PROFESSOR KOCH'S REMEDY FOR TUBERCULOSIS.

REPORT BY PROFESSOR H. B. ALLEN.

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY HIS EXCELLENCY'S COMMAND.
## APPROPRIATE COST OF REPORT

<table>
<thead>
<tr>
<th>Description</th>
<th>£</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation—Not given</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printing (100 copies)</td>
<td>16</td>
<td>7</td>
</tr>
</tbody>
</table>
University of Melbourne,
20th February, 1891.

The Honorable the Premier of the Colony of Victoria.

Sir,

I have the honour to inform you that I have returned to Melbourne, and to submit herewith a Report on Professor Koch’s method of treating Tuberculosis. Other Reports will follow, dealing with the various subjects regarding which I was empowered to gather information.

I have the honour to be,

Sir,

Your most obedient servant,

H. B. ALLEN, M.D.,
Professor of Anatomy and Pathology.
In compliance with the request of the Honorable the Premier, transmitted by cable to the Agent-General for the colony, I have made inquiry concerning Professor Koch's remedy for tuberculosis. Through the courtesy of Professor Curnow, Dean of the Faculty of Medicine in King's College, London, I was enabled to attend several of the demonstrations given by Mr. Watson Cheyne, at King's College Hospital; and I also examined certain cases under treatment at the Brompton Hospital for Diseases of the Chest. Subsequently I paid a second visit to Berlin, where Professor Ewald kindly showed me the results obtained in a great number of phthisical patients under his care in the Augusta Hospital. Avoiding historical details as much as possible, I shall attempt to collate the chief facts hitherto recorded, incorporating with them my own observations.

Tuberculosis a bacillary disease.—The researches of Professor Koch, published in 1882, proved that tuberculosis in all its forms is due to the implantation of a minute vegetable organism—a bacillus—in the body. In the absence of this organism there is no tuberculosis. Different species of animals vary greatly in their susceptibility to invasion by the bacillus. Among human beings some are prone to the disease, while others are not. The predisposition is partly general (consisting in a frailty of the constitution, perhaps inherited), partly local, engendered by previous inflammation of some tissue, weakening its vitality and perhaps leaving in its substance certain products which favour the lodgment, the retention, and the nourishment of the bacillus. Tuberculosis not only embraces its well-recognised manifestations in the chest, the windpipe, the abdomen, and the membranes of the brain; it affects nearly every organ of the body; it is the essence of a large proportion of prevalent diseases of bones, joints, and lymphatic glands; it includes all the lesions called serofulous; and the skin affection called lupus, whether ulcerative or not, is another form of the same disease. In all these processes the changes in the affected tissue have a special character more or less clearly expressed; the specific bacillus is present in all cases, and may be cultivated from them in the pure state on suitable media; and, when these cultivations are inoculated into susceptible animals, such as rabbits or guinea pigs, an acute tuberculosis follows. The evidence concerning the communicability of tuberculosis has already been collated for the Government of the colony of Victoria in the report of the Board on tuberculosis in cattle, submitted in 1885. Additional information may be found in the "Evidences of the Communicability of Consumption," recently published by Dr. Heron.

Discovery of Professor Koch's remedy.—Koch found that inoculation of tubercle bacilli, either alive or dead, caused quite different results in guinea pigs, according as the operation was performed on a healthy animal or on one already rendered tuberculous. Following out this result, he discovered that pure cultivations of the bacilli, killed and ground up in water, might be injected under the skin of healthy guinea pigs in large quantities without any result beyond local suppuration; but in guinea pigs already tuberculous small doses proved fatal; somewhat smaller doses causes extensive death of skin around the point of inoculation; whereas very small doses, greatly diluted, and repeated at intervals of one or two days, not only did no harm, but arrested the progress of the original tuberculosis. Notwithstanding this remarkable result, the dead bacilli which had been introduced were not absorbed; they remained in their new positions, and caused local suppuration. Hence it was evident that the good result was due to some soluble substance which diffused out of the bacilli into the fluid around them, and which was rapidly transferred to the circulating fluid of the body. The pus-forming quality remained in the bacilli. After much labour, Koch found that he could extract the useful substance from cultures of bacilli by means of a 40 or 50 per cent. solution of glycerine. The glycerine extract so formed arrests the progress of tuberculosis in an infected guinea pig without causing suppuration at the site of inoculation.
The remedy with which the new therapeutic treatment of tuberculosis is carried out is therefore a glycerine extract of pure cultivations of tubercle bacilli. The exact details of its preparation have not yet been made public. The process is said to occupy about six weeks, and the efficacy of every sample must be tested by inoculation of suitable animals. Great difficulty is experienced in obtaining any approach to uniformity of strength. The active principle is, in Koch's opinion, allied to and derived from albuminous bodies. It is present in very small proportion, probably constituting only fractions of 1 per cent. of the extract. It is not a tox-albumen, as it resists high temperatures and dialyses easily. It is insoluble in absolute alcohol. The extract also contains colouring matter and extractives, but these are said to have no influence on the human organism.

The remedy is a most powerful poison. It is much more potent in its action on man than on guinea pigs. In a healthy guinea pig the injection of 2 cubic centimetres (c.c.) under the skin may produce no notable effect; but in a healthy man 0·25 c.c. causes an intense reaction. In relation to body weight, 1/300th of the quantity which has no appreciable action on the guinea pig is powerfully active in man. Koch watched in himself the effects following the injection of 0·25 c.c. under the skin of the arm. After three or four hours he experienced pains in the joints, languor, a tendency to cough, and difficulty in breathing, which rapidly increased; then, at the fifth hour, a very severe shivering fit, lasting for an hour; then nausea, vomiting, and a rise of temperature to 103·3° Fahr. This disturbance ceased at the end of twelve hours, the temperature falling next day to the normal level; the joint pains and lassitude lasted for a few days; and for the same time the site of the injection remained slightly painful and reddened. The smallest quantity which produces any reaction in a healthy human being is about 0·01 c.c., or, in other words, one cubic centimetre of a 1 per cent. solution of the glycerine extract. This dose causes slight pain in the joints, and transient languor, and sometimes a rise of temperature to 100·4° Fahr. Apart from this difference in dose, the results in animals and men are very similar.

Special susceptibility of tuberculous subjects.—The next fact is all-important. The injection of 0·01 c.c., which has scarcely any effect on the non-tuberculous subject, produces a powerful reaction in the tuberculous. This reaction is both general and local. The general reaction consists in an attack of fever, mostly beginning with a rigor, the temperature exceeding 102·2° Fahr. (39° C.), often rising to 104° (40° C.), and even to 105·8° (41° C.). With the fever there are pains in the joints, cough, great prostration, and often nausea and vomiting. The fever usually begins four or five hours after the injection, and lasts twelve to fifteen hours. Exceptionally it commences later, and runs a milder course.

