CLINICAL LECTURE

ON

THE ANTISEPTIC TREATMENT OF PULMONARY CONSUMPTION.

Delivered at King's College Hospital.

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GENTLEMEN,—It is but a short step from the consideration of the "contagiousness of consumption," and the infective quality of tuberculosis, concerning which I last addressed you, to the question of the antiseptic treatment of that disease.

If the expectoration, if the matters discharged from the air-passages of a phthisical patient, swarm with infective micro-organisms, as we are assured on the highest authority is the case; if the active invading area of the diseased portion of the lung be also crowded with these same infective bacilli, what treatment can be more rational and more appropriate than that which aims at destroying the life and activity of these organisms? indeed, I might ask, what treatment can be rational or appropriate which neglects to follow this indication? The only questions that admit of argument in connection with this subject are these two: 1. Are we satisfied that the presence of these infective organisms in phthisical lungs, and their causal relationship with phthisis, have been demonstrated? And, 2. Have we the means of treating this disease antiseptically—that is to say, do we possess, in an applicable form, the agents which will destroy these micro-organisms, and so arrest the progress of the disease?

With regard to the first question, I have lately had careful search made by very competent workers with the microscope, in the expectoration of patients with advanced phthisis, as well as in sections of typical tuberculous mesenteric glands; but they have not yet succeeded in finding the organisms described by Koch. But it does not follow that they were not there; the method of investigation needed for their discovery and demonstration is no doubt a difficult and delicate one, and we must not be surprised or discouraged if, notwithstanding our best efforts, we fail in our earlier attempts to demonstrate that which has cost Koch and others so much time and labour to discover. And already Koch's method of demonstrating these organisms in the sputa of phthisical patients has been improved upon by Dr. Ehrlich.

But just as a belief in the contagiousness of phthisis has long existed in some minds, so also a tendency to apply to it an antiseptic mode of treatment has long prevailed with some physicians. For my own part, I may say that, during the last ten years, I have repeatedly prescribed the inhalation of antiseptic vapours in cases of phthisis, as well as other treatment which I have believed to be also antiseptic; and you must often have noticed, in the wards of this hospital, that all my phthisical patients have been in the habit of wearing a form of respirator-inhaler for the purpose of inhaling antiseptic vapours, which I shall immediately describe to you.

In a paper on "Recent Researches in the Treatment of Phthisis," which I contributed to the annual meeting of the British Medical Association in 1876, I called attention to the progress that had been made in the direction of the antiseptic treatment of this malady, and I described several methods of applying this form of treatment; and, since then, several physicians, who have had large opportunities of testing its usefulness, have published some very successful results as following this plan of treatment.

Moreover, it would not be difficult to trace an antiseptic action (assuming phthisis to be dependent on the presence of an infective organism in the lungs) in some of the remedial measures of greatest repute in the treatment of this disease. The beneficial effects which are reported from the employment of the sulphurous waters of Eaux Bonnes (Dr. Leudet, *Les Eaux Bonnes dans le Traitement de la Phthisie Pulmonaire*), and of Cauterets, and of the so-called "arsenical" waters of Mont Dore, may they not be due to an antiseptic action? for the explanations of their mode of action hitherto put forth are eminently unsatisfactory. For example, when it is suggested that the sulphurous springs of Eaux Bonnes cure phthisis by "the formation or arousing of constitutional maladies of a slighter kind, which act as antagonists to the graver disease," we must feel that we are not very far off from such dogmata as the *similia similibus* of the homoeo-

paths. But, even supposing we are on the right track in applying an antiseptic method of treatment to phthisis, and in assuming an unity and identity of origin in the great majority of cases which are recognised as pulmonary consumption, we must not ask more of this method or expect better results from it than it can possibly give.

