

The probable lesions in a case of incipient caseous pulmonary phthisis of over four years' duration : with no physical signs, but abundant bacilli in sputum ; with some remarks upon their diagnostic and prognostic value / by R.F.C. Leith.

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Publication/Creation

Edinburgh : Printed by Oliver & Boyd, 1895.

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THE PROBABLE LESIONS
IN A CASE OF
INCIPIENT CASEOUS PULMONARY
PHTHISIS

OF OVER FOUR YEARS' DURATION,

*With no Physical Signs, but Abundant Bacilli in
Sputum; with some Remarks upon their
Diagnostic and Prognostic Value.*

BY

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(Read before the Edinburgh Medico-Chirurgical Society, 1st May 1895.)

PRINTED BY OLIVER AND BOYD, EDINBURGH.

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THE TUBERCULAR
INFLUENT GASTRO-PULMONARY
PHYSIS

OF OVER FOUR YEARS' DURATION

WITH NO SPECIAL SIGN OF TUBERCULOSIS IN
SPERMATOPHYTES, AND NO TUBERCLES IN
TUBERCLES AND TUBERCLES

REPRINTED FROM THE EDINBURGH MEDICAL JOURNAL FOR OCTOBER 1895.

R. F. LITTLE, M.D., F.R.C.P.

LECTURE IN MEDICAL HISTORY, DELIVERED AT THE
EDINBURGH MEDICAL SCHOOL, ON THE 11TH OF
OCTOBER 1895, BY R. F. LITTLE, M.D., F.R.C.P.

AND REPORT ON THE CASE OF A PATIENT

WHO DIED OF TUBERCULAR PHYSIS

THE PROBABLE LESIONS IN A CASE OF INCIPIENT CASEOUS PULMONARY PHTHISIS.

TUBERCULAR processes naturally engage a great deal of our attention in this country. When we remember that phthisis alone is accountable for about one-seventh to one-tenth of the total number of deaths in Britain, we may well consider that we can hardly spend too much time upon its study. I am induced to bring the following case of incipient phthisis before your notice on account of its somewhat unusual features, and also on account of the interesting pathological and therapeutical considerations which it raises.

William N. M., aged 43, clerk, a well-developed, healthy-looking man, of a somewhat dark and sallow complexion, first consulted me on 19th February 1890, complaining of a swelling of his scrotum. This proved to be a left hydrocele. It returned, and was treated a second time on the 2nd June, and this time successfully. While attending him during this second attack I noticed that he had a slight cough and a scanty expectoration. On being questioned, he said that he had frequently had a similar cough, but had not paid much attention to it. He had been more or less subject to winter colds so long as he could remember, and latterly these had been more severe. They had never incapacitated him from his work, however, and he had not considered them of any importance. He had had a good deal of cough during the previous winter, and it had recurred several times during the spring. It was often dry, but sometimes accompanied by a viscid sputum tinged with carbon pigment. It was not irritating or painful. I examined his chest carefully, but could find no evidence of any mischief whatever. Its expansion was good, and equal on both sides, resonant all over, and the respiratory sounds perfectly normal. I was inclined to regard the cough as due to chronic pharyngitis, with some laryngitis. He had a slight huskiness of speech. This had developed gradually, and had been in existence for a good many months. He had been a regular member of his church choir until about a year ago, and he thinks it was not present then, as his singing voice had been in no way

affected. His general condition was eminently satisfactory. He was apparently in excellent health. He had a capital appetite, took his food well, and enjoyed it. He slept well and had no sweating at nights. He was in vigorous muscular condition, and took plenty of regular exercise, being in particular an excellent walker. His height was 5 ft. 10 in., and his weight about 11 stone, and the latter had kept pretty constant for several years back at any rate. His chest measurement at the level of the nipples was $33\frac{1}{2}$ inches during expiration, expanding $\frac{3}{4}$ inch during inspiration. The expansion was everywhere equal.

His family history is not of the best, as one brother died of phthisis at 33 years of age. This was nearly thirty years ago. Two sisters died in infancy from water in the head, and a brother from some accident during childhood. He has three sisters still alive, one older than himself, and all are healthy. The father and mother both died at an advanced age, and never suffered from any tubercular disease; and so far as we can ascertain there was no other case of tubercular disease in any member of their family.

