. Various contrivances have been suggested to relieve the air tubes of some of their contents, through the artificial opening in the trachea, but all are at best uncertain, and nearly inefficient. An assistant may remain constantly beside the patient, ready to remove by brush or otherwise, the mucus as it is hawked up to the neighbourhood of the aperture, of

which Mr. Porter, in his late work, gives several instances.* But such measures are not of sufficient efficacy to be relied upon, and must be comparatively useless where bronchitis is extensive: for the larger air tubes only, it is evident, could be thus relieved, and if they secreted as actively as we generally find they do when in a state of inflammation, even these would soon become so choked up, as to interrupt the transmission of air through the lungs.

It is possible, also, to relieve the bronchi to a certain extent, by instructing the patient to stop the opening in his trachea with his finger, and while it is thus closed to attempt a cough. Such an attempt may sometimes in the adult be followed by a considerable discharge of mucus, on suddenly withdrawing his finger from the aperture, but in the case of a young patient, it will be impossible so to school him, that he will perform his part with adroitness sufficient to produce an effectual cough, and the incapacity of any assistant to secure that effect, is too evident to require any comment. The expiratory efforts must take place at the same moment that a resistance is made to the air's passage through the

* On the Surgical Pathology of the Larynx and Trachea. Mr. Porter mentions one case in particular, where the life of his patient was saved by one of his pupils sucking out the mucus from the opening in the trachea, as it gurgled up into the wound.

trachea and this again must be suddenly removed at a time when the former are in full force. Now it is impossible for a young child so to understand what is going on, that he shall violently expire synchronously with the closure of the opening in his trachea, and that this shall be withdrawn with such exact promptitude, as to secure the expulsion of the mucus in the same way as it would be driven out by cough. To any one who reflects upon the subject, the difficulty must at once appear of thus attempting to imitate the association of a set of muscular movements which are by nature instinctively combined, when necessity for their exertion stimulates them to act.

All diseases of the larynx and trachea, in which bronchitis (at least to any extent) is also indicated, must, if the foregoing remarks be well-founded, be unfit cases for the employment of bronchotomy. Keeping this in view, accordingly, a prognosis may be formed of the probable result of the operation where this affection, or any similar one of the air cells, co-exists with the disease in the windpipe.

Cynanche Trachealis, if its pathology be rightly described by some of our best authors, is one of this class, and the history of bronchotomy in regard to it fully bears out the conclusion which might *a priori*

have been formed of its utility. In croup, bronchotomy could of course never suggest itself to any one in the first stage, because no symptoms then indicate its employment, and other remedies of known efficacy are within the physician's reach, and after the deposition of the false membrane there is much reason for doubting the propriety of the operation. This membranous tube is, by the time that bronchotomy is indicated, rarely confined, even in those cases where it originates in the vicinity of the larynx, to the trachea, but more frequently extends either continuously or in patches beyond the bifurcation of the bronchi. In other cases, we know that it may disappear in the larger air tubes, while inflammation exists in the minuter divisions, where puriform matter in large quantities is not unfrequently secreted, and this is a condition which as decidedly as the former should warn us against attempting the operation. In other instances where bronchotomy would be equally unsuccessful, the inflammatory action has, there is reason to believe, commenced in the bronchial cells themselves, and when it has reached the trachea, disease has already proceeded to such an extent, as to preclude the entertainment of favourable hopes from any treatment, and least of all from opening into the windpipe.

Cases might be multiplied, if it were necessary, to

illustrate these several phenomena, but it will be sufficient at present merely to allude to one furnished to us by Mr. Porter, where bronchotomy was unsuccessful in saving the patient's life, notwithstanding the almost cheering prospects of its efficiency which seem to have been held out by the immediate effects of the operation. In Case XI. of the last edition of his work, the patient was a girl of five years of age, who had troublesome cough without expectoration for one day before she became affected with imperfection of voice, occasional spasmodic breathing, and increase of cough which now resembled that of pertussis. For two days afterwards those symptoms gradually increased till they reached such a height as rendered tracheotomy, in the opinion of her medical attendant, her only chance for life. The operation was performed with great relief to the patient, and on the day following she seemed to be making progress towards recovery, and gaining strength,—the pulse falling considerably in frequency. An assistant was however under the necessity of sitting constantly beside her in order to prevent suffocation, by removing the mucus from the opening in the trachea, and her sleep was every four or five minutes disturbed by the urgent anxiety to get rid of this accumulation. Hopes were still entertained of her recovery till the fourth day after the operation, when

notwithstanding the great attention of the assistant in cleaning the aperture of mucus, she died of asphyxia caused by its accumulation. Mr. Porter gives an account of the post mortem examination of the body, and after describing the appearance of the larynx, he states, that "the mucous membrane of the bronchi was red, swelled and puffy, and slightly smeared over with a yellowish substance resembling paste; and above an inch of the extent of the trachea situated between the diseases was left unchanged and healthy."

In Case XII. by the same author, there is another instance of there being no trace of inflammation for some distance round the site of the incision, while the larynx was covered with a thick layer of adventitious membrane, and at the bifurcation of the trachea further symptoms of inflammation were discernible, which extended downwards, accompanied by considerable effusion into the bronchi and bronchial cells. The patient in this, as in the last case, was much relieved for some little time after the operation. The details of these cases resemble closely those of one in which a friend in the course of last winter operated under similar circumstances. The patient, a boy of three years of age, was apparently moribund on the fourth day after he was first attacked with croup, and as death seemed certain at any rate, without recourse to such a measure,

my friend thought himself justified in trying the effect of bronchotomy: as in the cases related by Mr. Porter, the relief, though immediate and great, was only temporary. The patient lingered on for some time, and died at the end of the second day after the operation.

These cases, though fatal, can scarcely be considered as wholly unsuccessful, because their result would seem to have been even more favourable than usually happens, inasmuch as life, so far as we can judge, would seem to have been prolonged by the operation. Others, if it were necessary, might be brought forward, but the preceding may perhaps be regarded as fairly representing the success of bronchotomy in croup, at least in Britain, if we except a very few solitary cases.* Such however are so rare, and bear so small a proportion to many others, if they were but chronicled, where the operation has been unsuccessful, as, in the present state of our knowledge on the subject, to cause much scepticism as to the advantage of its adoption.