The local reaction is best observed in cases where the tubercular disease is visible, especially in lupus. Within a few hours after the injection, and usually before the rigor, the lupus nodules swell and redden. While the fever lasts these changes become more and more intense, so that the lupus patch looks as if attacked by severe erysipelas. The inflammatory process may pass into necrosis or death of tissue, but this is not unusual. The lupus tissue is surrounded by a narrow white zone of inflammatory oedema, and around this there is a broad defined band of bright redness and swelling. Serum exudes freely from the lupus area. After the fever has declined the swelling diminishes, and in a few days it disappears. During the process the serum dries into crusts, which separate in two or three weeks. The reactive process is confined to the tissue actually tuberculous. It will pick out little islets of lupoid growth in the midst of old scars, which do not react in the slightest degree.

In cases of tubercular disease of bones, joints, or glands, the local reaction is manifested by heat, swelling, pain, and tenderness, and sometimes by redness of the skin. In tubercular disease of the larynx the inflammatory reaction is often very marked, sometimes even rendering tracheotomy necessary; and it may pass into actual necrosis or death of the tubercular tissue.

In the lungs it is difficult to study the reactive process. Many observers have found increased cough and expectoration after the first injection, and some have recognised a manifest increase in the physical signs of the disease, such as would be explained by an inflammatory process resembling that which occurs in lupus. Other

observers, however, have been unable to detect any such change in the physical signs of tubercular disease in the lungs, and increased expectoration is not a constant phenomenon.

The general reaction, therefore, is well marked in connexion with tubercular processes of every variety, whatever may be the organ or tissue affected; but the local reaction, which is so intense in lupus, is usually much more moderate in tuberculosis of bones and joints, and is not distinct in pulmonary phthisis.

Exhaustion of susceptibility.—As a rule, the susceptibility of patients is rapidly exhausted; repetition of the injection causes less and less reaction, and soon no response occurs. With larger doses, reaction again follows, but in a few weeks the injections may be increased so that no effect is produced by 0·05 or even 0·1 c.c.; when this result is attained, it is presumed that no living tuberculous tissue remains.

Cheesy or necrotic tubercles are unaffected.—Koch states that tubercular tissues which have passed into the cheesy or necrotic state are not affected by injection. The circulation in them has ceased, and the remedy does not reach them. Yet living bacilli, perhaps in considerable numbers, may persist for years in cheesy nodules in the lungs or in cheesy lymphatic glands. Hence, even when a patient has ceased to exhibit any reaction, either local or general—when, according to Koch’s theory, all tubercular tissue is dead—old cheesy masses may persist as storehouses of bacilli, from which a new dissemination may afterwards occur. Similarly, when actual necrosis of tissue follows the employment of the remedy, bacilli remain enclosed in the necrosed tissue, which is not affected by further injections. In many cases surgical interference is necessary for the removal of the tissues killed by the remedy.

Diagnostic value.—The occurrence of the reaction in connexion with all forms of tuberculosis, including the various lesions of serofula and lupus, has confirmed in striking fashion the modern view that all these diseases are essentially one, though differing vastly in appearance and in history. The skin disease known as lichen scrofulosorum would also seem to be tubercular in origin, as patients suffering from it manifest local and general reaction after inoculation. In cases of doubtful tuberculosis, a single inoculation may afford proof of the nature of the mischief. Subject to certain reservations which will be indicated at a later stage, it may be stated that tubercle is almost certainly present when reaction occurs after the injection of 0·01 cubic centimetre of the fluid; and if no reaction occurs after repeated inoculation of a similar quantity, it may be held with a still greater approach to certainty that tubercle is not present.

One or two examples may make the diagnostic value of the process more obvious. Professor Guttmann, the head of the Moabit Hospital, in Berlin, narrates the case of a medical man who wounded his index finger slightly at a post-mortem examination a year and a half previously. A small indurated swelling developed, and remained persistent, though indolent. Local and general reaction followed the injection of 0·003 c.c. of Koch’s fluid.* In diseases of the larynx, perhaps tubercular, perhaps cancerous, a single injection has sufficed to establish the diagnosis. Sir Joseph Lister has related the case of a young medical man who had an injection performed upon him as a mere matter of experiment, having no suspicion that he was the subject of tubercule. A violent febrile reaction followed, which led to careful examination by a physician, and this revealed slight but unmistakable disease of the apex of one of the lungs.† At King’s College, Mr. Watson Cheyne inoculated a boy on whom he had operated for tubercular disease of the foot; strong general reaction followed, with little local change in the foot; but distinct reaction occurred on the back of one of the hands in part of a previously unnoticed scar, in which living remains of an old tubercular process still lay hidden. Surgeons have now on many occasions practised inoculation to test the completeness of the cure after treatment of diseases of bones and joints by the usual methods.

A difficult problem here presents itself. In cases of pulmonary phthisis or lupus or other localized tubercular process, injection may be followed by distinct inflammatory reaction in parts not previously known to be tuberculous. Thus, in a patient with lupus of the face, great numbers of lymphatic glands in various parts of the body may react even to the point of necrosis. In cases of pulmonary phthisis, various joints, especially the knees and ankles, may become inflamed. In some instances the parts so affected are distinctly tubercular, though the disease had

† Lancet, 13th December, 1890, p. 1257.
previously been overlooked or utterly hidden. Baumgarten, too, has shown that a few tubercular bacilli may exist for some time in a tissue without producing obvious changes, a certain multiplication being necessary, for which the local conditions may not be favorable. But the comparative frequency of inflammatory reaction in the joints in cases seemingly of ordinary pulmonary phthisis makes some of the best observers pause. Obvious tubercular disease very rarely presents itself in the joints of a patient already phthisical. Hence Dr. Lindner, of the Augusta Hospital, in Berlin, has expressed the belief that the glycerine extract contains not only the toxic principle which acts upon tubercular tissue, but also an element of septic nature, to which certain of these complicating local reactions must be ascribed.*

As this question of diagnosis is most important, I may further quote two cases which I saw under Professor Ewald's care. A patient with slight pulmonary phthisis, when injected, became feverish, showed no local reaction in the lung, but reacted in several joints with pain, tenderness, and swelling. One leg was shortened by old hip disease and there was lordosis. But the knees and ankles also reacted, which had been apparently healthy. In another case, operations had formerly been performed on cheesy glands in the neck. Just before admission, pleurisy set in with effusion. Injection was followed by strong general reaction. Under repeated injections rapid absorption took place. But just as in the case of pulmonary phthisis, there was doubt whether local reaction in the knees and ankles proved the existence of tubercle in these joints, so also in this case it is questionable whether the general reaction proved that the pleurisy was tubercular. The question is still an open one, the balance of evidence, in my opinion, leaning against the absolute value of the method in diagnosis.

Absence of reaction in tubercular cases.—Many instances have been recorded in which no reaction either local or general followed repeated inoculation of full doses in cases of unquestionable tuberculous disease. Examples may be found among the patients with surgical tuberculosis in the clinique of Professor Billroth, at Vienna;† also in four cases treated by Professor Leyden;‡ and in one laryngeal case under the care of Professor Krause, in Berlin.§ This absence of reaction has been experienced in cases of phthisis with well-marked physical signs, and with bacilli present in the sputa.‖ But such cases are relatively few in number, and merely constitute exceptions to the general rule. Much more commonly, no reaction follows the injection of a small dose of the liquid, while definite reaction is obtained when the dose has been repeated or increased. I have not myself seen a single case which, on repeated trial, failed to respond to the test.

