In no department of medicine has our outlook altered of late years so much as in connexion with phthisis. It is within the recollection of many of us that not long ago a diagnosis of tubercle of the lung was equivalent to a sentence of death, and that cases which did recover after such a diagnosis were looked upon as something of a marvel. Yet the experience of post-mortem examinations, even in those days, taught us again and again that a very large percentage of the population at one time or another during their life did suffer from tubercular disease of the lungs, which passed unrecognized and recovered spontaneously. The lesson to be derived from this was that phthisis could exist without any sign of its presence which could be recognized by the methods of examination which were in vogue in those days, and that the cases of tubercular disease of the lungs which were serious were those which had progressed so far as to produce lesions which could be detected by the ordinary methods of physical examination. Various symptoms were recognized, however, as common forerunners of florid phthisis, symptoms which were, and still are, frequently called those of the "pre-tubercular stage"; it is a term which is peculiarly inappropriate since it connotes the idea that the anæmia, the slight fever and so on which precede the appearance of manifest phthisis are symptoms of a special susceptibility to tubercular infection; whereas, as we know now, these symptoms are actual evidence of infection by the tubercle bacillus. The only legitimate use of the word "pre-tubercular" would appear to be in connexion with those peculiarities of body structure which are generally recognized as being associated with a special susceptibility to tubercular disease, the long thin flattened chest, the regular features, fine skin, highly strung temperament, &c.

Tuberculosis is an insidious disease, generally slow in onset, and it tends to advance steadily if the conditions under which it arose are allowed to continue, but in a great many cases if the patient is submitted to modern treatment at a sufficiently early stage it is a disease which is eminently curable; when, however, it has passed beyond the early stage, when there are marked physical
signs, fever, sweats, and quantities of tubercle bacilli in the sputum it becomes a very serious matter. Nothing stands out more clearly in the statistics of sanatoria than the fact that the earlier the case is put under treatment the better is the prognosis. It follows that the chief hope of improvement in the treatment of phthisis rests in the use of methods which shall secure early recognition of the disease, before marked physical signs are present, before fever and sweats make the condition obvious and before tubercle bacilli appear in the sputum. In the Army we are in a specially favourable position for attaining this object, we have the men constantly under our eyes, the conditions of a soldier's work compel him to report sick if he finds himself unable to work at the same rate as his healthy comrades, and when he does go on the sick list he is treated in a hospital where it is possible to observe his symptoms infinitely better than is the case with the civilian, who is either seen casually at a surgery or, if he is attended to at his own home, is only seen once a day and is completely removed from skilled observation in the intervals.

The symptoms which may give rise to a suspicion of phthisis are as follows: There is a gradual deterioration of the general health, the patient loses his energy and becomes easily tired; this may be interspersed with periods of exceptional vigour, and in the case of an intellectual man with periods of remarkable brilliancy. The patient usually loses colour and becomes thin; loss of weight is an extremely important symptom in a man, men do not lose weight without serious cause; with women it is different, a woman may lose weight and even become emaciated from emotional causes alone. Loss of appetite, dyspepsia, and evening headaches are frequent phenomena, whilst even in quite early cases one can often elicit a history of night sweats. Cough may be entirely absent, or may amount to no more than a slight morning cough with expectoration of a little mucus, or muco-pus, in other cases it may be the most prominent feature of the case, and appear as a worrying dry cough which is worst at night and keeps the patient awake. Sometimes the cough causes so little inconvenience that the patient may deny that he has a cough at all, even though he has actually been coughing in one's presence.

The cough of the early stages is largely due to irritation of the lung tissues, and not so much to the necessity for expectorating pathological secretions; so that as a rule, sputum at this stage is scanty or absent, and in really early phthisis it contains tubercle bacilli only in about 10 per cent of cases. This is a sufficient
comment on the frequent practice of ignoring all the other phenomena, and insisting on the finding of tubercle bacilli in the sputum before making the diagnosis. Hemoptysis is always recognized as an extremely suspicious symptom; to be of importance it must amount to more than a mere streak of blood on an odd sample of sputum; and it has to be remembered that other diseases, mitral stenosis for example, can also cause marked hemoptysis. Stabbing pains in the chest occur in many quite early cases; they may be due either to a small patch of pleurisy over a tubercular focus, or to intercostal neuralgia consequent on irritation of the visceral nerves belonging to the same spinal segment. This irritation of the visceral nerves may also cause patches of hyperesthesia over the whole or part of the peripheral distribution of the corresponding somatic nerves; in still other cases it may produce trophic phenomena in the muscles, atrophy or irritability.