Though success cannot be said to have attended bronchotomy in croup in this country, continental surgeons may seem to have been more fortunate. Thirty cases of croup are mentioned by M. Trous-

* See one by Mr. Chevalier—Medico-Chirurgical Transactions, vol. vi.

seau, in eight of which the patients were saved by the operation, and out of the twenty-two who perished, we are told that six died of contingencies, not imputable either to the operation, or to any modifying effect it might be supposed to have exerted upon the disease itself. According to his report, three were dead before the operation, and three died in consequence of the displacement of the canula, which could not be re-adjusted by the assistant left in charge of the patients.

The success of this French surgeon is so much at variance with the experience we have of the operation in this country, that we are inclined to adopt one of two opinions on the subject. We must suppose, either that M. Trousseau has been singularly fortunate in meeting with an unusual proportion of those cases, where the false membrane and bronchitic affection were limited to the upper part of the trachea; or, that some of the patients on whom he operated were not affected with genuine croup, as that disease is defined by authors in this country. "Croup," as the late Dr. Hugh Ley defines it,* "is now restricted in its application to an inflammatory affection of the lining membrane of the windpipe," whereas in several of M. Trousseau's cases, the disease, as described by him, for which he operated,

* On the Laryngismus Stridulus, &c.

was attended by other appearances, and these it would appear of such a character as to involve the doubt how far they could be considered as symptomatic of croup. Several of these cases are detailed in the Journal des Connaissances Medico-Chirurgicales,* and the following are the descriptions of the disease as it occurred to him. In the course of his report, on the case of one Théodore Chiquet, he remarks, " le docteur vit les amygdales tapissées de concrétions pelliculaires, et quoique l'enfant eût peu de fièvre et d'oppression, il pensa bien que l'inflammation couenneuse s'etait étendue dejà des tonsils au larynx." In the family where another case occurred, that of a child called Adam, two had died in fifteen days, and this was the third individual belonging to it who had been attacked in that short period. In giving the history of this case, he remarks, " une épidemie d'angine pharyngienne, pelliculaire tant qu'elle restait bornée au pharynx, envahissait promptement les voies aeriennes et faisait alors périr tous les malades sans exception. Le père des enfans nous dit, que la soeur ainée du petit Adam et son petit

* I have not had an opportunity of seeing this work, but have made extracts from the cases as they are detailed in the Encyclographie des Sciences Medicales, which I understand to contain a reprint of the Journal des Connaissances Medico-Chirurgicales.

frère avaient eu les amygdales couvertes des concrétions blanches avant d'être pris de croup, et nous pouvons constater en ce moment que les tonsils de notre malade étaient encore couvertes de fausses membranes." I need not adduce the descriptions of any of his other cases, as these are sufficient to create considerable doubt of the identity of, at least, some of them with real croup.

Though it must be admitted that in most, if indeed not all M. Trousseau's cases, he mentions the fact of something resembling the adventitious membrane having been expelled through the glottis before, or through the wound after, the operation of bronchotomy, yet his descriptions of those cases in which he operated, do not appear to apply to croup so well as to some other diseases. They agree more closely with the symptoms and morbid appearances observed in that affection of the fauces and neighbouring parts, described by Dr. Bretonneau of Tours under the name of dipthérite, where inflammation generally commences on the surface of the tonsils and pharynx, and frequently extends down into the larynx, thus giving rise to many of the symptoms which are observed in croup. In the former disease too, incrustations are met with on the trachea similar to those described by M. Trousseau, as occurring

in many of his cases, and these may even extend down the windpipe, assuming the form of the membranous tube deposited in croup.

It may seem easier thus to criticise, than completely to refute the statements of M. Trousseau, and yet there are circumstances which render doubtful the probability of his cases being identical with croup as defined by us : and if there be a difference at all between the two diseases, it may be to such extent that in the one, the affection of the windpipe, when present, rarely extends beyond the trachea, while, with the other bronchitis is generally concomitant. Moreover, there appears to be perhaps another characteristic difference between the two, as regards their contagious nature. Though croup is known to be endemic, and at times perhaps even epidemic, yet there seems no valid arguments in favour of its being contagious, whereas the cases in Adam's family favour the supposition, that such was in all likelihood the nature of the disease described as croup by M. Trousseau.

While, then, it must be evident that these successful cases of M. Trousseau, as well as others by different surgeons, cannot be relied on as examples of the advantage accruing from the performance of bronchotomy in croup, there may still be some reason why the operation is not to be altogether discarded as a useless one. It is a question on

which an unbiassed person may perhaps have some difficulty in making up his mind: for as the chief symptom of importance is impeded respiration, it must be evident, that if the obstacle to the air's entrance to the lungs be limited to the upper part of the trachea, bronchotomy, if it could be done below the site of such obstruction, ought to hold out the prospect of a favourable result. The extreme rarity of such an insulation of the affection, however, and the difficulty of getting the treatment of the case at that particular period, when, in the transition from the first to the second stage of the disease, suffocation is just commencing, but no bronchial affection to any extent is present, are circumstances which must materially lessen a surgeon's confidence in the efficiency of the remedy. Further evidences of its utility are still much wanted.

The conclusions which these considerations would point to is, that with the means of diagnosis which we at present possess, and the precedents of success from the operation, croup is not one of those affections in which, except in some very rare cases, if indeed in any, bronchotomy can be safely recommended as an effectual remedy: and even in these it is probable that other modes of treatment would be equally efficacious.