I saw him occasionally during the summer of that year, and finding that the cough did not entirely disappear, although he might be for days without it, I again examined his chest most carefully, with as negative a result as before. His cough was almost restricted to the morning, being then mostly accompanied by a little expectoration. This did not seem to me to be in the least suspicious; however, I asked him to send me the morning sputum each day for a week. This I found to average somewhere about a drachm, sometimes a little more, and to apparently consist entirely of semi-transparent sticky mucus. Beyond a few carbon particles, it contained no specks visible to the naked eye, even when spread out in a thin layer upon a black photographic tray; but on examination with a hand lens I thought I could detect one or two tiny slightly opaque points. Having prepared a cover-glass film with a portion of the sputum containing one of these, I stained it by the Ziehl-Neelsen method. I did not expect to find tubercular bacilli, for such a purely mucous sputum seldom shows them, and I made the examination more on the ground of routine practice than on account of any suspicions which I entertained. We soon learn in a pathological laboratory not to be easily surprised, but I confess that I was considerably astonished on this occasion. The specimen presented almost the appearance of a pure artificial culture of the tubercle bacillus. It simply teemed with them (shown under the first microscope). It was now perfectly clear that the case, notwithstanding its innocent and simple appearance, was really one of great gravity,—viz., tubercular disease of some part of the respiratory tract, either the larynx, the main air-passages, or the lungs. I felt inclined to exclude the lungs on account of the entire absence of any

symptoms or signs, and the main air-passages on account of the extreme rarity of a primary tuberculosis of this nature, and thus for a time feared that the patient was the unfortunate victim of a primary acute laryngeal tuberculosis. His huskiness of voice and the great numbers of the bacilli seemed to support this view. Hunter Mackenzie¹ says:—"In the sputum of laryngeal phthisis, especially if at all acute, bacilli are frequently present in enormous numbers;" and although Percy Kidd and Taylor² say "we cannot confirm the statement of Dr Hunter Mackenzie that the bacilli are always numerous when the tubercular ulceration of the larynx is present," it certainly appears to have been true in one of his cases at any rate, as shown by the illustrative Plate. I therefore made several laryngoscopic examinations, and fairly satisfied myself that there was nothing wrong with his larynx. The patient showed a singular intolerance to the laryngoscopic mirror, which neither cocaine nor ice seemed in the least to relieve, and I never really got a thoroughly good examination of his cords at any one time; but from the results of several attempts I felt pretty sure that his larynx was healthy. Dr Hunter Mackenzie kindly examined him for me at a later date, and corroborated this opinion. I now fell back upon the lungs, and for reasons which I shall presently give, considered that the presence of a cavity or cavities somewhere therein was more than probable. A minute examination of his chest elicited nothing. He was apparently perfectly sound and apparently none the worse for being the rich breeding-ground for such vast numbers of bacilli. I hesitated for some time about informing him of their presence and significance, as patients are apt to brood too much over such a condition; and the consequent depression of spirits reacts injuriously upon their bodily health. He received the sad intelligence extremely well, and I duly emphasized the great hope we had of recovery in such cases.

It was impossible for him to leave Edinburgh for longer than a month or so, and I confined my treatment mainly to dietetic and hygienic lines, making the former as rich as his powers of digestion would allow. He went to the country shortly afterwards, in the month of August, for his summer holiday, and when he returned the cough and sputum had almost disappeared. His condition remained much the same during the next two years,—the morning cough, though occasionally absent, never quite left him, and it was attended as before by a slight and pretty constant expectoration. Once or twice in the following winter and spring-time he developed a slight coincident bronchitis, and his cough and sputum accordingly partook during these times of the characters natural to that condition, remaining at other times much as they had always been. A slight admixture of pus

¹ Hunter Mackenzie, *A Practical Treatise on the Sputum*, p. 49.

² Percy Kidd and Taylor, *Med. Chir. Trans.*, vol. lxxi., 1888, p. 351.