Nothing can be more certain than that tuberculous disease, whatever may be its intimate nature, tends invariably to be complicated with the products of inflammation. Wherever there is tubercular disease present in the lung, there you will find the results of present or past inflammatory action. The course and aspects of pulmonary tuberculosis are so uniformly overclouded with the phenomena of inflammatory action, that some of this "cloud" seems to have settled down over the minds of many pathologists; and, in regarding phthisis, they seem to be unable to see through this mist of inflammation; and it must be admitted, if these micro-organisms cause destruction of lung-tissue, they do so by exciting a peculiarly destructive form of inflammation; so that, in the treatment of phthisis, you must never lose sight of this inflammatory process, which always accompanies it, and plays a predominating part in its manifestations.

If in phthisis, as seems most probable, we have to do primarily with a specific virus or infective organism, and secondarily with an inflammatory process excited by it, our treatment must have a twofold object—the destruction of the virulent agent, and the reduction of the accompanying inflammation; and, in actual practice, my own experience certainly shows that the best results follow the combination in treatment of these two ends.

If we look through the whole of the literature dealing with the treatment of phthisis, it seems to me that two facts start out in remarkable prominence: one is the value of treatment which may be regarded as antiseptic—sea-voyages, mountain air, dry pure air in any locality, sulphur waters, terebinthinate vapours, iodised vapours, etc.; and the other is the value of counterirritation, systematic and continued counterirritation; treatment, you see, directed against a virus or an infective property—treatment directed against the results of present and past inflammatory action. But we must not expect more from antiseptic treatment than it can possibly yield. I have seen it remarked that cases of phthisis, though they might be benefited, are not cured, by antiseptic treatment. To this, I would reply, that aseptic and antiseptic treatment, if it do not cure, is, at any rate, an essential condition of cure, where cure is possible. Nature often herself erects an antiseptic barrier against the invasion of septic agents. And one of the most universally admitted remedies for staying the progress of phthisis is the removal of the patient to some place where he shall breathe an aseptic, if not an antiseptic, atmosphere. It is foolish to expect that antiseptic agents can act, so to speak, retrospectively. Water may extinguish fire, and stay its ravages, but it cannot rebuild what the fire has destroyed. So antiseptic agents may arrest the activity of septic influences, but they cannot undo the mischief that is already done.

When I read of hospital physicians vigorously plying, with so-called antiseptic sprays, patients in the very last stage of phthisis, with lungs riddled with cavities, and then reporting that they have arrived at "decisive negative results," I am amazed to think that they ever imagined it possible that they could arrive at any other.

When I read that such a plan of treatment was attempted in nine patients during the last three weeks of their lives, and then read that after death "nothing was found in the pathological condition of the lungs which in any way indicated the commencement of a healing process; there was an extensive phthisical decay, with cavities filled with fluid pus; in one case of left-sided pneumothorax there was a perforated cavern." I feel constrained to say, that if ignorant charlatans wrote in this way, we should find no language too severe to condemn their imbecility. Gentlemen, this kind of thing is foolish trifling. When you are called to a case, as it is often my lot to be, and find a patient in the last stage of phthisis, with physical evidence of extensive phthisical infiltration, and breaking-down of large tracts of lung-tissue and signs of excavation in various parts of both lungs, you should honestly confess that you are absolutely powerless before such a state of things, and never bring discredit on any method of treatment by attempting with it what, from your experience and pathological knowledge, you must be aware is absolutely impossible.

Nor should we fall into the error, as some writers seem to have done, of regarding the antiseptic treatment of pulmonary phthisis as closely analogous, or a strict parallel, to the antiseptic method as adopted in surgical procedures.

The surgeon's object is to prevent the access of infective organisms from without; our object is to destroy or arrest the activity of a specific organism which is at work within—a very different end to keep in view; and I fail to see any practical or logical *a priori* argument against

the conclusion, that it may be possible to impose conditions on an organism which is spreading through the pulmonary tissues which shall prove inimical to its growth and reproduction, and that is what is meant by the antiseptic treatment of phthisis.