The amelioration of the symptoms which followed the operation in the cases previously alluded to, would seem indeed to hold out some encouragement for its adoption. The amendment, however, in such cases, is but delusive and temporary, and occasioned by no improvement in the disease itself. The urgent symptoms for which bronchotomy was performed, were, it is probable, caused chiefly by the adventitious membrane causing suffocation in the trachea, while the lesser branches of the air tubes, though in some measure obstructed, were not so to such an extent as to attract any particular attention during the violent paroxysms of dyspnœa produced by the former impediment. When it was removed, the patients, as might be expected, were in a state of apparent tranquillity when compared with their former condition, though the disease was still making a downward progress. As it descended, the dyspnœa accordingly increased, till the patients, now, on account of the opening in the trachea, unable to expel the increased secretion, died asphyxiated. The urgent symptoms might also, in some degree, be further mitigated by the afflux of arterial blood to the brain, caused by the freer access of air to the blood stagnating in the lungs. The cerebral system, besides being affected by the diminished supply of the blood circulating through it, in con-

sequence of the congestion in the lungs, would also have its functions materially affected by the deteriorated quality of that little which had lately reached it. In some cases, probably in many, this refreshing supply might come too late,—that is, not until the brain had sustained a shock similar to such impressions from other causes, from which it could not ultimately recover though it might for a short time appear to rally. If, however, the deleterious effect had, in such cases, been more gradually brought on, that organ, being, as we know, though impatient of any sudden impression, yet capable of bearing the same amount if slowly produced, would now be invigorated by the fresh stimulus of better oxygenated blood, and thus for a time react favourably on the general system. This, however, could be only a temporary effect, for one cause of suffocation, and that, though slower yet equally formidable, would still continue in operation, and its nature would be such, that the very means tending to obviate the obstruction in the trachea, would also tend to increase the probability of a fatal result to the bronchitis.

In Phthisis Laryngea, on the general grounds already stated, bronchotomy cannot with propriety be resorted to, unless the state of the lungs be ascer-

tained to be sound. However advisable it may be where these are in a good condition, as will be alluded to hereafter, it is to be refrained from in the far more numerous class of cases in which the disease is not limited to the larynx. Here, occasionally, the patient may for a short time obtain some relief from his uneasiness, by the freer access of air secured by the operation; but this will too frequently be only temporary, and may in some instances even hasten on his death. The most serious part of his complaints will derive no benefit from the remedy, while it is to be feared that the operation, simple and nearly harmless though it be in other cases, may be here productive of bad consequences. If before it, expectoration had been considerable, the patient will after it be unable, for the reasons already stated, to expel the mucous accumulation, and the pulmonary symptoms will, so far from being relieved by the operation, probably become aggravated.

II. If it be admitted that the co-existence of such affections of the lungs and air vessels, as have been noticed, constitute sufficient grounds for not resorting to bronchotomy in diseases of the larynx and trachea, the second division of these remarks must, in a great measure, resolve itself into the converse proposition,—that where no such complication exists,

that operation may be performed with a fair prospect of success. Where the disease is thus limited to the larynx, or upper part of the trachea, the patient is just in the same condition with one in whom any extraneous obstruction impedes the entrance of air into the lungs. If the removal of such an obstacle bring relief in the latter case, so in the former, if the operation be performed below the site of the temporary obliteration of the air tube, an equal amount of benefit may reasonably be expected. There are cases, accordingly, in which bronchotomy, so far from being one of the last resources of the practitioner, becomes a valuable remedy in the treatment of some of the most formidable complaints.

The windpipe is subject to numerous modifications of disease, which till of late years were involved in much obscurity. Though their pathology, however, notwithstanding late improvements in it, cannot yet perhaps be regarded as precise, it is too evident from the history of such affections, that their respective effects resemble each other in the destruction which each occasions to the transmission of air to the lungs. This may not unfrequently amount to complete suffocation, and wherever this tendency exists, in the absence of any contra-indicant symptom, bronchotomy has been judiciously recommend-

ed by Louis, Lawrence, Porter, and others. In order that it be effectual, however, the operation must be had recourse to early in the disease, when milder remedies seem incompetent to subdue it, for when delayed too long, and the complaint makes rapid progress, several conditions of the system are induced, which must render the performance of bronchotomy either altogether futile, or materially lessen its probability of success. Thus, if the patient be not soon relieved, emphysema of the lungs and effusion into the bronchial cells will be apt to supervene, or the blood, being in consequence of the obstruction imperfectly arterialized, will become congested in the lungs, and thus reacting on the brain, asphyxia or coma will be the consequence. Though in some such cases the heart should still contract, and pulsation be felt at the wrist, yet at that late period of the disease little benefit can be expected from bronchotomy. The diminished quantity and deteriorated quality of blood circulating in the brain and other organs, may already have produced a permanently deleterious effect, by causing a state of insensibility and prostration of the vital powers, from which the patient cannot be roused by any means whatever. The result of these will be, that though some arterial blood may, in favourable cases, again circulate for a time, in consequence of the air's admission to the lungs,

yet the depressing influence already produced may have been so long continued, and of so serious a nature, as to render recovery impossible. If the functions of the brain have been to any great extent deranged by the vitiated circulation in it,* asphyxia will at this stage be threatened, not by any mechanical impediment to the entrance of air to the lungs, but by the imperfect respiration induced through the intervention of insensibility. Accordingly it is probable, that after coma or convulsions have set in, it is too late to open into the windpipe; for by the time that these symptoms supervene, it may be inferred that the brain's functions have been too seriously affected to hold out any prospect of their being restored with sufficient promptness to save the patient.

In illustration of this remark reference may be made to a case related by Dr. Cheyne,† where, after inflammation of the larynx had continued for twenty-four days, bronchotomy was performed. Before recourse was had to the operation, the patient seems to have been in a comatose state; for as Dr. Cheyne states in his report, "his head suddenly fell on his breast, he ceased to respire, and the complexion had changed from the purple of imperfect circulation to the paleness of death." After the trocar had been intro-

* See Appendix.