Reaction in cases not tubercular.—On the other hand, local or general reaction, or both, have been known to occur in cases not tubercular, namely, in cases of leprosy, syphilis, and actinomycosis. Reference may be made to three cases of leprosy under the care of Professor Kaposi, in Vienna;‖ another under Professor Neumann, in Vienna;¶ another under Mr. Watson Cheyne, at King's College, London;** and others in Germany and in Madeira. One case of leprosy is said to have derived benefit from the treatment. As regards syphilis, less definite information is available. I saw one case in Professor Ewald's clinique which appeared to be syphilitic disease of the larynx, but injection caused distinct general reaction. The only instance, as regards actinomycosis, is reported from Billroth's clinique, and it showed well-marked local and general reaction.‖ Reference may also be made to a patient under the care of Dr. Heron, at the City of London Hospital for Diseases of the Chest (case 8 in Dr. Heron's demonstrations); here an anemic girl, aged eighteen, reacted distinctly to repeated injections, though most careful examinations by several physicians failed to reveal any reason why she should respond to the remedy. In this case also, reaction was accompanied by tenderness and swelling in both knees, and by tenderness in the right ankle.†† But excluding leprosy, which in many respects is pathologically parallel with tuberculosis, and concerning which further observations are needed, the general rule holds good that when reaction follows the injection of a dose not exceeding 0.01 c.c. tubercle must be present. It is worthy of remark that the lesions of tubercle, leprosy, syphilis, and actinomycosis all belong to

† Lancet, 13th December, 1890, p. 1292, and 20th December, 1890, p. 1361.
‡ L'Union Medicale, 6th December, quoted by the Lancet, 20th December, 1890, p. 1349.
§ Lancet, 12th December, 1890, p. 1292.
¶ Lancet, 20th December, 1890, p. 1361.
** Lancet, 20th December, 1890, p. 1351, and 27th December, 1890, p. 1410.
†† Lancet, 27th December, 1890, p. 1410.
one great pathological group, namely, that of the *granulomata*. Among Professor Ewald's patients at the Augusta Hospital in Berlin, I saw a cachectic patient with internal carcinoma of the abdomen, and a metastatic ulcerating tumour in the skin over the lower part of the sternum. He was injected, and showed strong general reaction, but no sign of tubercle can be found in him. A case of bronchietasis reacted strongly and repeatedly, though the sputum after numerous and thorough examinations showed no bacilli. This patient is losing flesh, has profuse expectoration, and tender.

As Professor Dr. A. Libbertz, Luneburger Strasse 28, Berlin, the glycerine extract is sent out in stoppered bottles, each containing 5 grammes, the price of each phial being 25s. The fluid resembles brown sherry in colour, and is somewhat sticky to the touch. In its pure state it is not liable to decomposition, but when it is diluted with distilled water bacterial growths are apt to appear, rendering it turbid. It is then unfit for use. But if the dilution is made with a one-half per cent. solution of carbolic acid the development of bacteria is prevented. Even this proportion of carbolic acid, however, slowly diminishes the activity of the remedy, so that dilutions should not be made till they are required; this dilution, however, remains active for a week. It is useful to have two dilutions—a first with the strength 1 in 10, and a second of 1 in 100. One cubic centimetre of the second will therefore represent 0·01 c.c. of the original, while 1 c.c. of the first dilution will represent 0·1 c.c. of the original. A further dilution may be made if so desired for injections of 0·001 c.c., or of fractions of this quantity. All apparatus used should be carefully sterilized. The solutions for use may be placed in sterilized stoppered phials, with a groove in the stopper. The customary antiseptic precautions should be observed. The injections may be made with Koch's syringe, which is a graduated glass cylinder, with glass nozzle, on which fits an ordinary hypodermic needle; while an indiarubber ball (which replaces the piston of the ordinary hypodermic syringe) fits on to the other end of the cylinder by means of a little metal stem furnished with a stop-cock. The syringe should be cleansed with distilled water. Immediately before use the indiarubber ball, with the metal tube, is detached from the cylinder. The cylinder is then filled with absolute alcohol. The ball and tube are then connected with it, and the alcohol is gently expelled by means of the ball. Many authorities prefer the syringe of Dr. G. Meyer, which is made by Windler, of Berlin. This resembles an ordinary hypodermic syringe, but the washer consists of asbestos, and the tension of the piston on the cylinder can be increased or decreased at pleasure. The washer is easily disinfected with absolute alcohol.

The injection is usually made through the skin between the shoulders, because in this region the operation causes a minimum of pain, while absorption is rapid. It should not be made in the immediate neighbourhood of any tubercular lesion. The skin should in the first place be washed, and disinfected by means of a 1 in 30 solution of carbolic acid. The point of the needle should be dipped in a similar solution. After the operation a piece of aseptic wool or lint may be applied, with a coat of collodion.

Professor Guido Baccelli, of Rome, has introduced the remedy directly into the blood by intravenous injection. Rapid reaction followed.
As Koch pointed out in the beginning, the remedy is inert when given through the stomach. Koch originally recommended that for lupus the first injection should consist of 0.01 c.c.; that the re-action should be allowed to run its course to the end; that then, after one or two weeks, 0.01 c.c. should again be injected, and so on till the reaction became feeble, and finally ceased. He advised a similar procedure with tuberculosis of bones, joints, and glands. Finding that phthisical patients were far more susceptible than those suffering from surgical tuberculous affections, he suggested for them a different method. He found they nearly all reacted strongly to 0.002, or even 0.001 c.c. Hence, as a rule, an injection of 0.001 c.c. was first given, and the dose repeated daily till no reaction occurred; then the dose was increased to 0.002 c.c. till this quantity caused no reaction; and so on, increasing by 0.001, or at most 0.002 c.c., up to 0.01 c.c., or even higher still. In this way patients were brought to bear very large doses of the remedy with the least possible suffering.

Subsequent experience has confirmed the policy of beginning with very small doses for phthisical patients; even less than 0.001 c.c. may be employed at the outset, and the frequency of repetition of the injection and the rate of increase of the dose must be adjusted according to the condition of the patient and the amount of depression occasioned by the remedy. Subject to such precautions, the dose may be increased to 0.05, or even 0.1 c.c.

In lupus Professor Bergmann commences with 0.01 c.c. if there be only one lupous centre, without any lesions in the lungs or other organs. When there are several deposits he does not give more than 0.006 c.c. But many authorities favour the use of smaller doses at the outset. The injections are often given more frequently than Koch at first recommended, the intervals allowing only the complete subsidence of the fever, and a short period of rest.

In children the doses should be proportionately reduced.