But a complete antiseptic treatment, though it may be possible, no doubt requires minute care in carrying it out in detail.

It is not a little instructive in connection with the history of this subject to find Dr. Copland, many years ago, recording the fact that a young man, who had repeatedly come under his observation in an advanced stage of phthisis, completely recovered his health after he had been for a considerable period employed in the manufacture of creasote; and at the end of his *Historical Sketch of the Treatment of Pulmonary Consumption* he observes:—

"The inhalation of the fumes of tar or of creasote, or of the terebinthates, very weakly diffused in the atmosphere breathed by the patient, is in some cases beneficial in impeding the advance of tubercles or the formation of cavities, and in healing the surfaces of cavities which have been formed."

Valuable testimony has been given by Dr. Lemaire and Dr. Sanson to the efficiency of the inhalation of "carbolicised air" in phthisis. Dr. Lemaire gave carbolic acid also internally in aqueous solution. He found very remarkable effects follow its use. There was diminution of cough after twenty-four hours, and in some cases almost a complete disappearance after a few days. The expectoration was diminished or almost suppressed, and if the sputa were offensive, their foetor disappeared. In many, the physical condition of the respiratory organs was ameliorated. Some were cured, in others there was a subsidence or disappearance of *râles*, and parts became pervious to air which had previously been impervious. In other cases he had noticed increase of strength, return of appetite and sleep, increased freedom of breathing, and general exhilaration.

Dr. Jaccoud, the eminent Professor of Medicine in the Faculty of Paris, in a treatise which he published last year on the *Curability and Treatment of Pulmonary Phthisis*, thus testifies to the good effect of creasote given internally. The "pure creasote of the beech-tree" is the preparation used by preference in Paris. "This remedy," he says, "more rapidly and more surely than any other diminishes the expectoration and limits the extent of the catarrhal lesions, and thus reduces considerably the area of the pulmonary changes. But that is not all; and I am induced to believe that creasote may act on the *fundamental lesions themselves, the tuberculous lesions*, and promote indurative changes, which, as you know, is the method of cure." He mentions the case of a young girl twenty-two years of age, who was in the hospital three months with infiltration and softening at the left apex; and, after the creasote treatment, she became greatly benefited, and was discharged fifteen pounds heavier. The signs of "peritubercular catarrh" had disappeared; the dullness had greatly diminished; and breath-sounds had to some extent reappeared. She remained in good health for two years, when she was readmitted with an attack of broncho-pneumonia from exposure to severe cold. She was very ill, but recovered to some extent; and, when convalescent, she was obliged to leave the hospital, and was lost sight of.

In another case quoted by Jaccoud, of a young Russian thirty years of age, he observed the area of infiltration and softening at the apex of one lung diminish one-half under the creasote treatment. "This amelioration has lasted two years, and is still maintained; and the state of the patient's general health is particularly good." He considers creasote a "precious medicine," and it now forms a "fundamental part" of his treatment. His method of giving it is to begin with a very small dose, to increase it very slowly, and to maintain its administration for a very long period. He never gives at the commencement more than three minims in the day, often less, increasing by one minim every ten days, rarely exceeding five minims, and never exceeding six. He wisely objects to its being taken pure in capsules, on account of its irritating effect, in this concentrated form, on the gastric mucous membrane. He prefers that it should be added to the cod-liver oil, if the patient take this; if not, that it should be given in glycerine. He has found that the addition of creasote to cod-liver oil has often had the effect of enabling patients to take the latter, who were unable to do so previously; adding to the dose one drop of essence of peppermint. His formula for creasote in glycerine is as follows: Glycerine, 10 drachms; brandy or rum, 2 drachms; creasote, 3 to 6 minims; a third of this to be taken three times in the day.