† On the Pathology of the Larynx and Trachea, 1809, p. 163.

duced through the crico-thyroid ligament, the patient breathed for some time through the canula left in the opening. His pulse was distinct, but he never seemed sensible to any external impression, not even during the performance of the operation. He died about two hours after the trachea had been opened; but for some time before his death the pulse had been regular at the wrist, and the efforts of the respiratory organs seemed vigorous, though the inspirations had fallen to seven or eight in a minute. In his comments upon this case Dr. Cheyne observes,* "I am inclined to think that this gentleman died from the circulation within the head having become oppressed. I admit that I did not entertain this view until the patient was dead, and I had time to consider the case more deliberately. The change which took place was instantaneous, from a distinct feeling of his situation to an insensibility from which he never emerged. He breathed freely both through the canula, the mouth, and the aperture in the windpipe, after the canula was withdrawn. The diaphragm was capable of great exertion, and the lungs of being filled with air, yet his countenance never altered from the paleness of death." The progress of this branch of surgery, ever since the publication

* Op. Cit. p. 171.

of Dr. Cheyne's work, will in some measure serve to qualify the reflection which he himself made upon the treatment adopted in the case. "Upon reviewing this case," says he, "I scarce think any means were neglected; I rather regret that the larynx was perforated," &c.; and further on, "I am persuaded that the operation affords no additional chance of recovery."

It must appear that the charge of the inefficiency of the operation is imputable, not so much to the nature of this case as to the period at which bronchotomy was performed. No one can now say whether or not the earlier recourse to it could have saved the patient, but under similar circumstances it seems probable that surgical interference would in these times be resorted to at an earlier stage of the disease, after medical treatment had appeared to be productive of little or no benefit. Before the opening was made into the trachea, there seems to have been an impression made upon the brain, of such amount or duration, as to destroy the functions of animal life, while those of organic life continued moderately sound, and the operation was done too late to prevent the destruction of the former from reacting injuriously on the latter.

Whatever, therefore, be the nature of the laryngeal affection (provided always there be no pulmo-

nic complication sufficient to contra-indicate the operation) where its effects are threatened suffocation, bronchotomy should be performed early if it is to be performed at all, and the more acute the attack the more prompt should be the application of the remedy if milder treatment appear to be inefficient. In cases of a more chronic nature, the lungs may gradually be brought to tolerate a diminution in the quantity of air which reaches them at each inspiration, but where the usual supply is quickly cut off, the system is less capable of accommodating itself to the privation, and in such instances the demand for the operation is more urgent, but at the same time its success is perhaps more demonstrably satisfactory than where the progress of the disease has been less rapid. It must be kept in mind also that cases not unfrequently occur for which there are medicinal agents of sufficient efficacy, if time were allowed for the full development of their effects. In these, however, the inflammatory action which threatens suffocation may not begin to yield to gentler treatment until the patient's fate is to a certain extent sealed. Such remedies may act well in gradually diminishing inflammation, but not in suddenly checking it, and if by any means assistance can be derived from some other measure, which will give time for their operation, the case may termi-

nate favourably. Bronchotomy seems to hold the place of such a measure, and in this state of matters accordingly its history corresponds with the advantages to be thus anticipated from its use.

There are other cases in which this operation would also seem to claim a higher character than that very equivocal one of being a last resource; in which, on the contrary, it may form a very important part of the treatment. Those, namely, where, from idiosyncracy or other causes, bleeding or powerfully depleting measures cannot be adopted. If it was advisable in the former, it is doubly so in this class, because all active and efficient efforts to save the patient are in a manner forbidden, and the chief source of hope must lie in time so wearing out the disease as to allow of his ultimate recovery. Without the aid of bronchotomy, however, such waiting on may in some instances amount to certain death; for it is to be feared, that before the decline of inflammation, asphyxia may have terminated the sufferings of the patient. But if the more urgent tendency to suffocation be warded off, as it may be by this operation, we are enabled to treat him more deliberately, and either wait till active remedies may safely be applied, or avail ourselves of the longer time allowed us for less vigorous treatment.

Some of the most successful operations of opening into the trachea will be found to have been performed in cases to which the preceding remarks are more or less applicable. In the various forms of acute laryngitis, when that disease cannot be subdued in its earlier stage, bronchotomy holds out the best prospect of a favourable result. If the attack be violent, inflammation runs its course so rapidly that resolution cannot be attained by the most energetic measures and effusion of serum into the submucous cellular tissue, causing what is termed Œdema Glottidis, or of lymph upon its inner surface, will speedily extinguish life if air be not admitted artificially to the lungs. This remark, as to its rapid progress, may seem at variance with one made by Dr. Baillie,* that " very few cases have occurred of inflammation of the mucous membrane of the larynx, and of the trachea, so violent as to destroy life in a few days ;" and he adds, that " in a practice of more than twenty years, he had only met with two such cases." Though his successors have profited largely by this physician's judgment in diagnosis and exertions in pathological inquiry, it is not improbable that even in his own time many sudden deaths may have occurred from acute laryngeal inflammation

* His Works, by Wardrop, vol. i. p. 54.

which may have been regarded as the effects of some other disease. Mr. Porter's remarks on the insidiousness of its approach, together with several cases narrated by him, appear fully corroborative of the truth of such a surmise.* In two instances within his own recollection, young men had gone to bed without any complaint, who were found dead the next morning. The day is perhaps not long gone past when such sudden deaths, in the ignorance of their true cause, might have been imputed to apoplexy, or some affection wholly unconnected with the respiratory organs.

Nothwithstanding Dr. Baillie's limited opportunity of studying the nature and treatment of such cases, the conclusions arrived at by him in regard to the latter, are fully borne out by the observation of later authors. "It evidently appears," says he, "from the cases which have been related," (three in all—one had been reported to him, and two he had himself attended) "that both general and topical bleeding, when employed early and strenuously was of no real use. Nor was any benefit derived from blisters, purgatives, expectorating or cooling medicines." Further, "this operation (bronchotomy) would probably enable the patient to breathe till the

* See Appendix.

inflammation in the larynx, more especially at the aperture of the glottis had time to subside." Whether this operation would be successful, can only be known by experience, but as far as we can judge *a priori*, it has so reasonable a chance of success as to justify a trial in so fatal a disease, and thereby to ascertain the degree of benefit to be derived from it."* The trial has since Dr. Baillie's time been made, and, as he anticipated, with a favourable result. Looking back indeed upon those very cases which he has himself recorded, there seems to be little doubt but that had bronchotomy been performed at an early part of the disease, the patients might have recovered. From the history of the cases themselves, and the *post mortem* examinations, no morbid change in the tissue of the lungs, nor bronchitic affection seems to have been present, but the larynx and upper part of the trachea were alone involved in the disease. The state of the lungs indicated by their not collapsing on the thorax being opened, seems to have been the consequence of emphysema, and serous effusion produced by the great and continued struggle for breath made by the patient.