Changes in the voice, hoarseness, alteration of pitch or loss of resonance are sometimes present even when the larynx is still unaffected.

Fever, especially after exercise and in the evening, is frequent; in really early cases it may be very slight, and the patient may deny that he ever has fever, though he may confess to the loss of appetite, headaches and general malaise which usually accompany slight fever. In other cases the patient may suffer from fever which he himself recognizes as fever, and he may say that he dates his illness from several attacks of "influenza," or that he is always getting "feverish colds," the "influenza" or the "feverish colds" being really tubercular fever. When the fever is associated with night sweats the suspicion of tuberculosis is so pronounced that only very definite evidence of another cause for it justifies one in excluding phthisis. When the patient is put under hospital conditions, and especially if he is put to bed, the slight fever and attendant phenomena may subside very promptly, and may not recur until the patient resumes his ordinary duties; such cases run some risk of being classed as malingerers, since they keep perfectly well in hospital and complain only when the exercise involved in their work produces excessive auto-inoculation and a relapse of their symptoms. Primary pleurisy is tubercular in a large percentage of cases, 70 per cent at least, and opinions differ as to the frequency with which this form of pleurisy is followed by definite phthisis. It largely depends on the subsequent treatment of the case; where the patient is well treated at the beginning, and afterwards returns to an open air life with abundant food, no further trouble may
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ensue; indeed, there is a good deal of reason for believing that under such conditions a primary pleurisy may act as an immunizing process. But if the case is not thoroughly well treated at the beginning, if the patient is allowed to return to work too early, or if he is allowed to return to unfavourable surroundings, or to continue such habits as over-indulgence in alcohol, or yield to other excesses, primary pleurisy is only too often followed by florid phthisis.

With regard to physical signs in the chest, it cannot be too strongly emphasized that phthisis may progress to quite a considerable extent without any abnormal physical signs whatever, or if there are changes on percussion or auscultation they are vague in character and their value depends on the concomitant general symptoms. At the most in early cases there may be some slight loss of resonance at the top of one or other lobe, or some defect in air entry over these situations; or again, if the case is more advanced, one may discover cog-wheel inspiration or harsh breathing. Crepitations when they occur are very significant, especially if they are constantly present over the same area; if they are confined to one apex they are still more suggestive; sometimes crepitations can only be brought out by making the patient cough vigorously four or five times, when the following inspirations may be accompanied by a shower of fine moist sounds. It is to be noted that tubercular disease does not always start at the apex of the lung; in some cases the first signs are to be found at the bases or over the tips of the lower lobes. In the case of a patient who has never been abroad the symptoms which I have enumerated—debility, pallor, wasting, slight fever, and cough—would always arouse the strongest suspicion of phthisis; when, however, the subject has been exposed to tropical influences the question is complicated by the possibilities of the symptoms being due to malaria, Malta fever, liver abscess, ankylostomiasis or other tropical disease, and these have to be eliminated. Malta fever, in its slighter intermittent forms, is especially apt to simulate phthisis, causing as it does fever of a hectic type, wasting, pallor, copious sweats and not infrequently a worrying cough; the same might be said for some cases of liver abscess. The tropical practitioner will naturally look for a tropical cause first, but it must not be forgotten that phthisis is just as frequent in the Tropics as it is in this country.

