reward we covet is that of being numbered among the true workers in science and searchers after truth—Science that has revealed the mysteries of our organisation, eradicated superstition from our minds, extended wide the bounds of knowledge, and put back the limits of the unknown, abridged both space and time, strengthened our intellectual gaze till we almost pierce the veil of Eternity and realise the Life beyond.

Gentlemen, my task is nearly done. I have only to add my own good wishes to those of my colleagues for your health, happiness, and success.

INVESTIGATIONS RELATIVE TO INHALATION AND DISINFECTION.

WITH DESCRIPTIONS OF NEW FORMS OF APPARATUS.

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IN my paper published in THE LANCET of the 5th of May last I stated the results of certain experiments made with some of the principal of the oral and oro-nasal inhalers now in use, and I showed that after the completion of one and even two hours' inhalation more than four-fifths of the antiseptic substances usually employed, as carbolic acid, creasote, and thymol, were recoverable from the sponge or cotton-wool of the inhaler. I pointed out that there were several ways in which the small loss which had taken place might in part be accounted for, without its being supposed that the antiseptics had really made their way to the seat of the disease in the lungs themselves. I have since continued my investigations and made many further experiments bearing on the subject of inhalation. In a paper communicated to the British Medical Association at its recent meeting at Liverpool, I gave the results derived from certain trials and experiments made with some of the chief air and steam sprays, and I showed that in the case of the sprays also a very large proportion of the antiseptics employed were recoverable; the inference being that, except in the case of throat affections, they were but little more effective than are the oro-nasal and oral inhalers, as at present constructed and used. In the same communication I detailed the results of experiments with an apparatus devised in imitation of natural respiration; these proved that, using the oral and oro-nasal inhalers and the air and steam sprays as at present practised, not more than traces of the antiseptics used made their way into and were to be detected in the water or spirit contained in the receiver, or Woulfe's bottle, placed at the end of the trachea of a recently killed sheep. (For further details in reference to these experiments the reader is referred to the paper above alluded to.) Recognising the inefficiency of the means now resorted to, for introducing into the lungs various antiseptic and other curative substances by means of inhalation, I was led to consider whether it were not possible to charge the air of a chamber with the required medicaments, and these in the proper amounts, and I have communicated my observations and experiments under this head to the British Medical Association in a second paper.

Without entering into details, I may here state that I have arrived at the conclusion that such a charging of the air of chambers is really practicable, an object which has not, so far as I am aware, been hitherto accomplished. For effecting this purpose I rely on two principles: one is the greatly increased volatilisation of certain chemical substances, which at the ordinary temperature of the air are but little volatile, obtained by spreading the substances over a very considerable surface, and exposing them either in the air or on water. To show the effect of this principle, I may mention that 50 grammes, or 770 grains, of carbolic acid, exposed to the air on a rough and moistened fabric, having a superficies of eight square feet, had disappeared, and were entirely lost at the end of thirty hours. Now, had the same quantity of the acid been exposed to the air in any vessel presenting only a small surface, the loss would have been but trifling, and in fact the weight of the crystalline acid would have become increased by the formation of the liquid hydrate. The second principle is the

augmented evaporation obtained by increase of temperature in combination with extension of surface. Armed with these two principles, applied in a practical manner, we possess the means, as I have said, of charging chambers with medicaments to any required extent, and of forming true inhalation chambers. The second paper already referred to, dealt mainly with the principles of the construction of inhalation chambers, and did not enter into any definite description of the means to be employed; these details were left for further observation and inquiry.

I now proceed to give the necessary data on which the methods to be used are based, and to describe the apparatus I have devised. A piece of Turkish towel 16 by 11 inches, giving a superficies on the two surfaces of 352 inches, was moistened with 100 cubic centimetres of water, containing 100 grains of carbolic acid. Six of such pieces were similarly treated, suspended on glass rods, and the amount of carbolic acid contained in them determined at the end of each successive hour; the quantities recovered were 82·79, 75·49, 63·89, 57·02, 48·73, and 41·39 per cent. These figures show a progressive loss each hour of 17·21, 24·51, 36·11, 42·98, 51·27, and 58·61 per cent. Thus, if the six pieces had all remained suspended for the six hours, of the 600 grains of carbolic acid used in charging them, no less than 350 grains would have disappeared, or more than one-half. Six cloths of the same dimensions were next taken, each being moistened with a mixture of spirit and water in equal parts, containing 120 grains of creasote; the entire quantity in this case for the six cloths would therefore be 720 grains. There were recovered at the end of each successive hour the following amounts: 103·5, 86·8, 83·7, 80·8, 72·0, and 66·0, showing a loss of 16·5, 33·2, 36·3, 40·0, 48·0, and 54·0. Thus, of the 720 grains taken, no less than 324 grains would have disappeared had all the cloths been suspended for the six hours. Lastly, five cloths were each moistened with a mixture of spirits of wine and water, in equal parts, containing 5 grammes of thymol, = 77 grains; these cloths therefore contained 25 grammes of thymol, or 385 grains. The following amounts were recovered each hour: 4·74, 4·44, 4·08, 3·88, 3·12 grammes, = 73·0, 68·3, 62·8, 59·7, and 48·0 grains respectively, the loss for each cloth in grains standing thus: 4·15, 8·78, 14·30, 17·4, and 29·15 respectively.