In Mr. Lawrence's Memoir,† he describes a laryngeal affection apparently of a more chronic nature

* Op. Cit. vol. i. p. 65.

† Medico-Chirurgical Transactions, vol. vi.

than the preceding. In the cases there referred to by him, the inflammatory symptoms were not well marked, but the fatal progress of the disease, though in some instances very slow, is, if it be not successfully arrested, not the less certain. That eminent surgeon states, that at the time* he read his communication to the Medico-Chirurgical Society, he had examined after death five cases of this complaint, besides the two where bronchotomy was performed, and the particulars of which he relates. He remarks on these,—"Although I am unacquainted with the details of the histories and symptoms of these cases, I know that they were not acute diseases, that there was no stage of active inflammation, and that the patients lived many days after the difficulty of breathing had commenced." The *post mortem* appearances were similar in all, and are thus described by Mr. Lawrence in his account of one of those cases which he himself had seen. "The membrane of the chordae vocales, sacculi laryngis, and front of the arytenoid cartilages, possessed its natural colour, but was thickened and granulated on its surface, so as completely to shut the rima glottidis. The affection, entirely confined to the parts first enumerated, occupied a very inconsiderable extent of the membrane, just enough to

* June 6, 1815.

close the entrance of the trachea. The rest of the tube, the epiglottis and neighbouring parts, and the contents of the chest were perfectly healthy." In this form of laryngeal affection, the effect produced, namely suffocation, would appear to be the same as in the most acute form, but according to Mr. Lawrence's experience even less under the control of medical treatment. This might indeed be inferred from the frequently fatal result of the disease, though time be allowed for some effect being produced by the remedies, if the complaint had any disposition to yield to them. Mr. Lawrence considers that "local and general bleeding, blisters, and the various internal means are usually inefficacious, and that the operation of bronchotomy, by procuring an artificial opening for the air produces complete relief." This, however, is ineffectual, as he adds, unless early performed, on account of the debilitating effects on the constitution, which are in themselves fatal after a time, even if the impediment to the air's passage be removed.*

In this Chronic Laryngitis, accordingly, as much as in the acuter form, there are circumstances which, when the efficacy of milder remedies appears doubtful, would indicate the propriety of resorting to bronchotomy. The disease is in general limited in extent, and, at least at its commencement, rarely

* Medico-Chirurgical Transactions, vol. vi. p. 248.

complicated with bronchitis or other pulmonary derangement. After it has continued for some time, however, besides the constitutional symptoms mentioned by Mr. Lawrence, some organic change of the lungs, as emphysema or effusion supervenes, when, as might be expected, surgical interference will be of little avail. If, on the other hand, the operation be resorted to in good time in this as in the other variety of laryngitis, these are the idiopathic diseases of the larynx, in which bronchotomy is likely to be attended with the most favourable results.

It is not the province of this paper to enter minutely into the pathology of those affections in which bronchotomy has been advantageously employed, except in so far as they illustrate the principle stated in the commencement; nor without prolonging it to an inconvenient length, is it possible to weigh the arguments for and against the operation in individual modifications of the same disease. Such an investigation would indeed be highly interesting, but would call for more lengthened statements and more elaborate discussion than can be devoted to it in these remarks. It has appeared better for the present to confine them to the statement of some of the general principles, as they may be called, in accordance with which the adoption or rejection of broncho-

tomy is to be determined on, and briefly to apply these to some of the diseases where that operation may seem to be indicated.

Nearly allied to acute idiopathic Laryngitis is that form of the affection which is caused by acids, hot water, or other irritating matters incautiously taken into the mouth. Here, too, bronchotomy is indicated, and with another view besides that of relieving a mechanical obstruction. The inflammatory action caused by the irritation consequent on such accidents must no doubt materially thicken the lips of the glottis and neighbouring parts, thus giving rise to imperfect respiration ; but another object is to be gained, besides relieving this tendency to suffocation, namely, the promotion of the sanative process at the seat of the injury. In the highly irritable state of the parts affected, it is evident that their constant movement, and the excitement produced by the permeating air must delay, if not altogether prevent their healing, and by removing the necessity for their action, we remove an offending cause. By performing tracheotomy, air is allowed free access to the lungs, and thus not only is the patient relieved from the sense of anxiety otherwise attendant on such accidents, but also the rest in this manner secured to the parts about the glottis acts beneficially in diminishing vas-

cular excitement, and thus favours the abatement of the inflammation occasioned by the irritating fluid.

For similar reasons bronchotomy may be advisable in those accidents where, though no inflammatory action be present, the nature of the case is such that suffocation is threatened, and in many cases restoration of the parts to their healthy condition is prevented. A severe blow on the larynx, for example, may so alter its dimensions, or otherwise obstruct the caliber of the trachea, that though no thickening of the lining membrane immediately supervene, asphyxia may in a very short time cut the patient off, if air be not artificially admitted to the lungs.*

Where the windpipe is wounded, as in the attempts of the suicide, it may sometimes happen that the injury is so complicated with displacement of the neighbouring textures, that free respiration is effectually prevented. By securing, as in bronchotomy, the air's entrance to the lungs through an avenue unconnected, in some manner, with the site of the injury, the feelings of the patient are tranquillized by the easy breathing thus restored; and while the additional opening in his windpipe does not materially increase his danger, the wound itself can be leisurely

* See Appendix.