In many cases the history alone would justify one in diagnosing tubercle of the lung, even in the absence of signs of consolidation in the lung or of tubercle bacilli in the sputum. An example of such a case is the following: The patient had an illness in Egypt
which was labelled debility; he never had any very definite symptoms, but always felt tired, and now and again he suffered from slight fever. On his return to England he developed a morning cough, nothing to cause alarm and it was unaccompanied by any sputum, he still felt out of sorts, got easily tired and he found he was getting thinner; occasionally he sweated profusely at night. Then he reported sick on account of a stabbing pain below the left clavicle; pleuritic friction was heard over this area for one day, but later examination failed to disclose any abnormality except perhaps some defect in air entry over the left apex. In this case there came the sudden development of a patch of pleurisy over one apex to clinch the diagnosis. But even before this the history was practically diagnostic of phthisis if one could exclude the tropical diseases. When the history and physical signs are only sufficient to raise a suspicion of tubercular disease and when, as is so frequently the case, tubercle bacilli cannot be found in the sputum by ordinary methods of examination, one has to fall back on other procedures to complete the diagnosis; the antiformin treatment of the sputum, animal inoculation of sputum, tuberculin tests and the estimation of the opsonic index. Details of these methods are given below.

**Antiformin Method.**—This naturally is of use only when a fair amount of sputum is available. The formula for antiformin is 15 per cent solution of caustic soda and liquor sodae chlorinata equal parts; 3 c.c. of this mixture are shaken with 10 c.c. of sputum, the specimen is then allowed to stand for twenty-four hours, the sediment washed with distilled water, centrifuged and stained in the ordinary fashion for tubercle bacilli. Various modifications of the method have been recommended with a view to securing better depositions of the bacilli, but my experience both of the original process and of its modifications has been unsatisfactory, possibly because we chiefly deal with early phthisis; in very few cases have I been able to find tubercle bacilli by this method which were not demonstrable by the ordinary processes. Another disadvantage, so far as early cases are concerned, is that in these patients sputum is often either absent or extremely scanty.

**Animal Inoculation of Sputum.**—This is an extremely delicate test for the presence of tubercle bacilli in pathological material, the disadvantage is that it takes three or four weeks before the typical tubercular bubo develops in the guinea-pig’s groin; and, in this country at any rate, it is necessary to have a licence to perform the operation.
Tuberculin Tests.—Three of these tests have been in general use.

Von Pirquet’s Test.—A couple of areas about ¼ in. diameter are scratched on the skin, one of these areas is left as a control and to the other is applied a solution of old tuberculin (50 per cent in cases of adults, 25 per cent for children). When a tubercular focus is present in the patient’s body the area to which tuberculin has been applied develops into a dull red slightly raised plaque with a surrounding pink areola; the plaque appears after twenty-four to forty-eight hours, and lasts for several days, it often leaves for some time longer a pigmented scaling patch rather suggestive of a tuberculide. The control patch should show nothing but a traumatic erythema which disappears after twenty-four hours at the latest.

The method is so very sensitive that it produces a positive reaction in most adults. It tells nothing as to whether the infection is active, latent or extinct, and nothing as to the site of the tubercular lesion. In children under 12 the method is useful since, at this age, whatever tubercular infection it reveals must necessarily be recent. In adults the only result that is of value is a negative reaction, when this is found it serves definitely to exclude the idea of tuberculosis except in advanced cachexia.

A modification of von Pirquet’s test is done by inunction of Moro’s ointment on the unbroken skin. The formula for this ointment is equal parts of old tuberculin and lanoline. A positive reaction consists in the development of a crop of papules over the area treated with the ointment. The method has the same diagnostic significance as von Pirquet’s test, but it is not quite so delicate.

Calmette’s Reaction.—This consists in dropping a suitably prepared solution of tuberculin into the conjunctival sac. Several accidents have occurred from its use and it is not to be recommended.

Hypodermic Injection of Old Tuberculin.—This test is only available in non-febrile subjects. The patient should be put to bed for three days and his temperature taken, in the mouth, every four hours. If the temperature does not rise above 99°2°F. the test can be applied.