Here, again, the loss is very considerable, although not so great as in the two previous cases. Had all the cloths been exposed the whole time, the loss would have amounted to 145 grains out of the 385 originally taken. A considerable loss, of course, also takes place in the case of other but little volatile substances, exposed in the same manner on an extended surface, dissolved, if necessary, in suitable menstrua, the extent of the loss being proportionate to the natural volatility of the substance and its solubility. If the loss is so great resulting from the exposure of such a limited superficies as is afforded by a suitable fabric of 16 by 11 in., it is obvious that by extending the surface we possess a most powerful means for charging the air of a chamber with any required medicament, although it may possess only a feeble volatility at ordinary temperatures, and this to any extent required. But there is still another means whereby the same result may be aided or accomplished—namely, by exposing the substances on a comparatively extended surface of water, or even by dissolving them in it, raising and maintaining in some cases the temperature of the water at certain fixed degrees.

The following figures will serve to show the results obtained by this proceeding. Two grammes and a half of carbolic acid were dissolved in 150 cubic centimetres of water, and placed in a small glass dish having a superficies of eight inches; five other dishes were similarly charged, and all were floated on a water-bath, the temperature of the liquid in the dishes being maintained at about 74° C., or 165° F. And here I would remark that the temperature should always be taken of the liquid in the dishes themselves, and not in the water in the outer bath, as there is often a difference of 6° to 8° between the two, according to the nature of the vessels employed. The quantity of carbolic acid therefore contained in the six dishes amounted to 15 grammes, or 231 grains. The amounts recovered were 1·838, 1·470, 1·116, 0·868, 0·661, and 0·511 = 28·3, 22·6, 17·2, 13·3, 10·1, and 7·8 grains respectively. It thus appears that of the 38·5 grains originally present only 7·8 grains remained at end of the six hours. It follows therefore that of the 231 grains originally taken all but 47 grains would have been dissipated had all the dishes been

exposed for the same length of time, equivalent to more than three-fourths. With similar quantities of creasote—namely, 2·5 grammes—for each dish the results stand as follows:—In the first experiments the creasote was allowed to remain at rest, the greater part sinking to the bottom, it being only partially soluble in water, and part floating on the surface. There were recovered successively 1·245, 0·894, 1·10, 0·51, 0·21, and 0·37 grammes, = 19·17, 13·76, 16·94, 7·85, 3·23, and 5·69 grains. Thus, in this case had the temperature of all the dishes been maintained for the six hours, no less than 197 grains would have disappeared out of the 231 grains originally taken.

When, however, the contents of the dishes were stirred occasionally with a glass rod, whereby the heavier portions of the creasote, which had fallen to the bottom of the dishes, became broken up and dispersed, the loss was still more considerable, as indicated by the following figures:—0·76, 0·62, 0·43, 0·13, 0·035, 0·00, — 11·70, 9·54, 6·62, 2·00, 0·54 grains, while from the last dish the whole of the creasote had disappeared. The experiments with thymol furnished results almost equally striking. This substance is soluble only to a trifling extent in water, and when exposed to the air at ordinary temperatures, although it gives off its pleasant smell freely, it scarcely loses weight at all; thus, 15 grammes exposed to the air were found to have lost only the most trifling amount at the end of a fortnight. But thymol melts rapidly in hot water, and, being lighter than water, floats upon and spreads over its surface in a thin scum, and in this condition it becomes rapidly volatilised, as will be apparent on an examination of the annexed figures. 2·5 grammes being added to each of the six dishes containing the usual amount of water, the temperature of which was maintained at 74° C., the following amounts were recovered:—1·82, 1·23, 0·874, 0·64, 0·36, 0·096 grammes = 28·02, 18·94, 13·46, 9·85, 5·54, and 1·47 grains. Thus, had the experiments been continued with all the dishes for six hours, the loss would have amounted to 123 grains out of 131 taken at the commencement.