and effectively attended to, besides being also in a condition more favourable for healing, than when constantly liable to be disturbed by the air passing in and out of the thorax. Such accidents may, moreover, threaten instant death, in consequence of detached portions of the windpipe closing up its passage. Illustrative of this there is a remarkable case mentioned by Sir Charles Bell.* A man was brought into the Middlesex Hospital who had cut his throat, "There were times," says the report, " when he suffered violently from difficulty of breathing, and then a flapping of something in the throat could be heard. He died; and it was discovered that the knife had gone so critically that it divided one of the arytenoid cartilages, and the portion hung by the membrane so as to vibrate in the chink of the glottis, like a pea in a cat-call, and acting as a foreign body caught in the rima glottidis, occasioned suffocation; nor is this a singular occurrence." In the same work is mentioned a case where a girl in attempting suicide, plunged a knife into the trachea, and drew it downwards dividing five rings of the trachea. She lived for some time after the injury, and ultimately died from the divided edges of the cartilage turning inwards, which, with the swelling of the lining membrane, so diminished the caliber of the tube, as to produce

* Surgical Observations,—Part I. p. 45.

suffocation. The simple statement of these cases will, without any comment upon them, point to the utility of bronchotomy in similar predicaments, whatever be the manner in which they have been induced.

Cases of disturbed and impeded respiration sometimes occur in which it is almost impossible, even for the most acute and experienced practitioner, to form a correct diagnosis. They frequently appear to be either entirely functional, or so slightly to affect the structure of the organ concerned, as to entail no inconvenience on the subjects of them, if the temporary dyspnœa be relieved; or, if death be the consequence, to leave no morbid appearance which can account for the symptoms observed during life.*

Section, paralysis or irritation of the laryngeal nerves, as has been amply demonstrated by experiment and by the effect of disease, may so suspend or irregularly excite the action of the muscles which they supply, that the aperture of the rima glottidis may be closed to such an extent as in some cases to produce instant death. It is fully ascertained that when respiration becomes at all hurried, the aperture of the glottis is enlarged during inspiration and contracted during expiration. From the results of

* Dublin Journal of Medical Science—No. xxviii.

experiment it would also appear that when both the superior and inferior laryngeal nerves are cut, the muscles of the larynx no longer move in unison with the other muscles of respiration, and the aperture of the glottis remains permanently open. But since it so happens that the inferior laryngeal nerves are principally distributed upon those muscles which enlarge the rima glottidis, while on the other hand the superior laryngeal nerves supply those which diminish it, the section, or paralysis of the former must be followed by most important effects upon the facility with which air passes through the larynx during the respiratory movements. For it necessarily follows, that when the aperture of the glottis is contracted during expiration and the action of inspiration succeeds, the arytenoid cartilages are from the section or paralysis of the recurrent nerves no longer drawn outwards by their dilator muscles, but on the other hand are carried further inwards by the current of air rushing into the larynx, through which its passage will thus be seriously impeded or altogether suspended.

A nervous affection of this description may be caused in different ways, and its duration may vary considerably. It may amount to but a momentary derangement of function, and cause no further inconvenience to the individual, than the temporary

anxiety attendant on obstructed respiration; or, on the other hand, it may be prolonged till death supervene as the consequence. Where there is cause for dreading the latter result, it is evident that the prompt recourse to bronchotomy alone could save the patient; for the functions of the parts concerned, even supposing their temporary derangement to be the full extent of the affection, might not return before the dyspnœa had terminated fatally. In other instances, perhaps of greater danger, the nerves may be more permanently irritated or paralysed, as where tumours press upon them in their course to the larynx.* If these could not be removed, it would in many cases be advisable to open into the trachea, for by doing so the transmission of air to the lungs would be secured independently of the nervous chain, over which it might be impossible to exercise any such immediate influence as to save the patient from suffocation.†

In no cases is bronchotomy more clearly indicated

* See Appendix.

† Dr. Marsh of Dublin, remarks in a valuable paper by him in the Dublin Hospital Reports,—" Dr. Johnson has stated to me, that he has seen a child in a state of asphyxia caused by this disease, (spasm of the glottis) recovered from apparent death by the instantaneous application of artificial respiration."—Dublin Hospital Reports, vol. v. p. 619.

than in those where a foreign body is impacted in the larynx, or forced through that aperture into the trachea, or one of its bifurcations. The form and dimensions of such a body, or its situation and mobility in the air passage will of course greatly modify the uneasiness which its presence causes to the patient. If it be large and impacted in the rima, instant death will be the consequence ; or if it be moveable in the trachea, and more especially, if it be also of an angular form, it will, if not extracted, sooner or later cause fatal inflammation of the lining membrane of the bronchi. Though in some instances the symptoms may appear extremely mild, so much so, indeed, as to quiet the fears of the patient, and perhaps even of the surgeon himself, yet they have often been remarked to prove fallacious, for sooner or later, the presence of the substance in the air tube will bring on a fatal termination to the case. From instant suffocation, however, or the slower fate of pulmonary disease, bronchotomy holds out a favourable prospect of relief. If wedged into the rima, the foreign body can be reached through the aperture in the trachea, and either pushed up into the pharynx or extracted through the incision ; or, if it have descended below the site of the operation, it will, in the greater number of cases, be forced through the artificial opening by the upward current of air, or in the

event of this not taking place, be extracted by the operator. Of these different results, the history of surgery furnishes numerous examples.

In such cases, especially if they be of long standing, it must be admitted that some bronchitis is generally present, and not unfrequently to such an extent as might, agreeably to the principle stated in the earlier part of these remarks, contra-indicate the operation of bronchotomy. Where the bronchial inflammation is limited to a small space, no one would of course hesitate in performing the operation, and even where it is general and severe this may be regarded as a case, probably the only one, in which such a measure would be attended by a favourable result. The inflammatory action is so clearly the effect of an extrinsic irritant cause as to render the probability strong, that when this is removed, the bronchitis will subside.