gradually appeared in the sputum during 1892, becoming more pronounced towards the end of the year, when he caught another of his colds. I had examined it periodically for tubercle bacilli during these two years, and each specimen presented much the same appearance as the first had done. Shortly after the pus began to appear little tiny specks of opaque, or slightly yellow material, were also noticed, especially with a hand lens. These were found to be caseous centres teeming with bacilli. During all this time his health might be described as unimpaired. The winter cold attacks were slight, and confined mostly to the larynx and trachea, with perhaps a few of the larger bronchi, and while they caused him some discomfort, they were not sufficiently serious to keep him at home. He was always ready and fit for his daily work at the office, and would probably under ordinary circumstances have paid little attention to them. His general health, weight, and condition remained the same, and his lungs were as free as ever from any abnormal physical signs. If we exclude the occasional signs noticed during his catarrhal attacks, I only twice detected anything suspicious, once early and once late in the year 1892,—viz., a few fine moist crepitations in the second interspace on the right side, about 1 inch outside the margin of the sternum. They were present only towards the end of inspiration and the beginning of expiration, and were quite transient, but apparently spontaneous, being heard for about two to three days only. I believed also that the bacilli had increased during this year, as it was hardly necessary to select particular bits of the sputum. Any part, even the most transparent, contained them, though not nearly in such numbers as the little solid specks.

On February 22nd, 1893, I received a message to the effect that he had been taken suddenly ill. I had last seen him fully three weeks previously, and he was then doing as well as ever. On going to his rooms I found him sitting in an easy chair by the fire reading the newspapers. He complained of a pain in his side, which was pretty bad when he walked, but did not trouble him much so long as he kept quiet. He had first noticed it on the morning of the preceding day, the 21st, and took a tablespoonful of castor-oil, as he had missed stool on the previous day. This acted well and without pain, and he was able to go to his office and do his work all day, walking home in the evening. The pain had not disappeared. He was able, however, to enjoy his dinner, and slept well that night; but on wakening next morning he noticed the pain at once. It was more severe than it had yet been, and this was all the more marked when he got up. The bowels were moved slightly, and he thought that this diminished the pain a little. He now first noticed that it was more marked on the right than on the left side. He was able to take breakfast, and walked to the office at his usual time. He had to give in, however, in the course of the afternoon, and come home. There

had been no nausea or vomiting or headache. On examination I found distinct tenderness on pressure, an ill-defined sense of resistance, and a slightly increased tympanitis in the right iliac region. The rest of the abdomen could be freely handled, and there was no appearance of any swelling. His pulse was 98, and his temperature 100°. I believed that I had to deal with an acute appendicitis. The patient had committed no dietetic or hygienic error so far as I could discover. I mentioned fresh fruit, apples, etc., but he had not indulged in anything of this kind for some weeks previous. His bowels had been quite regular, and he had thus particularly noticed the single omission on the morning above mentioned, and took castor-oil to remedy it. He had been doing his usual routine office work, and had not required to undergo any unusual strain of any kind. He had not got wet at any time, and had always been well and warmly clad. He had felt perfectly well before the attack. I could, in short, find nothing which might be regarded as accounting for the condition, a common enough experience in appendicitis, except the tubercular affection of the patient himself, and I felt inclined to ascribe the present attack to the same source.

I need only refer shortly to this part of the history of the case. It was a fairly typical acute appendicitis, which ran a regular course, and, though for a time it gave cause for considerable anxiety, it progressed favourably towards recovery. It lasted about sixteen days. It is especially interesting to note that the pulmonary mischief was checked during the period of activity of the appendicitis. He never coughed at all during the first six or seven days, and but very little during the second week. The cough and expectoration began gradually to return. I examined his chest several times during this period, and found nothing. There was no sputum at all for about a fortnight, but when it did appear it was as full of bacilli as ever. It increased rapidly in quantity and the cough in frequency, so that by the time he was first able to leave the house, viz., the 17th March, the pulmonary lesion had seemingly made a considerable advance. Not only had he pretty severe coughing in the morning, but it often returned during the day, and the sputum, besides increasing in quantity, had become markedly purulent. There were also numerous moist sounds and prolonged expiration in the second interspace on the right side close to the sternum. It is pretty generally observed, I think, that cases of pulmonary phthisis do better, run a more chronic course, and live longer where there is at the same time some other existent tubercular lesion, such as a joint affection, the latter serving to act as a diverticulum to the central lesion. It is possible that the appendix had acted in this way in this case. He was considerably pulled down, and had lost over a stone in weight.