Besides the internal use of creasote, Dr. Jaccoud is in the habit of recommending the inhalation of a spray of carbolic acid in cases where the disease has advanced to the formation of vomicae, chiefly with the object of preventing the absorption of putrid secretions and *débris*. But it seems practicable to obtain the good effects of antiseptic agents without the necessity of using a spray, which entails a certain amount

of trouble, and can only be applied occasionally; whereas, with the plan I am going to advocate, you have the decided gain of being able to apply the antiseptic inhalation almost continuously, and of almost any degree of strength. Several instruments have been devised for the purpose of diffusing an antiseptic vapour through the atmosphere the patient breathes. I have found none answer better than the simple contrivance I am now going to describe to you. It has the great advantage that it practically costs nothing. A dozen such inhalation-respirators as those you see on the table before you cost less than a shilling; and, with a little instruction, a nurse can make one in a few minutes. My patients in this hospital have long used them.

You take a piece of paper about six inches long and four wide; you fold it along the middle, and cut it with a pair of scissors into this form. This is your pattern. You place this, as I now do, on a piece

of perforated zinc, which costs about sixpence a square foot, and then, with a pair of stout scissors, you cut out a piece of zinc of the same size and form as the paper. You see I have cut out a piece of perforated zinc of the size and shape of the piece of paper I showed you. Now you see by a little manipulation, for this zinc is very pliable, I can bring the two outer ends (A and B) together, so as to slightly overlap; and then, fixing them together with a twist of fine wire passed through the holes of the zinc, I get a suitable mouthpiece, or rather nose and mouth-piece, for it is important, I consider, to cover both nose and mouth. This can be bent to fit comfortably any face.

The two middle pieces (C, D,) now stick out behind, and, by gradually bending first one of these down, and then the other over it, you construct a little cage behind the mouth-piece which will hold a small bit of sponge, or a bit of tow or cotton-wool, or any suitable material for retaining the antiseptic vaporisable fluid.

It is desirable to cover the rough edge of the mouth and nose-piece with some protecting material, it matters not what; I have, as you see, used tinfoil; a loop of elastic on each side serves to attach it behind the ears. It can be covered with black silk or any other material, according to taste, but no covering is really necessary. You see nothing can be easier than the construction of an inhalation-respirator of this kind; and it costs so little, that it can be given, without hesitation, to hospital and dispensary patients. It is light and comfortable to wear, much more so than some other more expensive contrivances, and patients find no difficulty in sleeping with it on.

Now there are many antiseptic substances, the vapour of which may thus be continuously, or almost continuously, diffused into the air that is breathed. Your choice may depend somewhat on the taste of the patient; or you may change the applications, from time to time, until you find out, in each case, which is most useful, and best supported by the patient.

Some simply keep the sponge (or tow) moistened with carbolic acid; others prefer creasote, and others use spirits of turpentine. I have used all these alone, as well as in combination. I have also used eucalyptol, thymol, terebene, camphor, fir-wood oil (*oleum pini sylvestris*), solution of tar in rectified spirit, tincture of benzoin, tincture of iodine, etc. Specimens of these substances are on the table before you, and I hand round to you inhalers charged with several of them. Of all these, I prefer creasote; but I also frequently use carbolic acid and eucalyptol, with which I sometimes mix a little camphor. Turpentine is a useful addition as an astringent, where there is profuse secretion or a tendency to hæmorrhage. Camphor has been said to be a very powerful antiseptic, but it has the objection of diffusing itself

very rapidly, and is unpleasantly pungent and penetrating. I have also found it a very convenient plan to mix these substances, such as creasote, carbolic acid, eucalyptol, or turpentine, with equal parts of spirits of chloroform. It helps to diffuse and vaporise these substances, and it is itself somewhat of an antiseptic; and it has also a soothing effect on the often irritable bronchial mucous membrane. I have often seen a patient tormented with cough at night, so much so as to be unable to get any sound sleep, obtain perfect relief from this distressing symptom by using at bedtime one of these inhalations in an instrument of this kind. The quantity required for this purpose is often quite inconsiderable; it is rarely necessary to use more than twentyminims of a mixture of equal parts of creasote and spirits of chloroform dropped on the sponge at a time, and renewed occasionally as it becomes exhausted; and it is often desirable to begin with very small quantities, until the patient gets used to the vapour. Five drops of the mixture may be dropped on the sponge at a time, and gradually increased to fifteen or twenty. One of the advantages of the little inhaler I have described to you is that, being perforated all over, the access of air is unimpeded, while the vapour diffuses itself freely into the immediately surrounding atmosphere. With more solid inhalers, patients will often say they feel "stified", and refuse to use them.