Armed with these principles and data I have been led to devise the following forms of apparatus, the first two being intended for charging the air of chambers for inhalation and disinfection. The first of these, which I have named the "chamber inhaler and disinfecter, No. 1," consists of a long fabric woven so as to afford a very large extent of surface for evaporation. The length and breadth of this vary with the extent of the effect required to be produced. This is spread out in several tiers one above the other, by means of an arrangement consisting of a double series of rails which are attached to a box, and which lift out and in. These, when not in use, are packed away in the box, which also contains a tray to catch any drippings, and a tin box to receive the longcloth.

A second apparatus, the "chamber inhaler and disinfecter, No. 2," consists of an outer water-bath to which a thermometer is attached, and an inner porcelain dish divided into four equal parts. The divisions of this are also filled with water, the temperature of which, by means of the outer bath, can be regulated and maintained to a nicety. With this apparatus, if desired, no less than four antiseptic or other substances may be used at the same time, either for inhalation or disinfection. It combines the advantages of moderate extent of surface with a temperature augmented, but regulated according to the nature and composition of the substances used—a very valuable combination. No hospital should be without one or more of these powerful disinfectors, especially the No. 1 "chamber inhaler and disinfecter." It will also be found of great service in private houses in cases of infectious disease. In using them one important fact must be borne in mind—namely, that it is not possible to charge the air of any ward or room with any medicinal substance or disinfectant while the doors and windows are open, as of course any amount of the substances which may be eliminated will be too rapidly dispersed to be of any service. It is not possible therefore to combine either effective inhalation or disinfection with free ventilation.

It occurred to me that some, at all events, of the advantages gained by increasing the surface of exposure might be obtained by applying the principle of extension to the construction of oro-nasal and oral inhalers, and with this object I made a variety of experiments. Without giving in detail the results of these, I will now describe two inhalers I have devised, the "globe" oro-nasal inhaler, and the "globe" oral inhaler.

That the inhalers at present employed are defective in construction in many ways, and are all but useless in practice, particularly in chest affections, has, I think, been sufficiently demonstrated. One defect is that, as a rule, they are not accurately adapted to the contour of the face of the wearer, so that air enters freely through other than the proper channels. Another is, that the amount of the substances used is generally much too small, and this is also the case with the materials on which these are placed; then the nature as well as the size of the materials selected, such as sponge or cotton-wool, are but ill-suited to the object in view, since they hold but a few drops of liquid, and even these are sufficient so to clog them as to render them more or less impermeable to the air, which should pass in all directions freely through them. In fact, the physics of the right construction of oro-nasal and oral inhalers have been even less studied than has the chemistry of the substances employed. The "globe" oro-nasal inhaler consists of a covering for the nose and mouth of a material which, becoming flexible in hot water, may be accurately adapted after it is made to the contour of the face of the wearer—a point of great importance with all oro-nasal inhalers. To this is attached a light glass globe, which is filled with a suitable material packed so lightly as to allow of its ready permeation by the air drawn through it in inspiration. This is then charged with the medicines desired to be employed. Supposing carbolic acid to be used, the quantity would be from 1½ to 2½ grammes, = 23·14 and 38·57 grains, partially dissolved in 8 c.c. of water, = 2 drachms. The extent of the loss of this antiseptic varies according to the amount of the acid taken, the care with which the globe is charged, the greater or less vigour with which the act of inspiration is carried on, and the length of time occupied in the inhalation. When 2½ grammes are used and the inhalation continued for two hours the loss varies from half to one gramme, or 15·4 grains.