Fearing a rapid extension of the disease, I strongly advised his going abroad as soon as he was able. Through the kind considera-

tion of his employers he got four months' leave of absence, and was able to leave Edinburgh a week or two afterwards and stay in Torquay for over three months. He commenced work again at his office towards the end of August. During the time he was away he sent me fortnightly reports of his progress and specimens of his sputum. He gained greatly in strength and weight. He was 10 stone 2 lbs. when he went, and 11 stone when he returned. The cough and sputum both diminished gradually, the latter from over 2 ozs. daily to about a drachm. The bacilli generally showed a similar diminution, and as great care as possible was taken to select similar parts for examination. With due regard to the difficulty of forming a decision in such a matter, I am decidedly of opinion that the bacilli steadily diminished greatly in numbers during this time. His lung sounds were perfectly clear, and breathing natural; the moist sounds having entirely disappeared. He continued well after his return, and while at home for a short holiday at Christmas time 1893, he was told, after having undergone a very careful medical examination, that his lungs were as sound as a bell.

He has continued in excellent health throughout the whole of the past year, and from his appearance, as you saw him to-night, you would not think there was much amiss with him. He has been constantly at his work, and fit for it. He is not afraid to undertake a twenty to thirty-mile walk, and enjoys other amusements in moderation. He suffers in no sense from mental or bodily languor or muscular weakness. He is not more anæmic now than he was four years ago. He sleeps well, and does not sweat at night. He has never had any pyrexia, except, of course, during the attack of appendicitis. His cough and sputum have both gradually increased, however, during the year. He occasionally coughs a good deal during the day, especially in damp and foggy weather. The sputum averages about $\frac{1}{2}$ to 1 oz. in amount.

The specimen now shown is yesterday's collection. It is viscid and purulent, and shows several minute caseous foci. I have placed a stained specimen of it under the second microscope, in order that it may be compared with that under the first, which is a preparation of the first sputum examined in 1890.

To all intents and purposes he is as well now as he was over four years ago.

Treatment.—It will suffice to mention the line of treatment adopted throughout:—1st, *Dietetic.*—His food has been as rich as possible, and has consisted of a generous supply of nitrogenous carbohydrates and fatty foods, port wine and Burgundy, and cod-liver oil and malt, and their various combinations and modifications. Unfortunately, he cannot take the oil for any length of time, but can generally manage cream instead. He has also used the oil as an inunction. 2nd, *Hygienic.*—He sleeps in a large airy bedroom, takes a certain amount of exercise both out of doors

and indoors, and is most careful as to his being always well and properly clothed. 3rd, *Medicinal*.—Besides expectorants and tonics when necessary, he has taken hypophosphite of lime without any apparent benefit. Various antiseptic inhalations were also perseveringly tried, apparently with some benefit, and he has now been taking considerable doses of creosote for some time. I have fancied when I left off these for a little that the symptoms became somewhat aggravated. It may become advisable to try the injection of prepared animal serum, if reliable material can be obtained.

Remarks.—From the facts of this case, as they have all along been present to my mind, I have tried to construct a picture of the pathological condition of the lungs. It is now about $4\frac{1}{4}$ years since the presence of the disease was demonstrated, and it may well have been present even much longer than that. If we regard incipient phthisis as meaning the disease localised to one apex, with or without physical signs—and this is the sense in which I have used it—then this case provides us with a good example, characterised further by apparently remaining in this stage all the time. So far as we can tell from the symptoms, general condition, and physical signs such as they are, the case has remained very much in a stationary condition. I am well aware that many physicians have met with cases so far similar to this in that the presence of bacilli in the sputum has been the first indication of the disease. Such cases are to be found not infrequently scattered throughout the vast range of the literature of phthisis, but the great majority of them had but a short spell of existence. In some death followed within a few months of the outbreak of the disease, in others not for a year or two, but in nearly all where the duration has been of any extent there were obvious indications from the physical signs that tuberculisation was slowly spreading. In such chronic cases, where the physical signs tell us that there are well-marked lesions in the lungs, the duration of life is often greater than it has been so far in this case; for we find that Laennec, Louis, and Bayle assign two years as the mean duration of life in phthisis generally, while Pollock,¹ from a study of 3566 Brompton Hospital cases, found that the further expectation of life was fair even at the end of two and a half years. Fuller,² in 118 cases at St George's Hospital, found the average duration mostly under eighteen months, whereas in 46 private cases it ranged from one to four years. Still more striking results are given by Theodore Williams and C. B. Williams.³ Their analysis in 1000 cases in the upper classes gave an average duration in 198 deaths of seven years 8·72 months, and in 802 living of eight years and two months. Many of these had lived twenty years since their first attack. Some of these were cases of fibroid phthisis, which have the longest expecta-

¹ Pollock, *Elements of Prognosis*.