The substances I have named are, I believe, the best for continuous, or almost continuous, inhalation; for occasional inhalation, you will find a weak iodised vapour often very useful; and even a very dilute chlorine vapour is well borne by some patients. But in these matters, as I have already said, you must consult in some measure the tastes of your patients.

Iodine vapour may be diffused through a room or small chamber by throwing fragments of iodine on a heated plate, as I now do; or it may be inhaled from the surface of hot water, by pouring a few drops of tincture of iodine on the top of hot water contained in a suitable vessel, and holding the mouth and nose over the vapour, with some light covering over the mouth and nose and vessel. The vapour of tar may be inhaled in the same manner. A sleeping apartment may be impregnated with tar vapour by putting some tar on a heated metal plate, or stirring a vessel containing tar with a piece of heated metal of any kind. Other antiseptic substances which are not volatile or are vapourised with difficulty may be inhaled in solution in the form of spray. A Siegle's spray-producer is the instrument usually employed for this purpose.

A substance which has been given in Germany, and recommended as an antiseptic in cases of tuberculosis by Dr. Max Schüller of Greifswald and Dr. Rokitsky of Innsbruck, is the benzoate of soda. This they give in the form of spray, *i.e.*, the two to five per cent. solution in distilled water. But the great objection to this mode of treatment was the amount of fluid it was necessary to inhale (twenty ounces of a five per cent. solution daily) in order to take in the minimum dose. The patient would have, as indeed Dr. Max Schüller says, to devote his life to his cure; for you cannot inhale a spray and do anything else at the same time, whereas the inhalation of an antiseptic vapour by the method I adopt can be continued at the same time with almost any other occupation.

I have adopted this plan of treatment in a great number of cases, and in nearly all of them it has been attended with conspicuous benefit. Even in somewhat advanced cases, it allays the cough, lessens the amount of expectoration, and diminishes the fever.

There is a young girl twelve years of age in the hospital now, an orphan with no obtainable family history, who was admitted three months ago in a wretched general condition, and apparently sinking from rapid phthisis. There was dulness all over the left side, with co-extensive moist crepitation and coarse *râles*; there was diminished resonance over the upper half on the right side, with diffused bronchial *râles*. The temperature was high and fluctuating; constant cough; much dyspnoea; loss of appetite, and great emaciation. She has been kept inhaling a mixture of equal parts of eucalyptol and spirits of chloroform; and considering the miserable state in which she was on her admission, she has mended wonderfully. She coughs now very little; her appetite is good; she has gained flesh, and become quite cheerful. The moist sounds have completely disappeared from the right side, where the resonance is now good; and on the left side the catarrhal sounds have, to a great extent, disappeared, and the dulness is now limited to the upper lobe. She continues, however, to manifest a sub-febrile fluctuating temperature.