Results obtained in Lupus.—Beyond question, the results obtained in the treatment of lupus are exceedingly good; after the first injection, when the crusts come away, the surface may be found much more healthy, the edge less raised, the morbid tissue passing more gradually into the healthy parts around. After repeated injection the reaction becomes less and less, even with increasing doses, and at last may cease altogether, and healthy skin grows over the ulcerous patches. With non-ulcerating lupus the skin rapidly assumes a more healthy appearance. These results have been obtained in a few weeks in cases which have resisted all ordinary treatment during long periods of time. Excellent examples of the treatment may be found in case 11, in Dr. Watson Cheyne’s demonstrations at King’s College, and in the cases submitted by Professor Bergmann, at Berlin, in his last demonstration immediately before the new year. No case can yet be quoted of absolute cure. Relapses have occurred after apparent cure, but they will probably yield to a continuation of the treatment. Time only will tell whether the remedy by itself will finally deliver patients from this terrible disease. No other known treatment produces such results. Great improvement sometimes follows an intercurrent attack of erysipelas; and, as already pointed out, the local reaction caused by Koch’s fluid closely resembles an erysipelas-like process. But erysipelas would be an unmanageable remedy, dangerous both to the patients and to those around them. At Innsbruck a woman with lupus died, collapsed after the injection of only 0.002 c.c. of Koch’s fluid; but she was suffering from tuberculosis of both lungs, of the intestines, the legs, and the arms. Professor Cornil, of Paris, says that injections should not be used in cases of lupus in which there are numerous tubercular complications in the lungs or elsewhere. But Professor Bergmann simply advises that in such patients the first doses should be very small.

Even in lupus, the use of Koch’s remedy does not of necessity wholly displace surgical interference. When the disease spreads deeply, Volkmann’s spoon may perhaps be used with advantage prior to the specific treatment; or when the new method has ceased to cause reaction, the old surgical measures may be employed to remove the altered remains of the lupoid tissue, and thus hasten the final cure.

Results in Diseases of Bones and Joints.—Here the results have been less constant, and, according to the experience of Cornil in Paris, sometimes in the direction of improvement, sometimes the reverse. At King’s College I saw under treatment cases of early and late disease of the hip joint and elbow joint, of the tarsal bones and joints, of the head of the tibia, of strumous dactylitis, &c. Reaction, both local and

---

* Lancet, 13th December, p. 1296; 20th December, p. 1351; 27th December, p. 1410.
† Lancet, 3rd January, p. 50.
‡ Lancet, 3rd January, p. 50.
general, occurred in all cases, the local reaction being, as a rule, less marked when abscesses had formed around affected joints, with consequent septic infection. For example, a child, aged eight, with indolent hip-joint disease, was submitted to treatment; the limb could be flexed to a right-angle with the trunk, but adduction and rotation were impossible. Injections caused pain and swelling in the joint. The temperature rose with successive injections to 106°, 105°, 105°. till at last no reaction was obtained. The treatment was commenced on 3rd December, and the Lancet on 10th January reported that addiction and rotation were now very apparent, and that no case treated by the ordinary methods could show so much improvement. Bergmann has exhibited a little boy in whom hip disease was apparently cured in a month, after four injections. In some cases the treatment has been followed by suppuration in or around the affected joint, and pieces of necrosed tissue have come away. Dr. Israel, the senior assistant of Professor Virchow, has examined this tissue in one case, and reported fully upon it.* In several cases the treatment is reported to have caused fever, with swelling and great pain in the affected part, and without subsequent improvement. The specific treatment does not do away with surgical interference; and Dr. Lindner, of the Augusta Hospital, in Berlin, notes that tubercular material can subsequently be removed from diseased joints with a facility formerly unknown. For the diagnosis between tubercular and non-tubercular disease of bones and joints, a question often full of difficulty, it is claimed that injection furnishes an unfailing test.

**Results in disease of the lymphatic glands.**—In tuberculous disease of lymphatic glands no case of cure by the direct action of Koch's fluid has come under my notice. But repeated injection, with increasing doses, has been followed by diminishing reaction, the affected glands becoming smaller, more defined, and more movable, and, therefore, presumably more easily removed by the surgeon. The local reaction is not constant, and is usually slight. Bergmann has never seen any permanent diminution in size of the affected glands:

**Results in tuberculosis of the larynx.**—As the loose tissues at the orifice of the larynx are very subject to edematous swelling during any acute inflammation, it might be expected that startling dangers would attend the local reaction in cases of laryngeal tuberculosis. The occurrence of local reaction is sufficiently proved by Sir Morell Mackenzie's cases recorded in the Lancet.† Sometimes necrosis occurs, and fragments of dead tissue are detached. In some instances the inflammatory swelling has rendered tracheotomy necessary, as, for example, in cases reported from Bonn.§ In a case related by Dr. Fraenkel, of Berlin, perichondritis of the arytenoid cartilage developed after three weeks pursuance of Koch's method.|| Phlegmonous inflammation, with suppuration, has also been reported as having followed injection. In several instances the treatment has been followed by the appearance of numerous distinct tubercles on the mucous membrane of the larynx or pharynx. It has been generally supposed that in such cases these little tubercles have been already in existence, though so small as to be invisible, and that the inflammation induced by the remedy has brought them into view. Professor Virchow, however, suspects that the injection itself may cause an eruption of new tubercles.

Professor Fraenkel, of Berlin, says that, when necrosis occurs, the ulcers soon cleanse themselves and tend to granulate.|| Cornil, in the Laennec Hospital, and Gougenheim, at the Lariboisière, in Paris, did not experience any untoward results in their treatment of laryngeal cases, and hold that the remedy, carefully employed, may be useful, provided always that a skilled laryngologist is ready to intervene surgically should any necessity arise.** In Professor Ewald's clinique, at the Augusta Hospital, in Berlin, I saw several cases of laryngeal tuberculosis under treatment by Koch's method; in none of them did any marked local reaction occur; and in several there had been diminution of swelling, and general improvement. On the other hand, Professor Schroetter, of Vienna, whose clinique for throat disease I had the privilege of visiting in September last, is said to have found no sign of improvement in his patients after several weeks' trial of the method, loss of weight being noted in every case.††

* Lancet, 6th December, 1890, p. 1239.
† Lancet, 13th December, p. 1296.
‡ Lancet, 10th December, 1890, p. 1291.
†† Report in Le Temps, 22nd December, 1890.
With such conflicting reports, it is impossible to arrive at any conclusion.