The material used is old tuberculin (Tuberculin, Koch); of this two solutions are necessary, a $\frac{1}{1,000}$ and a $\frac{1}{10,000}$ dilution; the simplest method to make these dilutions and to avoid waste is as follows: Sterilize three test tubes in the flame and allow to cool, then with
a sterile capillary pipette make a \( \frac{1}{10} \) dilution of tuberculin with normal saline containing \( \frac{1}{2} \) per cent carbolic acid; place this in the first test tube and mark it distinctly (10); take a portion of this dilution and mix it with 9 volumes of the carbolized saline, giving \( \frac{1}{100} \) dilution, place this in the second tube and mark that distinctly (100); the \( \frac{1}{1000} \) dilution is made in a similar way by diluting the \( \frac{1}{100} \) ten times, it is placed in the third tube and clearly marked (1,000). It is well to throw away the \( \frac{1}{10} \) dilution as soon as the others are made so as to reduce any risk of confusion between the tubes, and for the same reason the marking of the tubes should never on any account be omitted. The initial dose is usually \( \frac{1}{2} \) mg., i.e., \( \frac{1}{2} \) c.c. of a \( \frac{1}{1000} \) dilution; this is injected under the skin of the forearm. A positive reaction consists in (1) a red and tender swelling at the site of inoculation; (2) fever exceeding 100° F. and commencing six to thirty hours after the injection; (3) focal signs in the lungs, e.g., the appearance of crepitations which were not present before, or a considerable increase in the adventitious sounds which were already present. Of these results the focal signs are the most important, since they tell one not only that the patient is tubercular, but that the lesion is in the lung. In many cases the initial dose of \( \frac{1}{2} \) mg. causes no reaction, the dose is then increased to 1 mg. (1 c.c. of \( \frac{1}{1000} \) dilution), leaving an interval of two clear days before its administration. If this fails to cause a reaction a third dose of 5 mg. (\( \frac{1}{2} \) c.c. of \( \frac{1}{100} \) dilution) is given, again after an interval of two clear days. In some cases a final dose of 10 mg. (1 c.c. of \( \frac{1}{100} \) dilution) is necessary before excluding the idea of tuberculosis; but, as a rule, it will be found that one or other of the smaller doses is sufficient to cause a reaction in a tubercular subject. When the reaction is doubtful, when for example, the temperature rises only to a little over 99° F. and there are no focal signs, the subsequent dose should not be increased, since experience has shown that an increase in the dose under such circumstances is apt to produce an excessive reaction. The rule in this case is to repeat the dose which caused the doubtful reaction. As to the significance of the three elements in the reaction the fever and inflammation round the point of inoculation only inform one that there is an active tubercular focus somewhere in the patient's body; the focal reaction shows where the lesion actually is.

The doses which are recommended are well within the limits of those which will produce disturbance in a non-infected subject; Koch gave the maximum non-toxic dose for a healthy
man as 25 mg. As regards the significance of a reaction to a certain dose, it may be taken broadly that early active cases tend to react to small doses, whilst older and partially quiescent cases require a larger amount of tuberculin to bring out the characteristic phenomena. The safety of the method has been established in many thousands of cases, but it is necessary to observe the rules laid down. The hypodermic use of old tuberculin for diagnostic purposes is contra-indicated if the patient's temperature in the mouth exceeds 99·2° F., if there has been recent hæmoptysis, where there is non-compensated heart disease, and where there is kidney disease, epilepsy or hysteria. It is advisable not to use the test within one week preceding a menstrual period, and it is not to be recommended where the diagnosis has already been made on other grounds.