² Fuller, *Diseases of the Chest*.

³ Williams, *Med. Chir. Soc. Trans.*, vol. liv. pp. 112 *et seq.*

tion of life; others had, besides the affection of the lung, a similar process in a joint, which, acting as a diverticulum to the central disease, kept it in check, and thus considerably prolonged the duration of life. In the light of these figures we cannot consider the term of four and a quarter years, during which we know that the disease has been existent in this case, as greatly exceptional. We are naturally enough led to inquire more particularly into a case of this kind, and to ask if we have any evidence beyond their clinical history of such quiescent tubercular lesions. And the answer is easy, for every pathologist is familiar with them. The lungs of patients who have died of some independent disease are frequently seen to show tubercular foci of a dormant or obsolete character. They are most commonly situated at or near the apex, and may be present in one or both lungs. They vary in size from a small pea to that of a marble or larger, and may be single, or two or three close together. They may be placed within the substance, not showing upon the surface; but more commonly their position is indicated by a more or less depressed, irregular cicatrix upon the pleural surface. We can arrange them practically in two great groups, according as they have undergone a fibrous or a caseous change. Both these groups include changes differing somewhat in appearance from one another,—*e.g.*, in the first there may be simply an irregular scar of fibrous tissue, or such a scar containing few or many little fibroid tubercles, miliary or larger; or a number of these fibroid tubercles more or less closely grouped together, without the appearance of a branching and contracting scar; while in the second we have caseous or cretaceous foci grouped together more or less completely. The agglomerated tubercles may be encapsulated by one general fibrous capsule, or if more discrete each may have its own capsule. Encapsulated smaller foci may be seen around a larger mass in the centre. Still further changes may take place. The caseous centre may become calcified, or soften and break down, resulting in a cavity. The pleura over the surface may become greatly thickened and adherent, the interlobular septa in the neighbourhood thickened and contracted, the bronchi dilated, etc. All the fibrous tissue, whether it be the radiating scar, or the fibroid tubercle, or the capsule of a caseous mass, is generally deeply pigmented. Sometimes these foci show giant cells, and sometimes not. The fibroid forms, cicatrices and tubercles, do not show tubercle bacilli, while the caseous and even cretaceous foci generally do, although commonly in smaller numbers. In all of them, however, the tubercular process is no longer active, but has retrogressed, and may be properly described as obsolete or dormant. I have seen a lung even riddled with cavities which could with justice be placed in the same category, as the walls were smooth and lined throughout by healthy fibrous membranes; and another extremely interesting, though unusual, which I have reproduced in the Photograph, Fig. 1.