I could enumerate a great many cases which have come under my care during the past five or six years in which remarkable results have followed this method of treatment when it has been honestly and faithfully carried out; but I must not weary you with these details. I cannot, however, forbear to call your attention to the particulars of a case I have quite recently had under my care, and in which, I must say, I

have never seen better immediate results from this or from any other kind of treatment. I first saw the case on the 6th of May. The patient was a married lady twenty-eight years of age, living in a low damp locality, who had lost two brothers from consumption, one at nineteen the other at twenty-three years of age. She had had a cough for two years, and had been losing flesh. She was confined last Christmas, since which time she had been worse. Night-sweats were constant; the cough was troublesome, and expectoration abundant. Her voice began to be hoarse a fortnight ago, and was now nearly lost. Her appetite was bad. Pulse 112; respirations 20; temperature 101° Fahr. She was considerably emaciated. There was some dulness over the left apex in front and behind, with moist clicks at the end of inspiration, and some diffused largish crepitations on coughing. On the right side, subcrepitant *râles* were heard over a spot just below the angle of the scapula, where there was also a patch of dulness. She was ordered to wear as constantly as possible one of my inhalation-respirators, charged with from five to twenty drops at a time of a mixture of equal parts of creasote and spirits of chloroform, so as to breathe an atmosphere only as strongly impregnated with the antiseptic as was quite comfortable to her. She was also to rub into the chest a mixture of turpentine and iodine liniment, and to take three times a day a mixture, each dose of which contained three grains of hypophosphite of lime, two grains of quinine, twenty drops of the syrup of phosphate of iron, and half a drachm of glycerine, and to continue the cod-liver oil she had been taking. She was also ordered to leave the place in which she was living, and go to some dry, bracing locality. It was agreed that she should go to an isolated farm-house built on a hill three hundred feet above the sea, between thirty and forty miles from London, on the borders of Hampshire and Surrey, where there were pine woods and open heather country. She came to see me again after about three weeks, and she had improved immensely. The temperature had become normal, the night-sweats entirely disappeared after a week of the treatment; her voice had returned after ten days; the cough and expectoration were greatly lessened. The dulness over the left apex was much less evident, but respiration there was feeble, and there was a distinct pleuritic creak in the left supraspinous fossa, a notable sign of past mischief in that region; all the moist sounds had disappeared. Her general condition had completely altered.

I have never seen a more striking improvement in so short a time, under any plan of treatment or in any locality. But this patient had been unusually obedient to the instructions that had been given her. She had devoted herself at once and unhesitatingly to all the details of the treatment. She had removed immediately to an aseptic if not an antiseptic atmosphere; she had passed a great part of her time in a hammock, suspended between fir trees, in the situation I have mentioned, and she had perseveringly worn her inhaler as I had directed.

But there is another antiseptic method of treatment which has come into general reputation within the last ten or twelve years, and of the advantage of which in certain cases there can be no kind of doubt. I allude to the removal of consumptive patients to the dry, pure, cold air of elevated regions. The low temperature of these regions may have much to do with limiting the vitality and propagation of the tubercle organisms. But I have gone into this question fully elsewhere, and I need not go over that ground again here. I will, however, refer to a remarkable passage in a letter from a well known resident in one of the chief of these resorts, Davos Platz, which seems to me to have great significance with regard to the question of the contagiousness of consumption. Speaking of the overcrowding that has taken place in that locality, he says: "The tendency at Davos has been.....to pack the patients together in as small a space as possible, and to build new inns at the doors of the old ones. All this is done in a climate where winter renders double windows and stove-heated buildings indispensable. All this is done for a society where the dying pass their days and nights in closest contiguity with those who have some chance of living. Within the last few weeks, two cases have come under my notice; one, that of a native of Davos attached to the service of the visitors; another that of an English girl, who have both contracted lung-disease in the place itself, owing, as I believe, to the conditions of life as they have recently been developed here" (Mr. J. A. Symonds, in the *Pall Mall Gazette*).

Now, if the infective character of tuberculosis were generally recognised, and the tuberculous nature of pulmonary consumption generally admitted, mistakes of this kind would hardly be committed. So, again, the antiseptic influence of sea-voyages is greatly interfered with by the unavoidable occurrence of bad weather necessitating the confinement of the invalids in close overcrowded cabins, in which the atmosphere they may have to breathe, for days and days together, is anything but antiseptic.