Results in tuberculosis of the intestines.—In several cases of tubercular ulceration of the intestines, injections have been followed by inflammation in and around the ulcers. In one patient, who died after injection, the inflammation had been so intense as to produce death of tissue, extending through all the coats. Had life been prolonged, perforation of the intestine must have followed. Such perforation actually occurred in one instance; but there is doubt whether this fatal event was due to the injection, for it sometimes happens in the ordinary course of the disease. Professor Virchow reports that inflammation and death of tissue occur in old intestinal ulcers after injections just as in lupus, and that abundant fresh growth of tubercle has been found in connexion with the ulcers.*

Results in tuberculosis of the lungs.—Public interest concentrates itself on the main question—whether or not ordinary pulmonary phthisis can be arrested or cured by this new remedy. Hence I think it advisable to quote Koch's own words from the authorized translation of his paper, published in November, in the Deutsche Medizinische Wochenschrift. After explaining the method of regulating the dose, he continues:—"The action of the remedy in cases of phthisis generally showed itself in this way: the cough and expectoration usually increased after the first injections, but then gradually became less and less until, in the most favorable cases, they totally disappeared; the expectoration also lost its purulent character and became mucous. Only those patients whose expectoration contained bacilli were chosen for experiments, and the number of bacilli generally decreased only after the expectoration had assumed a mucous appearance. They then sometimes disappeared entirely, but were met with occasionally from time to time until the expectoration entirely stopped. Simultaneously, too, the night sweats ceased, the patients improved in appearance and increased in weight. These patients, who were treated in the early stages of phthisis, were all free from the symptoms of the disease from within four to six weeks, so that they might be looked upon as cured. Patients, too, with not too highly-developed cavities improved considerably and were almost cured. Only those whose lungs contained many and large cavities did not improve objectively, although the expectoration decreased and their subjective condition was better. From these experiences I conclude that phthisis in the early stages can be cured with certainty by this remedy." In a foot-note, Koch adds the limitations that it has not yet been shown that the cure is a lasting one; that relapses may still occur, but that probably they will be just as easily and as quickly cured as the first attack; and, moreover, he suggests the possibility that, as with other infectious diseases, patients once cured may always retain their immunity. Koch speaks less hopefully of more advanced cases, and states that patients with large cavities will probably only in exceptional cases derive any lasting benefit from the use of this remedy.

I cannot quote further from the original paper, but recommend all those who are specially interested in the subject to peruse the "Cure of Consumption: Further Communications on a Remedy for Tuberculosis, by Professor Robert Koch," the authorized translation published by William Heinemann, London. The original paper appears in abstract in the Lancet of 22nd November.

What confirmation, then, have Professor Koch's statements received? The Lancet of 13th December gives the notes of two cases which were discharged from the Charité Hospital, in Berlin, after being treated for two months by Professor Fraenzel according to Koch's method. Instead of being miserable and cachectic, as at the time of admission, they felt strong and well. Weight had increased, night sweats had disappeared, cough had almost left them, and bacilli in the sputum were few in number or absent. The physical signs of disease had almost vanished.†

Professor Fraenkel, before the Berlin Medical Society, at the end of December, said that he had obtained diminution or cessation of bronchial respiration and dulness, better appearance of the sputum, and improved general condition.§

Before the Hufeland Society, Dr. Guttmann, of the Moabit Hospital, in Berlin, spoke of 109 cases under treatment by him (some for 26 days) and of six treated by Koch himself since the end of September. In a small number of his own cases he had already obtained improvement, and in 5 per cent. of them the tubercle bacilli had disappeared. Of the six cases treated by Koch, some had gained considerably in weight; two girls with infiltration of the apex appeared to be cured.§

---

† Lancet, 13th December, 1890, p. 1290.
§ Ibid.
At the City of London Hospital for Diseases of the Chest, some of the cases included in Dr. Heron's demonstrations have undergone notable improvement both in symptoms and physical signs, especially cases 1 and 7.*

Among the many important contributions to the subject are those of Professor Kast and Professor Cornil. Professor Kast is director and chief physician of the magnificent new hospital at Hamburg. He has treated consumptive patients in all stages. "In the cases in which the disease was just beginning, retrogression of the local phenomena took place, the general condition improved, appetite and weight increased, but the improvements were not greater than those obtained by the methods hitherto in use. In the advanced cases a favorable influence of Koch's medicament was not observed."†

Professor Cornil, the eminent pathologist, who was till the end of last year physician in the Laennec Hospital in Paris, speaks as follows:—"Pulmonary tuberculosis, for the cure of which Koch's fluid had excited most hopes, seems to be on the contrary the form of tuberculosis in which its use should be most restrained. The treatment is useless in cases of phthisis, advanced, febrile, with cavities. It does not prevent hæmoptysis, and perhaps favours bleeding by the congestion which follows its use. It may occasion or promote pleural effusions when the pleura is the seat of tuberculous granules. It is injurious in disseminated miliary tuberculosis of the lungs and in acute pneumonic phthisis. In patients recently attacked, the pulmonary congestion and engorgement which occur around the diseased parts after each injection appear to be more dangerous than useful. As regards old tuberculous lesions in the lungs, limited in extent and inert, which patients without fever and of healthy appearance have borne without trouble for eight, ten, or fifteen years, it would be dangerous to arouse them by Koch's fluid, which would assuredly give them a new impetus." Cornil will, therefore, cease almost completely to treat pulmonary phthisis by the method of Koch, except in using small doses in a limited number of chronic cases, without fever or with very little fever, and without any disquieting local reaction.‡

The cases which I found under treatment at the Brompton Hospital for Diseases of the Chest were precisely of this description, but they had not been long enough under observation to permit any inference as to the success or otherwise of the treatment.

In examining the numerous patients under Professor Ewald's care at the Augusta Hospital, in Berlin, I was impressed by several important facts. The patients almost invariably presented the disease in an early stage. Those suffering from advanced disease knew it was hopeless to seek admission. A large proportion came in with no fever, and in fair bodily state, usually with signs of very early change, sometimes with doubtful cavity, rarely with more advanced lesions. As a rule they had cough, expectoration, and night-sweats, and in many cases were losing weight. Injections were given in very small doses to begin with, and were cautiously increased. General reaction occurred in every case, but not always with the first injection. A patient might fail to react to the first doses, and then react severely to a subsequent injection, either without any increase in the quantity administered, or after increase from 0·001 to 0·003 or 0·005 c.c. After strong reaction with one dose, subsequent injections of the same amount might produce little or no reaction, while a slight increase would cause strong reaction. A small dose would cause violent reaction in certain patients, while a large dose induced feeble reaction in others. The intensity of reaction was not proportionate to the amount of tubercle present; trivial lesions were sometimes attended with strong reaction, and extensive lesions with slight reaction. In reaction the rise of temperature was usually steadily progressive towards the maximum, the crisis short, and the fall fairly uniform. But in some cases the rise was broken by one or two small falls, sometimes the crisis was prolonged, and sometimes both rise and fall were very abrupt, and the crisis extremely short, so that the temperature tracing had, as Professor Ewald expressed it, a Matterhorn abruptness. In some cases reaction was delayed for fifteen or more hours, and was then feeble. Very often the reaction was followed by subnormal temperatures, lasting for several days. On the contrary, in a limited number of cases a continued fever, lasting several days, remained after the main fall. This secondary fever was sometimes severe, sometimes slight. It never occurred until the dose had been raised several times, and even

---

* Lancet, 10th January, 1891, pp. 105-6.
‡ Le Temps, 22nd December, 1890.
then did not recur after every injection. As a rule, the patients suffered very little during the reaction, whatever might be the height of the fever. This was a most striking general feature of the cases. Some, however, suffered greatly during reaction from lancinating pains in the chest, or from prostration, which was sometimes so intense that it was necessary to discontinue the treatment. In some cases the spleen underwent decided enlargement during the reaction.