In all the affections hitherto noticed under the second division of the subject, which are far from forming a complete catalogue of the various modifications of disease in which tracheotomy may be advantageously employed, it will be found that with the exception of the last, inflammation does not in general extend down into the lesser bronchi. As the reasons for which an exception is made in favour of that case appear to be sufficiently satisfactory, the

position will still hold good, that diseased lungs, as laid down by all, and bronchitic inflammation of any extent, as perhaps not sufficiently insisted on by some surgeons, are contra-indicant symptoms of the operation of bronchotomy. The converse proposition is equally tenable, that their absence should encourage the surgeon in its performance, where other circumstances call for its adoption.

Cases sometimes occur, in which, though bronchotomy be not distinctly contra-indicated, its performance is still a measure of doubtful propriety, inasmuch as the restoration of the air passages to a healthy state, cannot reasonably be looked for. Of this nature are some of the varieties of Phthisis Laryngea, which, threatening the life of the patient, will in many instances prove inevitably fatal, unless some substitute be found for the transmission of air to the lungs. Where these were in a healthy state, bronchotomy has accordingly been useful; and though the nature of the laryngeal affection be such, which in most cases of this nature it probably is, that it is to be feared the patient must breathe through a canula for the remainder of his life, yet it would appear that even this, in time, ceases to be an annoyance of much importance to him, and he can, with comparatively little inconvenience, pursue his usual

avocations even where these require some bodily exertion.* The parts about the larynx are prevented from resuming their function, because the lining membrane having become permanently thickened, or the ulcers, in the progress of healing, having left numerous cicatrices, the aperture of the rima glottidis has thus been rendered insufficient for the due admission of air into the lungs, and can rarely allow of the artificial opening in the trachea being with safety dispensed with.

* See Appendix.

APPENDIX.

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Though later* experiments have set aside, in some measure the conclusions arrived at by Bichat on the subject of Asphyxia, his observations are perhaps less unsound in kind than in degree. The effects of venous blood circulating through the system, seem to be more of a negative than of a positive nature, inasmuch as though not absolutely deleterious, that fluid is insufficient for the due stimulus of the organs to which it is applied.

While Dr. Kay† is justified by the result of his most satisfactory experiments, in rejecting the theory of the French physiologist as to the destruction of muscular contractility by the presence of venous blood in its tissue, he himself admits that it is less favourable than arterial for the development of the phenomenon ; and if such be its effects on muscle, there

* See Dr. Williams in Edinb. Med. and Surg. Journ. vol. xix.
Dr. Alison, ditto, ditto, vol. xlv.
Kay on Asphyxia.

† Kay, p. 150.

is greater reason for believing that it will extend also to the brain. The symptoms alluded to in the text, may perhaps be produced partly by the disturbance to the balance of circulation in the brain, caused by its no longer receiving a due supply of blood of any kind, even though the left ventricle may contract for some time after the blood has stagnated in the lungs and right side of the heart. While the coma may in some measure be thus accounted for, which appears in those cases where protracted obstruction exists to the due arterialization of the blood, it seems to be in a great measure caused by the circulation of venous blood in the substance of the brain. The conclusion arrived at by Dr. Kay, from numerous experiments carefully performed, is to the effect that venous blood, though certainly less nutritious and stimulating than arterial, may circulate through the brain without suddenly affecting the nervous system by contact with the substance of that organ. He remarks, however, " that its presence in the vessels of the brain occasions languor and feebleness, and if its circulation be prolonged, we may imagine that sensation would become still further impaired." *

If pathological phenomena be taken into consideration, there is further reason for believing that impeded respiration may, by producing venous circulation in the brain, occasion a similar condition. It must be frequently remarked that in some diseases of the chest, especially in the advanced stages of extensive bronchitis, the patient is frequently oppressed with irresistible drowsiness. Whether this symptom be the result of diminished circulation in the brain, or of the deteriorated

* Op. Cit. p. 198.

quality of the blood sent there, is still doubtful; but it seems not unlikely that both causes may be in action. Whichever be the true one, however, this tendency to stupor appears to be the effect of some modifying influence on the cerebral circulation exercised by the disease, and the impression thus made upon the brain may be of such amount or duration, as to bring that organ into a condition from which it cannot recover, even upon removal of the offending cause. The impairment of the cerebral functions thus produced, may, by causing coma, or in other words, suspending all sensation, interrupt the respiratory movements of the thorax, when fatal asphyxia will of course supervene.

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Though it may be unnecessary to multiply cases illustrative of the rapidity with which acute laryngitis may run its course, the two following cases, extracted from Mr. Porter's* excellent work, may show the qualification with which Dr. Baillie's statement on the subject must be taken.

"Case XIII.—In the month of April 1816, a gentleman residing about sixteen miles from Dublin, was attacked with what he conceived to be a sore throat. He was a large man, very strongly made, inclining to corpulency, but of active habits, and moderate in the pleasures of the table. He might have been about forty-seven years of age. He was taken ill

* On the Surgical Pathology of the Larynx and Trachea, pp. 98-9.

in the evening with shivering and an inclination to crouch over the fire, slight headache, pain in the throat, and trifling difficulty in deglutition. He had some warm drink, and went to bed, but passed the night rather restless and uneasy, and when towards morning, exhausted with watching, he had fallen asleep, he shortly awoke in a paroxysm of suffocation. Still when he had roused himself, the difficulty of breathing was not such as to occasion great alarm. He complained of a dryness or huskiness in his throat, and was annoyed by a short cough without expectoration. In the morning an apothecary who resided in the neighbourhood was summoned, and by the time he arrived, the symptoms had advanced so rapidly as to become serious and alarming. The patient was bled, had purgative medicines, and a large blister was applied to the throat, but without the smallest relief.

" Happening accidentally to be in the neighbourhood, I was called to see him about four o'clock in the afternoon. His face was then pale and swollen ; his eyes glassy and protruded ; his breathing loud, harsh, and stridulous ; and the efforts he made to carry on this function were frightful. His pulse very rapid, but not full. He perfectly retained his senses, and pointed to the thyroid cartilage, when questioned as to the seat of his distress. He died in about an hour afterwards, *twenty-one* hours from the first approach of the disease."

Case XIV. by the same author, is no less corroborative of the remarks in the text.