In conclusion, let me again remind you that you will fall into a serious error, if you carry away with you the idea that the treatment of

phthisis is to be altogether comprehended in the inhalation of an antiseptic vapour. It is a part, and only a part, of the rational treatment of phthisis.

I know of no disease in which so many and various indications for treatment arise during its progress. But, if pulmonary phthisis be pulmonary tuberculosis, and if tuberculosis depend on the presence of an infective organism in the tissues, a rational treatment of phthisis must include the administration of antiseptic agents, or the surrounding our patients with antiseptic conditions.

THE LOCAL TREATMENT OF PHTHISIS BY CARBOLIC ACID.

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FROM the interest the subject excites, I am glad of an opportunity to supplement at somewhat greater length the remarks under the above heading in the JOURNAL of July 2nd, 1881.

The primary dependence of the lungs on the external atmosphere, for their healthy nutrition, distinguishes them from all other internal organs, and makes apparent a certain resemblance between them and the skin: a resemblance not merely imaginary, for they are structurally identical in many points. And where they are so, it is evidently for the same physiological reasons; namely, to carry out an interchange which must increasingly continue, so long as vitality lasts, between the atmospheric constituents, and the particles which the lungs and the cutis alike bring to their respective surfaces, in the process of nutrition. By the lung-surface, is here meant the inner walls of the air-cells and of the terminal bronchial twigs.

The relationship of the skin to the surrounding atmosphere is one of great importance. In the many varieties of skin-disease which occur, there are several which, undoubtedly, arise entirely from external agencies directly impinging upon the part affected, and producing the abnormal appearance it presents; and we may go further, and say of the large majority of skin-affections which are set down to internal causes, that very many of them evidence, by their amenability to local treatment alone, that external agencies have a power over them sufficient for their removal, even though their origin is supposed to be in altered or in some depraved condition of the blood; and the deeper thought that underlies even this latter truism is, that there are local skin-conditions originating in external influences which have prepared those parts for more readily than others undergoing the structural changes which the altered or defective blood will set up; in fact, without which, the blood could not manifest its deficiencies. It is a thought within a thought to attempt to explain why, for instance, the patches of psoriasis or eczema appear at any particular spot; but it is helpful to call to mind that in all diseases there are two distinct factors which have to be brought together, whose combined action is necessary for the production of the functional and structural changes which ensue. It is apparent in skin-degradation—it is probably true in all internal *malaises*—and it is undoubtedly true in that special form of lung-disease we call phthisis, and it may be in all the other forms. In consumption, we have a predisposing condition of the lungs, which may be more precisely described as a state of lung-development, that is, of cell-growth, defective in one or more points, either inherited or the result of insufficient surrounding sanitary conditions, and thus not fully commensurate to do the work they are called to maintain, or to contend against the malignant influences which at times are brought to bear upon them. Now what are these malignant influences? They come to the lungs directly through the medium of the atmosphere, which carries them almost without impediment into the very heart of the tissue, not filtering them or minimising their quantity through other media, as when they pass along with food into the stomach and are subjected there and further on to so many processes, that their individuality or power of working any changes on their account is as a rule lost. Giving these malignant influences another name and calling them germs (and surely we may do so with the knowledge we have acquired on the subject), we are brought at once to reason on their *modus operandi*, when they impinge upon a soil prepared for them—in other words in a receptive condition—whether in the lungs or elsewhere; and our reason is founded on analogy. How do another set of germs act when they alight upon a surface freely exposed to them, where formative material on a large scale is being elaborated as on the stump of a recently amputated limb, or the raw surface of a burn? The action of these germs is to arrest the vital processes of repair, not in its earliest stage, but somewhere along the line just where cell-growth is passing from the general to the particular to become a special form of tissue; and the blood-corpuscle which was about to be—or had recently

been—laid down as an atom in the building up of cellular tissue, or connective tissue, is turned aside into the pus-corpuscle, which is in other words but a blood-corpuscle deprived of its own vitality, and breaking up after it had undergone certain transformations through the action of the sporule of a fungus upon it.