But while the general reaction was so well expressed, the local signs of disease in the chest were not much affected. There was no case in which injection caused decided increase of local signs, followed by diminution. The expectoration sometimes increased and subsequently diminished, but in a great number of cases there was no primary increase, the expectoration being lessened from the first. Such diminution was another great general feature of the cases, and was attended with corresponding alteration in the auscultatory signs; but the change was not greater than that which could be obtained by other methods of treatment. Several patients had already been discharged with no fever, with lessened cough, with no expectoration, with no night-sweats, and with increased weight. But the percussion signs in the chest were unchanged.

Even if improvement had taken place, no great alteration could be hoped for in the percussion signs at all events, in so short a time as the treatment had yet occupied. Professor Ewald characteristically described the effects of injection as kaleidoscopic. He held that so far nothing certain was known as to the results of the remedy. He would not use it in cases of great debility, or in very advanced disease, or where many organs were affected, or where there had been repeated hæmoptysis. Would the same results be obtained by a fever-making poison without any special action on the tubercles? Can the subjective feeling of patients that they are better be trusted? How far is it the case that patients in fair bodily condition are made ill by the remedy, and feel better when they no longer react to it? When a man with doubtful tuberculosis fails to react to repeated small doses, and then reacts to a larger dose, is this the reaction of health or of disease? Such were some of the questions which I had the privilege of discussing with Professor Ewald, whose kindness I shall never forget.

But while Professor Ewald thus obtained general reaction without definite increase in the local signs of disease in the lung, Professor Baccelli, of Rome, in his early experiments had the reverse experience. Two cases were under observation.

In neither was there any systemic response; locally, however, in the lung itself, on careful repeated auscultation, "there was detected a notable increase of the tubercular nodes—in other words, the same swelling that had been caused superficially in the skin of the lupus cases had its counterpart in the lung at the seat of tuberculosis."

Hitherto I have referred to a general consensus of opinion that cases of phthisis in advanced stages should not be submitted to injection. But as against this, there is the fact that in several cases in which Koch's method had been pursued, surgeons have been emboldened to make openings through the chest wall into phthisical cavities. Thus, a recent telegram from Berlin stated that, on 6th January, the fifth of a series of cases of operation on cavity of the lung, to facilitate removal of necrotic tissue after Koch's treatment, was successfully performed by Professor Hahn, at the Friedrichshain Hospital. It was reported that in the four cases previously operated on, the results were so far favorable.† Surgeons have long been desirous of extending the benefits of free drainage and aseptic treatment to phthisical cavities; but hitherto an insuperable difficulty has been presented by the impossibility of reaching the bacilli embedded in the tubercular tissue around the cavities. If, however, Koch's fluid destroys all this tissue, and renders it easy of removal with its contained bacilli, a marvellous advance will have been made.

Emphatic condemnations of Koch's treatment have not been wanting. On 8th January, Doctors Fournier, Besnier, Hallopeau, Quinquand, Tennessee, and Vidal, of the St. Louis Hospital in Paris, lodged at the office of the Société de Dermatologie a paper giving an analysis of their observations on patients treated by Koch's method in the hospital. They find that it has been impossible to estimate the curative effects of the lymph, while the dangers to which it exposes the patients are clearly established. Its action baffles the most experienced practitioner. It produced accidents in organs known by careful previous examination to be in a healthy state. It induced complications of albuminuria, endocarditis, and erysipelas. The hair of two patients came out. One woman almost died in a swooning fit.

* Lancet, 26th December, 1890, p. 1860.
† Morning Post, 8th January, 1891.
The most important statement made since the publication of Koch's paper is that submitted by Professor Virchow at the meeting of the Berlin Medical Society on 7th January, 1891. He said he had examined the organs of twenty-one persons who died after being subjected to treatment by Koch's method. Among them were sixteen cases of pulmonary phthisis, one case of tuberculous bones and joints, one of tubercular meningitis, &c. He found clear evidence that the injections produced inflammation in tubercular organs in the interior of the body similar to that seen in tuberculosis affecting the surface of the body. In cases of pulmonary phthisis the treatment seemed to have been followed by extensive caseous pneumonia, especially affecting the lower lobes of the lungs, or by rapid and diffuse catarhal pneumonia, so acute as to be almost phlegmonous. In some of the patches of consolidation so produced, very rapid softening and excavation were in progress. Caseous and catarhal pneumonia occur in the course of phthisis as part of the natural history of the disease; but Virchow was impressed by their frequency, extent, and intensity in these cases. If the injections do in reality cause rapid disintegration of tubercular tissue in the lungs, the products of the destructive change would be very apt to be drawn back into the recesses of the lungs, and there set up inflammatory processes such as those described by Professor Virchow. But a further observation made by him is even more important. He found in these patients abundant outbreaks of fresh tubercles, which showed no signs of having been affected by the injections, and which, in his opinion, were developed after the treatment was employed. He showed specimens of laryngeal and intestinal tuberculosis associated with copious new growth of tubercles around the old ulcers, and he laid stress on the fact that young tubercles were found abundantly in the serous membranes, the pericardium being affected in two cases. Professor Virchow has not yet published the details of his cases, but he evidently believes that the remedy, in destroying the tuberculous tissue, may set free the bacilli, which then infect parts previously free from tubercle.* He submitted his conclusions with considerable reserve, because eruptions of tubercles occur in many cases of advanced pulmonary phthisis running their natural courses. Since his statement was made it has been reported that tubercle bacilli have been found in the blood of patients after treatment by Koch's method. Such a dissemination of tubercule by the remedy is not a priori improbable. When an old, cheesy nodule of tubercle softens, the bacilli contained in it not infrequently infect the surrounding tissues, or even gain access to the blood and cause disseminated tuberculosis. No reason has been given why similar dangers should not attend the destruction of tubercular tissue by Koch's fluid, seeing that it does not kill the bacilli nor deprive them of infective power. Cases have been recorded in which the process in the lungs underwent decided extension during treatment by injections.† But Virchow himself does not question the power of the fluid as a remedy; he simply utters a warning against its indiscriminate use.

Complications attending the treatment.—As already stated, patients under Koch's treatment usually suffer very little, however high the temperature may range. Some patients, however, have severe lancinating pains in the chest; others suffer from vomiting; children, in particular, may have troublesome diarrhoea; inflammation of the cornea and conjunctiva has occurred in several cases; cutaneous rashes, lasting several days, are not uncommon, resembling measles or rötheln or scarlatina, but sometimes distinctly popular or passing into vesication; albuminuria has followed in many patients, and is sometimes severe; hematuria also, and peptonuria‡ have been reported; jaundice is sometimes seen, or an icteric hue of skin and urine. Examination of the blood is said to have shown changes such as occur in severe blood or liver disease.§ Pulmonary oedema has been noted in many cases; and, more rarely, distinct pneumonia.¶ Stupor has followed injection not infrequently, and some patients have lain comatose for many hours. But the complication most to be feared is depression of the heart's action, sometimes very profound or even fatal.