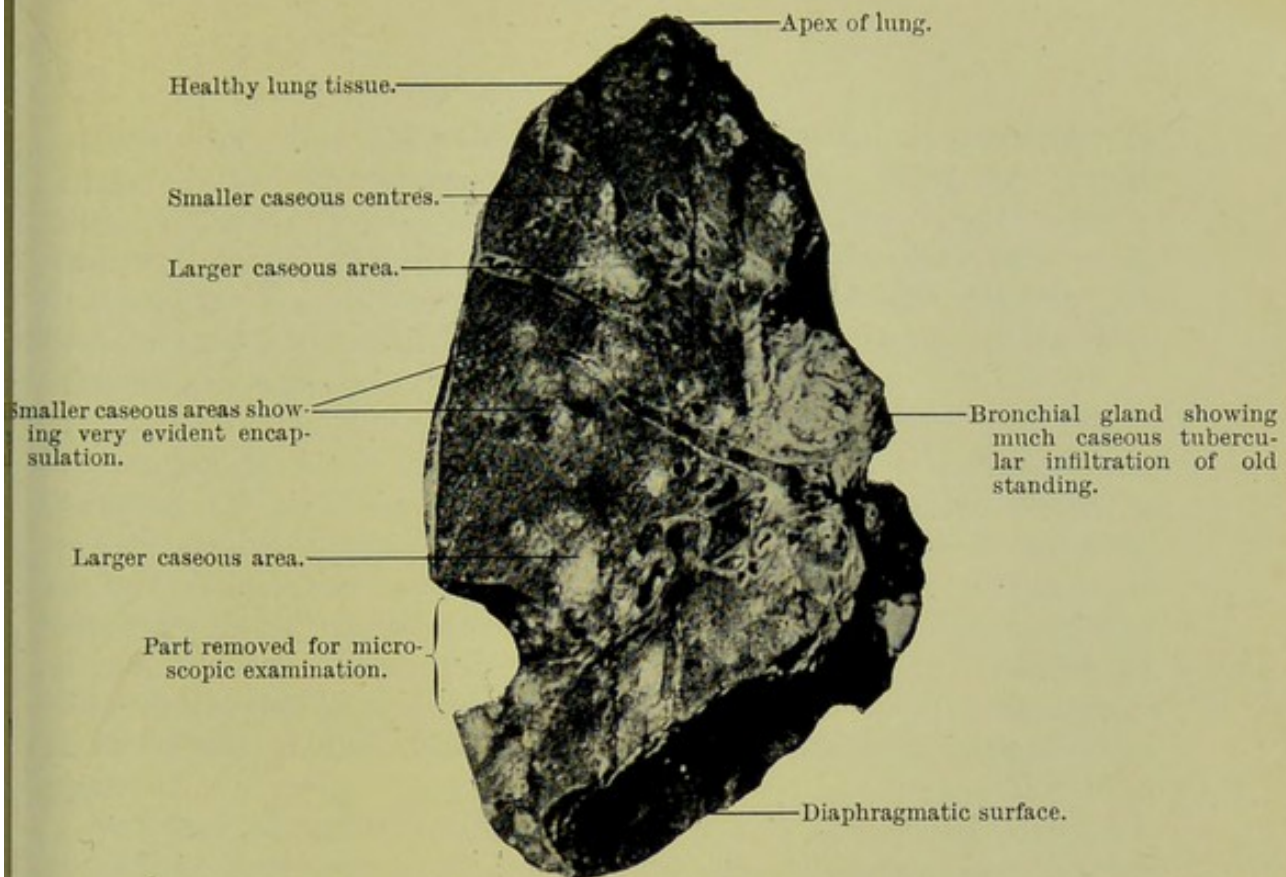


FIG. 1 shows a vertical section of the lung, made from apex to base. The bronchial gland is seen at the root of the lung; its plentiful caseous infiltration is well encapsulated. A large branch of a bronchus is seen just below it. Towards its termination a caseous focus is seen, entirely shut off by encapsulation from it. Many caseous centres of various size are seen scattered through otherwise healthy lung tissue. They are all completely surrounded by capsules, though this is best seen in the smaller ones in the photograph.