Before applying this reasoning to what takes place in the lungs in phthisis, we must allow the truth of another of the theories which is now pretty well established as a fact, with regard to germs; that is, the specific qualities which many of them possess. It would take up too much space to give all the reasons in favour of this view; but if it be granted (and how we can account for diphtheria, typhoid or cholera on any other supposition it is difficult to see), then the resemblance of the action of germs in the lungs to the action of germs on the fauces, in diphtheria for instance, may be thus traced. The air-cells of the lungs and the finer twigs of the bronchial tubes, weakened by long exposure to a vitiated atmosphere, or not originally in all parts well developed from hereditary causes, receive at some time an air charged with specific germs; and these latter alight on the cell-walls, and put a stop to the progressive changes taking place in those blood-corpuscles with which they there come into contact, and thus arrest to a large extent is put to the perfecting of new material, whilst yet the old and effete continues to disintegrate and pass away. Healthy formative material becomes for a time the nidus, out of which the sporules of a vegetable organism multiply.*

But it is not the ordinary non-specific germ such as we meet with in every suppurating surface, but the particulate one, which has characteristic properties of its own, which is the producer of phthisis. When it finds an entrance and a feeding ground prepared for it, and above all certain atmospheric conditions of temperature and moisture,† it rapidly converts to its own growth and material development the formative material which the blood has brought to the walls of the air-cells. The development of the tubercular germ proceeds in this way to the stage of reproduction, and there stops. The parent germ then loses its vitality and disintegrates, and it is this disintegrated germinal matter that constitutes the purulent expectoration of phthisical patients. It has, however, left its seed behind it, to go through the like stages at the expense of normal tissue.

Looking at the origin and course of phthisis from the above point of view, how should we plan our treatment? Firstly, we want a weapon which shall be quickly fatal to our enemy; and, secondly, we must bring it into direct contact with the foe. These are the two problems we have to solve, and they are surrounded with great difficulties. May we say at least that we are in the right track at last? We are experimenting on the best method of reaching the lungs directly through the trachea, and we are casting about to find the best germicides. These are the specific weapons of our warfare. The auxiliary ones remain the same as they have been for some time—abundance of fresh air, purity, and dryness of the same, and carefully selected diet.

The attempt to reach the air-cells by direct inhalation of the medicine we want to apply, need not be considered an insuperable one. To continue to do so only through the medium of vapour or steam is a mistake, for the reasons stated in my former paper, the medium itself has proved injurious, and therefore has acted as a hindrance in the way of successful prosecution of this form of treatment. Most medicines can be triturated or in some way reduced into particles lighter than air, and thus become capable of inhalation if brought into close proximity with the entrances to the air-passages.

That which at present awaits discovery is, what particular agent is capable of destroying the germ which sets up phthisis. At present, we are trying carbohc acid. We do this; reasoning from analogy, we have found that it exercises a deterrent action on the development of pus in other parts of the body, that a healing process will go on under an atmosphere of carbohc acid more rapidly than without it; and therefore we conclude, if its presence is a check to all other than normal action where an outward lesion is being repaired, it will have the like effect on lung-tissue when in a diseased state.

I admit at once that the two conditions can be shown in many respects to be dissimilar; but there is sufficient parallelism for us to advance a step further in the same line of argument, and urge that, though carbohc acid may not prove successful in checking tubercular

* The terms, "blood-corpuscles" and "formative material" are here used indifferently, for it is impossible to define at what stage from the moment of the blood-corpuscles escaping the vessels to their changed condition as germinal matter, the micrococci of a fungus act upon them.

† That certain conditions of temperature and moisture are necessary for the development of germ-life has been long known; but it is only lately that we have arrived at the conclusion that each of the specific germs has a temperature and moisture of its own, without which it cannot burst into active life. This holds true of the phthisis germ, as well as of the diphtheria and cholera germ.