As examples of the alarming condition which may supervene, I may instance a case of lupus of the face and a case of phthisis in Professor Ewald's clinic, at the Augusta Hospital. The patient with lupus received one injection, after which an erysipelas-like condition set in. The eyes were closed by the swelling. The redness was not so bright as in ordinary erysipelas, and was very sharply bounded; but in all other respects the phenomena resembled those of typical erysipelas. The temperature

† Lancet, 17th January, 1891, p. 152.
‡ Lancet, 3rd January, 1891, p. 63.
¶ Lancet, 20th December, 1890, p. 1361.
|| Lancet, 3rd January, 1891, p. 51; and 17th January, 1891, p. 131.
ran very high, the pulse was extremely rapid, the breathing greatly accelerated and of Cheyne-Stokes character. This patient had widely-diffused tuberculosis of the skin, and many of the points became very tender. In the case of phthisis, both lungs were affected; four injections were given, with the usual general reaction, and without any bad results. Then a slightly larger quantity was given, and most dangerous reaction followed. The patient seemed moribund. Respiration and pulse were extremely rapid, and prostration was intense: After recovery, another small injection caused similar phenomena, but of less severity. Then tolerance was established.

At Professor Kaposi's clinique, in Vienna, a patient with lupus was first injected with 0·005 c.c., reacting to 102·2° Fahr. A second injection of the same quantity two days later caused the temperature to rise to 104°, the fever being associated with collapse and pulmonary edema. A third injection of 0·004 c.c. sent the temperature above 104°, and the same evil conditions returned in such intensity that a fatal issue was feared.

Many deaths have occurred among patients under treatment by Koch's fluid; but very few can be attributed directly to the injections. The only such case which I have been able to study in detail is the one which has already been mentioned as having occurred at Innsbruck. Here a patient, with frightful lupus of the face, died collapsed after receiving only 0·002 c.c. The post-mortem examination showed acute disseminated lobular pneumonia, extreme pulmonary edema, edema of the brain and spinal cord, intense swelling of the spleen, and capillary hemorrhages in many parts.

How Does the Remedy Act?

At present no satisfactory explanation of the action of the remedy can be given. The general and local reactions are largely independent of each other. High fever often occurs without any noticeable local reaction; but, excepting the cases reported by Professor Baccelli, it would appear that local reaction never occurs without fever. Hence the power of producing fever must be considered apart from that of causing local inflammation.

The local reaction is constant in lupus. It does not in the least resemble an extension of tubercular inflammation or an added intensity of such a process. On the contrary, it is very similar to erysipelas. It spreads beyond the apparent limits of the lupus in the same fashion as erysipelas does. I cannot concur with many observers, who see in this a conclusive proof that the lupus has insidiously spread far beyond its apparent bounds. The weeping from the surface and the formation of crusts are analogous with the vesication and crusting of erysipelas. The improvement which occurs in many cases without necrosis resembles, though it surpasses, that which follows an intercurrent attack of erysipelas. When necrosis does occur, it results, in my opinion, directly from the intensity of the inflammatory process, and is an accident, and not an essential in the action of the remedy. The serum which flows from the surface contains great numbers of tubercle bacilli, which are, as it were, washed out of the lupus tissue. The crusts which form on the surface also contain tubercle bacilli in small number. These bacilli, as well as those found in the sputum of phthisical patients under treatment by Koch's method, may show changes, such as partial or complete division or conversion into chains of rounded particles; but similar appearances may be detected in the bacilli of phthisical sputum apart from Koch's treatment, and years ago they were described and figured by a contributor to Virchow's Archiv. The bacilli in the lupus tissue are not destroyed by the reaction. Whether their vitality is weakened is not yet proved. According to Koch's original paper, the remedy in some cases causes the destruction of the lupus tissue, which falls off as a dead mass, while in others it induces an absorption or atrophy of the tissue, which requires repeated injection for the completion of the cure. "The remedy does not kill the tubercle bacilli, but the tuberculous tissue." This tissue is so profoundly affected that it either dies outright or undergoes a slower process of wasting and absorption, or, in general phrase, of retrogression.

In tuberculosis of bones, joints, and glands the local reaction is far less marked, and if certain cases are omitted, in which sloughing and suppuration follow injection, all improvement must be due to a similar gradual retrogression of the tubercular tissue. The same remark applies to tuberculosis of the larynx. Practically nothing is yet known concerning the local processes in the lungs, but it would appear that so long as bacilli appear in the sputum they retain their vitality and their power of producing infection.

* Lancet, 10th December, 1890, p. 1361.
In his paper published in the *Deutsche Medizinische Wochenschrift* of 15th January, 1891, Professor Koch offered an explanation which may be stated shortly in the following terms. Tubercle bacilli secrete a substance which produces necrosis of the tissue around them. If this substance is in very large quantity extensive necrosis occurs, and the local conditions are rendered unfavorable for the further life of the bacilli, which may die or be cast off with the necrosed tissue. If the substance is in small quantity, partial necrosis takes place with formation of giant cells and other elements of tubercle tissue. The rationale of the treatment is to introduce an additional quantity of the substance which causes necrosis, and thus hasten the destruction of the tubercular tissue.

Mr. Watson Cheyne has suggested that tubercle bacilli secrete an irritating substance which diffuses into the tissues around, and causes a limited degree of inflammation of a peculiar kind, and that Koch’s fluid contains a second substance which enters into combination with that secreted by the bacilli, the result being a product capable of inducing intense inflammation.

This theory would suffice to explain the intense inflammation which occurs in lupus, and occasionally in other tubercular tissues. But a different theory must be found to explain the occurrence of retrogression without necrosis. In fermentation, yeasts do not multiply when alcohol is in excess; so also bacteria are known to produce substances capable in certain quantity of restraining their further activity. Doubtless this holds good in the case of the tubercle bacillus. It is possible that the introduction of an additional quantity of such a substance inhibits the activity of the bacilli, and thus permits the progress of the natural processes of repair which are prevented by the active bacilli. Though restrained from activity, the bacilli would be still alive, and would grow freely if transferred artificially to favorable culture media. This theory leaves large gaps unfilled, but it is the most satisfactory which I can invent.

The general reaction seems to be due to a specific fever-producing substance secreted by the tubercular bacilli, whether growing in the body or in artificial cultures. In persons free from tubercle the system contains no trace of this substance, and hence a large dose is necessary to affect the nerve centre which regulates the production of heat. But in tubercular persons a fever-producing agent is constantly passing into the blood in greater or less quantity; and hence a small dose, varying with the amount of the agent already in the blood, would suffice to induce the febrile reaction. This explanation does not altogether tally with the facts. In a person with extensive tubercle a large dose of the remedy may produce only slight fever, while a small injection in a person with limited tuberculosis may be followed by high fever; and though the history of other diseases shows that patients vary greatly in their susceptibility to fever, it seems to me that no adequate explanation has been found of the febrile phenomena attending Koch’s treatment. Hence for the present the remedy must be used entirely in empiric fashion.