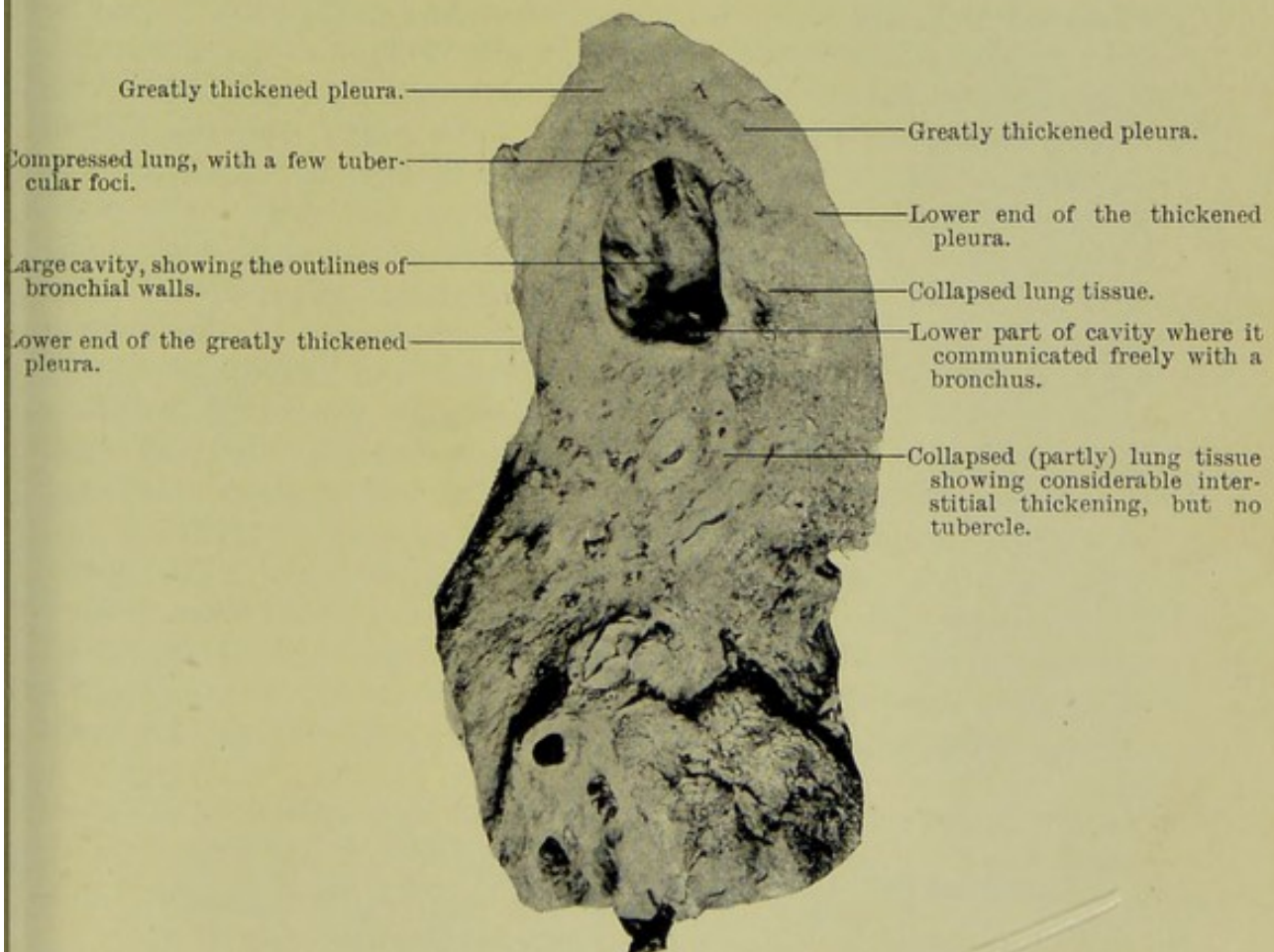
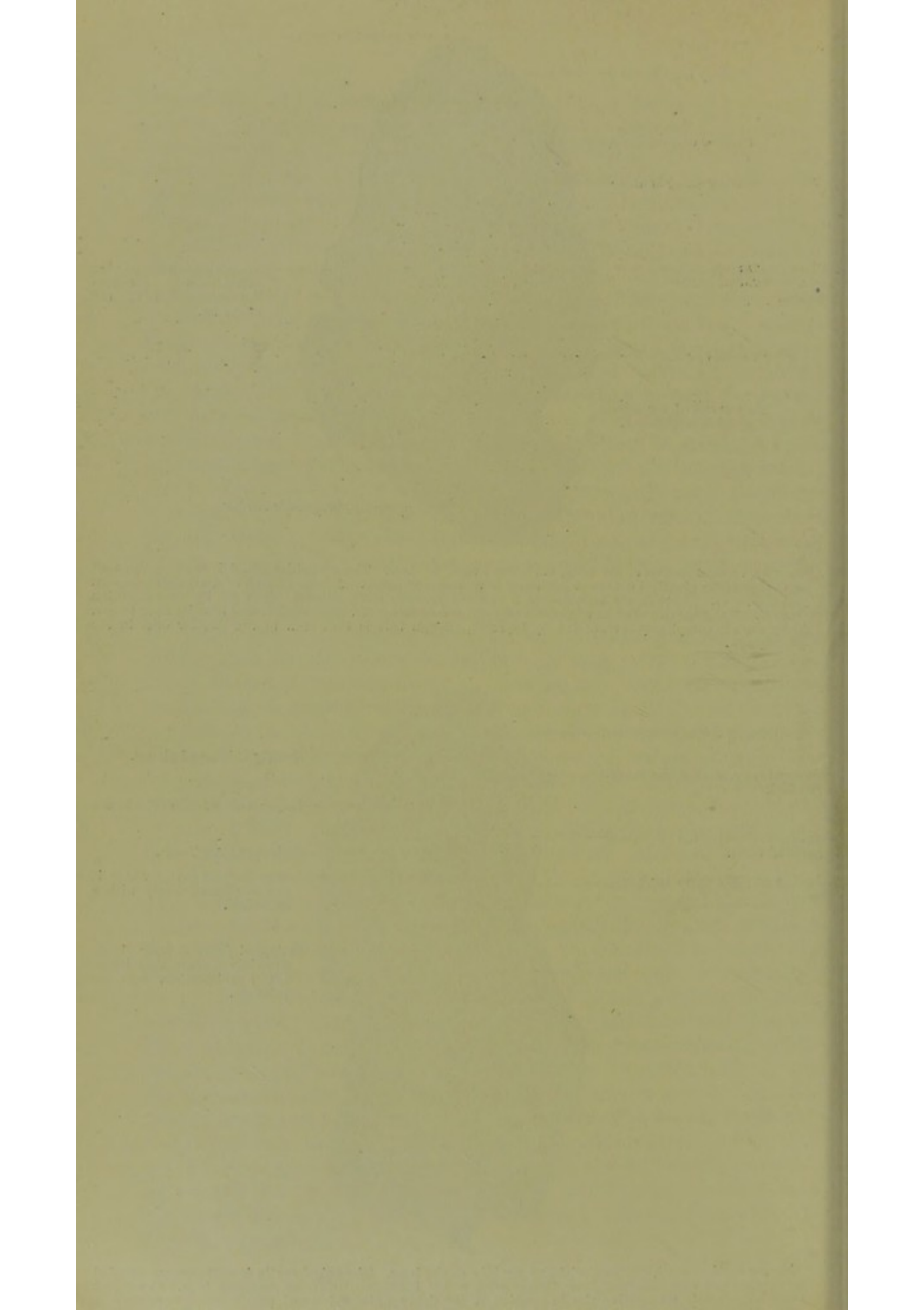