Although I have repeatedly used my "globe" oro-nasal inhaler with a charge of 2½ grammes of carbolic acid and have inhaled for two hours at a time, I have never experienced any decidedly ill effects, still I would recommend that the quantity used to begin with should not exceed 1½ gramme. The Pharmacopœial dose of carbolic acid for internal administration is one grain only. What portion of the amount of the antiseptic which disappears actually makes its way into the lungs has yet to be determined, but there is no question that, with my apparatus, much of it does really enter the system, part of it being absorbed by the mucous membrane of the mouth and fauces. A little, no doubt, is lost on the skin, and when a moustache or beard is worn, upon it as well. While using this inhaler the carbolic acid may be strongly smelt and tasted, and in a short time the skin of the lips becomes whitened and a tingling sensation may even be experienced in them; these last effects are produced wholly by evaporation, as, although the quantity of water or other menstruum used is several times larger than that employed in ordinary inhalers, not a drop ever escapes from the inhaler to the mouth, as so often occurs with most other oro-nasal inhalers. The last apparatus, the "globe" oral inhaler, consists of a glass globe with, on the distal side, an aperture and cribriform plate for the entrance of the air during inspiration, and on the near side a flattened tube for the mouth, guarded by a valve, which prevents the air being discharged into the globe during expiration. The nose is uncovered, the flattened tube only enters the mouth, and the air is drawn through the globe in the same manner as through a cigar or pipe. By the use of this inhaler, the objection so often urged against oro-nasal inhalers is removed: that by covering the nose and mouth they restrict the entrance of the air and greatly impede respiration; moreover, its employment is far less irksome and fatiguing; it may be taken up or put down in a moment, and when once charged it may be used for one or two days, in most cases without requiring to be refilled. The ordinary quantities of carbolic acid for this inhaler are the same as those for the "globe" oro-nasal inhaler. All persons do not use oro-nasal inhalers alike; some inhale simply by the nostrils and close the mouth during inhalation, others inhale by both the nose and mouth, and this is the best way, since the mouth being open, a portion at least of the medicaments used make their way directly to the throat without having to take the longer and more tortuous course, with the inevitable result of part of the substances becoming absorbed. The "globe" oral inhaler has therefore a distinct advantage over the "globe" oro-nasal inhaler in that the whole of the

medicaments pass at once into the mouth, none being lost on the skin of the face and lips, on the moustache or beard, or in the convolutions of the nares.

I have communicated all the necessary particulars to Mr. Banks, of the firm of Messrs. Maw, Son, and Thompson, respecting the four different kinds of apparatus above described, and he is now having them constructed. The firm will therefore, I hope, be prepared to supply them very shortly.

San Remo.

THE SURGICAL TREATMENT OF TUMOURS AND OTHER OBSCURE CONDITIONS OF THE BLADDER.

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A PAPER read by Sir H. Thompson at the meeting of the Medico-Chirurgical Society, on the 11th April, 1882, and further supplemented by a communication on digital exploration of the bladder, which appeared in THE LANCET of May 6th, and his more elaborate contribution to the Medico-Chirurgical Society on the 23rd January, 1883, entitle him to the credit of having popularised an operation which had previously been confined to the practice of a few surgeons, and which hitherto had not been recognised in any of the standard works on surgery. This operation, having now received the sanction of a surgeon of such unquestionable authority and such unrivalled experience as Sir H. Thompson, promises to open out a fresh field for cultivation in surgery, and a new sphere for affording relief in cases which hitherto have remained unrecognised and unrelieved.

The operation of opening the urethra in the membranous portion in cases of impassable stricture and cases of retention is an operation long familiar to all practical surgeons; but when it is performed for the simple purpose of investigating obscure diseases of the bladder, and with the prospect that some condition may be discovered amenable to operative relief, we recognise an idea, the full valuable significance of which does not appear to have been fully realised by anyone before.

With the object of contributing to this important subject, we propose to record a number of cases which have come within our immediate knowledge in public and private practice, and to draw attention to certain points which have forcibly arrested our attention in the study of these cases.

Previous to relating the cases, it has seemed advisable to give a brief *résumé* of the more salient pathological features of bladder tumours, and shortly to refer to the means at our disposal for arriving at a diagnosis of their resence and nature.

Tumours of the bladder may originate primarily in its walls, or may extend to them secondarily from neighbouring parts, such as the uterus, rectum, or pelvis.