**Further Reports and Researches.**

According to instructions given by the Minister of Instruction in Berlin, the results obtained under Koch’s treatment in the various polyclinics of Germany up to 1st January, 1891, are being collated, and will be published at or about Easter-time. Professor Koch has determined that, for the present, the remedy shall not be employed except in hospitals. Its use in private houses and hotels has led to many complaints. There was no adequate watching of the cases, no proper system of records, no due provision for the immediate treatment of complications or accidents. There was fear that the process was being exploited for private advantage. A hundred and fifty beds have been placed at Professor Koch’s disposal in the Moabit Hospital in Berlin; a private benefactor has given £50,000 to found a hospital for the pursuance of the treatment; Koch could not accept the administration of this money; but it will provide a sanatorium for fifty or sixty patients. The city of Berlin has offered a branch hospital with 150 beds; but Koch could not undertake the control. The hospital will, however, be used for soldiers, and Koch will provide the remedy gratuitously and instruction for the assistants. A special institution is being established in connexion with the Charité at Berlin, consisting of a scientific department under Koch’s direction and a new hospital of 180 beds. Here Koch’s method will be tested fully, and similar principles will be applied to the discovery of remedies for other communicable diseases. Trials of Koch’s liquid are now in progress in most of
the great hospitals of Europe, and many of those in America. I have obtained a
double quantity from Professor Libbertz, so that the remedy may be used in Melbourne
also.

Much remains to be done. Early prejudgments must be laid aside. Inaccurate
observations must be eliminated. Peculiar effects due to idiosyncrasy of patients must
be separated. Months and perhaps years must pass before, in the presence of a mass
of ripe experience, we can estimate the true value of the remedy. Probably it will
revolutionize the treatment of lupus, and will render material assistance in other
tubercular affections which come under the care of the surgeon. Its place in the
armoury of the physician time only will declare. It is no panacea, no elixir of life.
It may prove to be a great addition to the resources of the medical practitioner, but it
does not supplant in any degree the teachings of old experience. Every remedy that
was useful before will be useful still.

**Tuberculosis in Lower Animals.**

Great interest attaches to the question whether domestic animals affected with
tuberculosis will be influenced by Koch’s fluid in the same mode or degree as human
beings. In Germany, France, and Great Britain experiments to test this point either
are or shortly will be in progress.

**Where does the Tubercle Bacillus Grow?**

The original researches of Koch indicated that the bacillus of tubercle would
grow only under very special conditions. The germs multiply very slowly; they
must be at rest, they must be kept practically at body heat, and must be provided
with special elaborate food, such as sterilized solid blood-serum. Such was the accepted
teaching, and hence it was believed that the bacillus of tubercle was an essential
parasite, multiplying only in the living body. In Melbourne, Mr. Candler has
repeatedly protested against this theory, and his protests have recently been confirmed
by practical experiment. Thus, on 6th January, 1891, at the Pathological Society
of London, Sir Hugh Beevor reported that he had cultivated the bacilli on various
media, and within wide ranges of temperature. Colonies of the germs grew on potato
and on glycerine agar-agar; and in broth to which glycerine has been added the
bacilli grow at temperatures lower than those required with other media. Tubes
were shown with cultures made at or below 60° Fahr. Hence it is evident that the
question of the essential parasitism of tubercle must be re-considered. Possibly it
may be found that in nature, as in the laboratory, the bacilli multiply outside the body
at ordinary temperatures in some special media. The importance of such a discovery
cannot be over-estimated.

**Institutes of Preventive Medicine.**—The publication of Koch’s method has been
most fruitful in indirect results. In all countries public attention has been drawn to
the importance of the researches conducted by Pasteur, Koch, and other veterans of
experimental pathology. Governments and corporations are hastening to provide
laboratories in which specially trained experts may study the causes of communicable
diseases. I have already referred to the new department of the Charité, at Berlin,
which will be under the personal direction of Professor Koch. At St. Petersburg, an
Imperial Institute of Experimental Medicine has been established, and Professor Pfuhl,
Koch’s son-in-law, will take charge of it. A British Institute of Preventive Medicine
is being organized in connexion with the University of Cambridge, under the control
of a widely representative Council. In matters of organization and structure, Pasteur’s
Institute remains pre-eminent. But the French Government has recognised that
important work must be done in its colonies, and a laboratory will, next March, be
opened in Saigon, under the direction of Dr. Albert Calmette, a medical man of
the first class in the French service, at present attached to the Pasteur Institute. This
laboratory will afford means of studying cholera, dysentery, leprosy, beri-beri, and
other diseases of warm climates, and will provide supplies of Pasteur’s remedy for
hydrophobia.

It is high time that Australia made a movement in this direction. Economic
problems of vast importance beset us on every side in connexion with bacterial and
parasitic diseases. Anthrax and contagious pleuro-pneumonia are fatal enemies which
levy a serious tribute on Australian herds. They are assuredly preventible diseases.
Diphtheria has swept off robust children by thousands; typhoid annually slays a
frightful number of young men and women in their early prime; hydatid disease still
adds materially to our rolls of mortality. These losses are avoidable. Shall we wait
idly while others are earnestly seeking for remedies? Shall we, whenever a new
remedy is proclaimed, be without an institute in which it can be prepared and tested?
Are we for ever to be in treaty with institutes elsewhere for the supply of our needs?
Shall our medical practitioners, our officers of health, remain destitute of facilities for
practical study of modern preventive medicine? Surely the answer to these questions
cannot be doubtful. Hesitation can remain only as to the best method of satisfying
our obvious wants. This aspect of the question I propose to discuss at an early date
in another Report.

SUMMARY ADVICE.

In bringing this Report to a close, I beg to formulate my conclusions as
follows:—

(1) Little is yet known of the composition of the remedy.
(2) Its mode of action has not been satisfactorily explained.
(3) Its use must, therefore, be empiric and experimental.
(4) The local and constitutional results vary so greatly, independently of
dosage, that it is impossible to gauge them beforehand.
(5) Grave complications may follow injection in apparently simple cases.
    Instant surgical interference may be necessary.
(6) There is reason to fear that in some cases the treatment may disseminate
tubercle more widely in the body.
(7) Notwithstanding all this, the fluid is probably a valuable remedial
agent.
(8) Its usefulness has been demonstrated more fully in surgical than in
medical cases.
(9) For the present, in accordance with Professor Koch's desire, it should
be employed in hospital practice only.
(10) The supply in my possession is not larger than will suffice for a limited
    trial of the remedy in the Melbourne Hospital.
(11) No patient should be submitted to the treatment without prior consul­
tation in regular form by the members of the medical or surgical
    staff.
(12) The dilutions required for use should be prepared fresh.
(13) Strict antiseptic precautions should be observed.
(14) Very small doses should be employed at the outset in every case,
    whether medical or surgical.
(15) Special records should be kept of every case, with particular regard to
    temperature, sputum, &c.
(16) Provision should be made for careful oversight of the patients, under
    the control of the physicians and surgeons.
(17) Under such conditions the remedy may be used by the physicians and
    surgeons in their ordinary wards.

(Signed) H. B. ALLEN.

By Authority: ROBT. S. BAIN, Government Printer, Melbourne.