Estimation of the Opsonic Index.—When the diagnostic injection of old tuberculin is contra-indicated by any of the conditions mentioned above it is necessary to fall back on the estimation of the opsonic index. It may be said at once that this test can only be carried out satisfactorily by a skilled pathologist who has had very considerable personal experience of the method. It is desirable that the patient should be put to bed for two or three days before taking the samples of blood, these are obtained from the finger, half a capsule being sufficient. Similar samples of blood should be taken from two or three normal individuals at the same time as the specimen from the patient. Care should be taken to get a good flow of blood without excessive squeezing, this is secured by making a good bold puncture with a glass pricker or with a stout Hagedorn needle. In sealing the samples great care should be taken to avoid heating the blood, and the capsules should be put away in a box as soon as possible after labelling so as to avoid unnecessary exposure to light. The tests should be carried out within twenty-four hours after taking the samples. In cases where the blood is sent to a distant laboratory for examination it is useless to send samples from the patient alone, they must be accompanied by capsules of blood from two or three normal individuals, each properly labelled; it is also well worth noting that the specimens should be timed to arrive on a working day, so that it is better to start a series of examinations at the beginning of the week. The most convenient material for the emulsion is "Tubercle bacilli for opsonin estimation (Human)," which is prepared by the Lister Institute, and sold by Messrs. Allen and Hanbury. The emulsion is made as follows: A few crumbs of the bacilli are placed in a
watch glass and ground down to a fine powder with the rounded end of a glass rod, a minute quantity of distilled water is added by degrees, and the material worked into a smooth paste, more water is then added to form a fairly thick emulsion; this is centrifuged for three minutes to get rid of large clumps, the supernatent emulsion is then taken into another tube and centrifuged for half an hour to an hour in order to throw down the bacilli; the sediment, which now consists of a homogeneous paste of washed bacilli, is taken and made into an emulsion with normal saline, it is centrifuged for three minutes to separate clumps, and finally diluted with normal saline until it is of the consistence which experience tells one will give from 2—5 bacilli per phagocyte with a normal serum. If there is any doubt as to the emulsion being of the correct strength a trial test can be made with a normal serum. Such an emulsion, which it will be observed takes some trouble to prepare, can be kept for a fortnight on ice without deterioration, but if it is used after being on ice it should be warmed up sufficiently to avoid chilling of the phagocytes before making the usual mixtures. The blood cells are washed in the ordinary way for opsonin work. The mixtures used are equal parts of serum, blood cells and emulsion; these must be thoroughly mixed by drawing them in and expelling them from the pipette several times before eventually taking them into the tubes and sealing them, they are incubated in a water bath (a saucepan does very well) at 38° C. for fifteen minutes, then again thoroughly mixed, before making the smears, by drawing them in and out of the pipettes several times so as to dislodge the phagocytes which stick to the walls of the tubes. My own practice is to make separate specimens for each normal serum; in this way one secures a good check on the technique.

The smears are fixed by soaking for two minutes in saturated solution of corrosive sublimate, and after a good washing are stained in a bath of carbol-fuchsin at a temperature of 60° C., for half an hour; it is important not to exceed this temperature; the films are then decolorized with 2 per cent H₂SO₄ until they are just pink after washing, they are again doused thoroughly under the tap and then treated with water containing about 1 per cent of carbonate of soda; this neutralizes any remaining acidity and permits of the nuclei of the phagocytes staining properly. After a light washing the films are stained with methylene blue until the nuclei of the phagocytes and their cytoplasm are clearly defined when viewed with a 1/4 in. objective. After a final washing the films are ready for examination. Satisfactory
specimens should have the cytoplasm of the leucocytes clearly defined; there should be about 2 to 6 bacteria per phagocyte and there should be very few phagocytes containing clumps of bacteria. Not less than fifty cells should be counted in each film and the specimens should be examined, each of them, in the same way. I usually start at the top left hand corner and work along the edge from left to right. The counts of the normal specimens should all come within the limits of normal variations, i.e., they should have an opsonic index as compared with each other of not less than 0.8 or more than 1.2, in most cases with good technique the normal counts come out almost identical.

In order to form a satisfactory opinion the opsonic index should be taken three or four times at least, either daily or twice a day. If the patient is actively tubercular there may be found one or other of the following conditions present: (1) The index may remain consistently below 0.8; (2) it may be every time above 1.2; (3) it may vary within wide limits. If, say on the third examination, it is found that the opsonic index has remained within normal limits an attempt should be made to see the effect of auto-inoculation; the patient may, for example, be allowed to sit up or, if his condition permits, he may be told to take a walk of a mile or so; another method is to make the patient practise deep breathing for a few minutes. The blood is taken before, one hour after and again twenty-four hours after the auto-inoculating process. A simple way of obtaining the same result is to give the patient a minute dose of old tuberculin, ¼ mg. is a suitable amount for this purpose and can be safely used even when the patient has moderate fever, this will almost invariably produce a marked wave in the curve of the opsonic index if the patient is tubercular. If the opsonic index keeps steadily within normal limits in spite of auto-inoculation or the injection of old tuberculin it is extremely improbable that the patient is actively tubercular. It will be appreciated that the use of the opsonic index for diagnostic purposes involves very considerable trouble and a large expenditure of time, so that it is not a thing which one undertakes lightly if the diagnosis can be arrived at safely by other means, at the same time there are cases in which it is essential to carry out the test if one is to form a correct judgment as to the cause of the patient's illness.