With the secondary growths we are not at present concerned. As regards primary growths, the bladder, we must remember, being developed from hypoblast and mesoblast, is, according to the blastodermic theory of tumours, able to originate epithelial growths as well as those of the connective tissue, muscle, nerve, and vessel types. The bladder is constructed of connective tissue and muscular walls, and is lined internally by a stratified epithelium, developmentally sprung from hypoblast. The mucous membrane has no papillæ on its surface, but it contains, particularly towards the neck of the bladder, some racemose glands. Each of these tissues, theoretically, may be the seat of tumours common to them in other situations. The connective tissue may give rise to growths of adult or embryonic connective tissue (fibroma, myxoma, enchondroma (?), and sarcoma); the muscle to myoma, the epithelium to epithelioma, and the gland epithelium to carcinoma. Experience fully bears out these theoretical considerations. Enchondroma is added to the list on the authority of two cases, one published in the *Gazette Médicale de Paris*, 1836,

the other communicated to the Société Anatomique;¹ but it is considered probable by Cornil and Ranvier that in the latter case the bladder was secondarily implicated, the tumour having originated primarily in the pelvis. In this enumeration the most common tumour is omitted, that is the so-called villous tumour. The villous tumour consists of numerous simple or branched processes springing from the submucous connective tissue; each process is composed of connective tissue in very small quantity, supporting fine blood-vessels, and is covered with a thick layer of epithelial cells; the submucous connective tissue from which it grows does not show the least trace of pathological tissue. The term villous has been derived from the naked-eye appearance of the growth, and has, of course, no pathological significance. These tumours have from time to time received various names; but of these the term papilloma appears to us the best. This view is open to the criticism that there are no papillæ normally in the mucous membrane of the bladder, and that these villous tumours spring from the submucous connective tissue, and that consequently they have more affinity with fibromata; but in their typical form they consist simply of vascular loops supported by connective tissue and covered by epithelium—a structure exactly corresponding to normal papillæ—and therefore to be regarded as a true papilloma of new formation.² On the other hand, all tumours with a papillated surface are not papillomata; the point of distinction in these cases is found in the base of the growth; if, for instance, the base be distinctly fibrous, the tumour is most correctly termed a papillary fibroma; if, on the other hand, it be sarcomatous or epitheliomatous, the tumour is a papillary sarcoma, or a papillary epithelioma. So common is the papillation of the surface of all bladder tumours that this feature alone is of no importance in deciding the true nature of the growths. In connexion with this great tendency of the bladder to form papillæ, it is interesting to recollect its origin from the allantois, and to bear in mind that it is from the latter that the vascular portion of the chorionic villi are produced, for we have in the chorion the most typical papilloma, occurring as a physiological structure. So great is the tendency for bloodvessels of the submucosa to shoot out in a papillated form, that in sarcomata springing from this situation it is sometimes possible to detect a strikingly arborescent arrangement of the bloodvessels in their substance. The term polypus has often been applied to bladder tumours; indeed, Hutchinson proposed to call these villous tumours villous polypi, from the fact that the majority were pediculated, but a title based on such a feature would be very unsatisfactory, as the polypoid condition has no pathological significance, and all forms of bladder tumour may take on the polypoid formation. True, cystic growths in the bladder are, so far as we are aware, unknown; there is, however, a reference to a cyst of false membrane which was removed by Liston by suprapubic cystotomy, the cyst being the shape of the interior of the bladder.³ The following list shows eight histological varieties of tumours which have been recognised as having their origin in the human bladder:—(1) Fibroma, (2) myxoma, (3) sarcoma, (4) myoma, (5) enchondroma, (6) epithelioma, (7) carcinoma, (8) papilloma.

Villous growths (papillomata) rarely exceed the size of a hen's egg. They may either be sessile or pediculated, round or ovoid. They have a soft consistence and a rosy, sometimes yellowish, appearance. Immersed in water, they swell and send out floating filaments and branches resembling a sea anemone. The branches sometimes exceed two inches in length. The most common locality in the bladder for these growths is within the trigone, and the vicinity of the urinary orifices their most favoured site—situations which render them very liable to become impediments to the flow of urine, and, by causing repeated attacks of obstruction, lead eventually to hypertrophy of the muscular coat of the bladder, dilatation of the ureters, and ultimately hydronephrosis. The epithelial covering of villous growths being thin, friable, and easily removed, and, being subjected

¹ Soc. Anat., 1861, p. 191.

² Virchow (die Krankhaften Geschwulste, Bd. 3, Berlin, 1865) does not recognise papillomata as a special kind of tumour, and contends that they are nothing but papillary fibromata, or outgrowths of the connective tissue. Rindfleisch (Pathological Histology: English transl., vol. i., page 454, London, 1872), however, states that in the villous growths of mucous membranes the loops formed by the ascending and descending capillary vessels are mostly covered by one or several layers of epithelium without any connective tissue intervening.

³ Medical Times and Gazette, August 2nd, 1862.