" On 16th February 1819, I was requested by a woman of the name of Mathews to examine the body of a boy to whom

she had through charity given a lodging in a waste room, and whom she suspected to have taken poison. She could give no account of his illness, except that he had been dull and heavy the entire of the preceding day, unable to beg about the streets as usual, but complained of feeling his throat sore, and in the evening had gone to an apothecary's shop, where he got something in a cup, but what it was he could not tell. He went to rest early on his bed of straw, and was found dead next morning."

The appearances after death which are narrated in his work, satisfied Mr. Porter that the subjects of examination in both cases had died of Laryngitis Œdematosa.

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In illustration of such causes of suffocation I may here give in his own words a case mentioned by Mr. Liston.*

" A fine healthy child, aged eight, in running across the street, fell and struck the larynx with great force upon a large stone. She was taken up quite lifeless, and some time elapsed before respiration was at all established. A gentleman finding her face livid, opened the temporal artery, and applied leeches to the throat with some relief. I saw her about three hours after the accident. The breathing, inspiration more particularly, was exceedingly difficult, and this appeared to proceed not only from the injury to the larynx probably occasioning loss of power in the muscles, but

* Elements of Surgery, 1831, part ii. p. 257.

from collection of some fluid in the trachea and its ramifications. The child was evidently in such a state, that unless active measures were resorted to, and that speedily, a fatal termination would soon take place. Bronchotomy was performed; a quantity of coagulated blood and bloody mucus was evacuated from the opening; and when the discharge and coughing had ceased, a tube was introduced. In a short time the tube was withdrawn, and the aperture closed, and no unfavourable symptoms occurred."

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The following cases, taken from the work of the late Dr. Hugh Ley,* are, as well as others reported by him, of much interest in relation to this part of the subject.

"J. A. aged nine months, was always delicate, but never seriously ill until three months since, when the parents first observed something peculiar in its breathing. It seemed one day when wakened out of its sleep to be nearly choked. It had another attack on the same day, and after this there was frequent spasmodic crowing, especially when the child was excited, when it awoke from sleep, or after meals.

"When first visited the diagnosis was difficult, and a guarded statement was therefore made; but there was some suspicion that it might be hooping-cough, the sounds in inspiration resembling each other. But after a few more visits it became perfectly clear that the disease was that so well described and

* On the Laryngismus Stridulus, p. 40.

reasoned upon by Dr. Hugh Ley. The peculiar countenance, the distortion of the limbs, and above all, the visible enlargement of the cervical and even axillary glands, warranted a decided opinion as to the real nature of the complaint. The spasms or fits gradually increased, and more than once I was called in suddenly to witness the death of the child. Upon these occasions there seemed little or no hope of recovery; nevertheless in time the purple countenance disappeared, the blanched lips resumed their hue, and respiration returned. The child, however, rapidly fell away, and as it became weaker the fits returned with less violence, but greater frequency, coming on every quarter of an hour. Their character was the same, only that latterly there was less of the excited attempts at respiration. The infant was cheerful during the intervals, and now and then rallied, and gave slight hopes of improvement. Alteratives, aperients, and tonics, were employed, but without avail; the child died three months after the first symptoms of disordered respiration.

"*Post mortem* examination: The submaxillary, parotid, sublingual, and indeed all the glands throughout the body, were not only enlarged, but even apparently increased in number. The mesenteric particularly were diseased.

"The bronchial glands upon the right side surrounded the recurrent nerve which was completely embedded in a cluster of enlarged glands. On the left side there was to be seen but one, and that one not large. It was about the size of a pea, very hard, and seemed to press upon the nerve, squeezing it, as it were, against the trachea. The nerve in its course was accompanied by other glands.

"The larynx was healthy, the lungs gorged from congestion, almost resembling pulmonary apoplexy; the heart was hypertrophied, the left ventricle being also enlarged."

In another case which Dr. Ley attended along with another medical gentleman, the symptoms were similar to those enumerated in the last, and the child died of what its parents denominated a "choking."

The pathological appearances were the following: "No unusual congestion of the vessels of the meninges, or of those in the substance of the brain; the ventricles contained no fluid, and the brain was of the usual firmness in a child of that age.

"After removing the integuments from the front of the neck, the glandulæ concatenatæ could be felt enlarged, some of them appearing of the size of peas.

"The muscles being removed, and the par vagum traced from the top of the larynx to where it gives off the recurrent on both sides, three or four glands as large as peas were found upon and at the side of the recurrent, where it passed over the bronchi, just after their division from the trachea.

"On the right side, the angle formed by the innominata and subclavian artery was occupied by a gland; another behind the innominata was equal in size to a large almond, over which both the recurrent and par vagum passed, and a whole train of smaller glands accompanied the recurrent in its course by the side of the trachea, covering and obscuring the lateral filaments which proceed to the back of that canal.

"The mesenteric glands were much enlarged, some of them equal in size to pigeons' eggs. Peyer's glands at the lower side of the ileum were much developed and indurated, as well as the solitary glands. The others were in their normal state."

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Mr. Porter* narrates a case of Phthisis Laryngea, for which he performed bronchotomy, and the patient, after passing through a very dangerous state, ultimately recovered. The report a month after the operation is as follows:—

"Dec. 28. To look at this patient one might suppose him to be in perfect health, excepting the circumstance of the artificial respiration; his complexion is clear, the expression of his countenance tranquil, his sleep refreshing, his appetite improving; he still passes part of his drink by the wound, but it is probable the internal ulceration is healing, as there is now scarcely any foetor, and no purulent expectoration. However, on closing the wound, he cannot succeed in carrying on respiration in the natural way for a single minute; he makes a good attempt at speaking, but in a very hoarse rough tone."

On the 13th January following, he left the hospital quite recovered, except that he was obliged to breathe through the tube, in which condition he has continued ever since. Mr. Porter adds, "About three years after the operation, the tube became corroded and broke across, a portion of it dropping into the trachea, where it occasioned great distress, but was removed without difficulty. He has since continued quite well, and though breathing through a tube, earns his livelihood at the laborious occupation of a stone cutter."

* Op. Cit. 170.

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