Management of Early Cases of Phthisis.—Once the diagnosis of early phthisis has been made the patient should be transferred as
soon as possible to a proper sanatorium, but as there are inevitable delays before this can be accomplished he should be put at once under conditions as nearly as possible like those of a sanatorium. He should be isolated from his fellows, whether tubercle bacilli are found in his sputum or not, and should be placed in a large airy room with all the windows open or better still under a verandah or outside under a shady tree; the place selected should not be exposed to high winds or dust and in the Tropics it should be shaded from the sun, and the patient should be protected at night from mosquitoes by means of a net or punkah. Whenever it is possible a case in the Tropics should be transferred to the hills pending the beginning of the troop season; in this matter one has to run a certain amount of risk with haemoptysis cases, but it is essential to get the patient away from heat, dust, flies and malaria and one can often compromise by choosing one of the lower hill stations for such cases. Recent haemoptysis may also contra-indicate an immediate sea voyage; in this event the voyage may be postponed until the haemoptysis has been in abeyance for a month or so. On board ship there is especial necessity for isolation of phthisis cases since the cramped quarters of a ship are peculiarly favourable to the spread of infection; in this respect it has to be remembered that the dangerous material is not the gross lumps of sputum which can be so easily dealt with, but the spray which the patient ejects whenever he coughs and which may contain tubercle bacilli even when one has failed to find them under the microscope. In choosing a suitable place for locating tubercular patients on a ship every attention should be paid to securing free ventilation and, as far as possible, the conditions of an open-air life. In most cases, unless the weather is particularly bad, they are best kept out on a reserved portion of the deck. Seasickness is especially to be dreaded in haemoptysis cases; the use of sedatives and the recumbent position are very necessary to reduce this risk.

With regard to the general treatment of phthisis cases, patients with fever should be put to bed and kept there till the temperature goes down; a good rule is to keep the patient in bed whenever the evening temperature rises above 100°F., or whenever the evening pulse-rate exceeds 100. If the fever does not subside after simple rest in bed the rest must be made absolute, that is to say the patient must be treated like a case of typhoid fever, he must lie perfectly quiet, neither talking nor reading, he must be fed with a feeding cup and he must pass his dejecta into
a bed pan. Severe coughing helps to keep up fever by inducing repeated auto-inoculation; it should be kept in subject by the use of sedatives, of which codeine is perhaps the best. After the fever has subsided the restrictions can be relaxed gradually until the patient is able to be up for the best part of the day. Patients who are allowed up should follow the ordinary sanatorium rule and rest quietly on a bed or couch for three-quarters of an hour before and after the mid-day meal; any recrudescence of fever or constitutional symptoms necessitates a return to bed. Smoking should be restricted in amount and should be allowed only at definite hours three times a day, otherwise it will be found that patients are apt to smoke from morn till dusk.

For exercise, the only form that can be regulated easily in an ordinary hospital is walking exercise. This should commence with a \( \frac{1}{4} \) mile a day for a week, the distance is then extended to \( \frac{2}{3} \) mile, then to 2 miles, and lastly to 6 miles a day, each stage up to the last being continued for a week; the temperature should be taken one hour after the completion of the daily exercise, any return of fever or of constitutional symptoms, such as headache, malaise, or loss of appetite, necessitates either a reduction in the amount of exercise or a return to bed; if rest in bed is called for on account of over-exercise, the patient can usually return to an amount of exercise one stage less than the one which upset him. Diet should be generous, and should contain a high proportion of animal proteins and of fat, but it is not necessary to stuff the patient with food which he cannot digest; where there is difficulty in feeding, massage of the limbs for ten to fifteen minutes daily is often useful, and in many cases a glass of beer with the midday meal is a help to the appetite and to digestion. Cod-liver oil has had a reputation for many years in the treatment of tuberculosis and, whatever its mode of action, there seems to be no doubt that it is beneficial when the patient is able to digest it; experience seems also to show that other fats do not form efficient substitutes for it. It is best given in the form of an emulsion after meals, the emulsion can be prepared by the compounder and need not necessarily be one of the proprietary preparations, which are expensive.

A very good index of a patient's progress is to be found in his weight; this should be taken weekly; it is a good rule to have a weighing day for each ward so as to ensure that the matter is not forgotten; the weights should be recorded on the temperature chart, which should always be kept in custody of the sister or wardmaster;
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if the charts are left by the patients' bedside one finds that they brood over them, especially if things are not going well.

With regard to specific therapy, a large number of patients do very well without anything of this kind; at the same time there is no doubt that vaccine therapy is often extremely useful, and this is especially the case with mixed infections. It not infrequently happens that it is the advent of a mixed infection which has brought the man to hospital; his tuberculosis has, perhaps, been going on quietly, causing little trouble, until he caught a pneumococcus or catarrhalis cold, or until, say, a streptococcus infection was implanted on his previous trouble; thereafter followed an acute exacerbation with fever, and increased cough.

In such cases one often finds that if one deals with the mixed infection the mischief will quieten down until the case resumes the course of a chronic phthisis. If the measures which have been indicated above do not suffice to bring about a cessation of fever, it is desirable to have a bacteriological examination made of the sputum and a suitable vaccine prepared. The sample of sputum taken for this purpose should be as free as possible from mouth organisms, and the easiest way to obtain it is to make the patient open his mouth as wide as possible, and to give one vigorous cough on to a sterile plate (a dinner plate will do if it has been scalded); the fragment of sputum thus ejected should be lifted with sterile forceps and placed in a sterile bottle for transmission to a laboratory; it is well also to make two or three smears of the sputum to accompany the specimen.

It is unnecessary here to enter into details as to the method of preparing a vaccine, suffice it to mention that the most generally useful medium for sputum is blood agar. The following initial doses of vaccines are suitable:

- *M. catarrhalis* 20-50 millions
- *B. friedländner* 20-50
- *Streptococci* 10-20
- *Pneumococci* 10-20

It is as well to start with small doses and increase gradually, giving such an amount of vaccine as will produce no more than a slight rise of temperature or a slight increase in the catarrhal signs in the chest; the intervals between the doses should be seven to ten days. If the vaccine is doing good there will be a considerable reduction in cough and in the amount of sputum, the catarrhal signs in the chest will diminish, the fever subside, and the patient's general condition improve. Thereafter one can commence the administration of tuberculin. It would be impossible within the
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limits of this article to enter into all the details of the various methods for the administration of tuberculin; for these I must refer the reader to the many handbooks on the subject, of which perhaps, the one by Bandelier and Roepke is the most comprehensive. There are almost as many methods as men; for my own part I have a preference for small doses of "tuberculin, bacillary emulsion" (T.B.E.) I generally start with a dose of $\frac{1}{10000}$ mg. ($\frac{1}{10}$ c.c. of $\frac{1}{1000}$ dilution); if that dose does not produce fever or other disturbance I increase to $\frac{1}{5000}$ mg. ($\frac{1}{10}$ c.c. $\frac{1}{1000}$ dilution) and then to $\frac{1}{2500}$ mg., with intervals of a week between the doses. It will be usually found that these doses are well borne and, since the patient is only going to be kept until his transfer to a sanatorium, it is unnecessary to enter here into the question, a very much debated one, as to whether the doses should be pushed on to a higher level or not; the decision as to that will rest with the medical officer in charge of the sanatorium.

With treatment on the lines which have been sketched out above, a good proportion of early cases will go on to the sanatorium already in a fair way to recovery; there will, however, be some who are at a standstill, and others, a minority fortunately, who will go downhill as fast as ever they can. These last cases should be removed from contact with their more fortunate comrades; nothing is more depressing to the other patients in a phthisis ward than to have in it one of these acute cases getting visibly worse day by day. One has only to imagine what the effect of such a gloomy picture would have on oneself under such circumstances. Hope is everything to a man with consumption, and I am not at all sure that a great deal of the good effect of a sanatorium does not depend on the fact that the patient feels that he has gone there to be cured, and that the things which the doctors are doing to him are done as part of a definite plan for bringing about that happy event.