FIG. 2 shows a vertical section of part of the upper lobe of the lung. The apical cavity is well seen surrounded by compressed and collapsed lung tissue, with a few indefinite tubercles scattered in it. It was not consolidated, and its relative size in relation to the dense white thickened pleura which surrounds it like a cap is well seen.



Both lungs were affected. They show numerous tubercular foci scattered throughout the pulmonary substance. They are mostly about the size of peas, showing firm caseous centres encapsulated by firm and deeply pigmented fibrous walls of some thickness. The surrounding lung tissue is quite normal. Microscopic examination demonstrated plentiful bacilli within the caseous areas, but none outside the capsules.

It is quite probable, however, that all such lesions may not be tubercular, for some of them may have originated in dilated bronchi (isolated by an interstitial pneumonia), or in dried-up abscesses, or even in syphilitic growths; but the great majority are admitted on all hands to be tubercular. In both of the above-mentioned cases the lesion was undoubtedly tubercular, and the patients died of independent diseases. Out of a total of about 1400 necropsies observed by me in the Royal Infirmary of Edinburgh, such lesions have occurred about 165 times, or approximately in about 12 per cent.

Several writers have referred to them, and give interesting data regarding their frequency, relative to other diseases, age, sex, etc. Brouardel found them in the apex of the lungs of 60 per cent. of those over 30 years of age, whose bodies he examined on account of their having died a violent death. Coats,¹ writing in 1891, gives the necropsies in the Glasgow Western Infirmary for the ten months immediately preceding as numbering 131; of these, 28 were cases of acute tuberculosis, and therefore unavailable; and of the remaining 103 there were evidences of healed tubercle in 24, but in only 20 of these was the lesion in the lungs. This gives a proportion of 19½ per cent. Harris² of Manchester had two years previously given a somewhat similar analysis of 54 cases in the Manchester Infirmary. His term of involuted tubercle is, however, used in too wide a sense to be synonymous with obsolete. He includes cases in which the tubercle was not dormant, and hence his proportion of 38 per cent. must be regarded as much too high. Kingston Fowler,³ in a thoughtful paper written in 1891, gives the results at Middlesex Hospital from 1879 to 1886. Out of 1943 necropsies, obsolete tubercle was found in 177, a proportion of 9 per cent. Sydney Martin⁴ at the same time gave an analysis of 445 consecutive cases, also taken from the records of Middlesex Hospital, showing retrograde tubercle in 42 cases, or 9·4 per cent. Fowler also quoted Heitler's⁵ statistics from the Institute of Pathological Anatomy at Vienna, based upon the records of ten years (1869 to 1879). Out of 16,562 necropsies, obsolete tubercle was found in 789—i.e., only 4 per cent. It is a somewhat curious

¹ Coats, *Brit. Med. Journ.*, 1891, p. 935.

² Harris, *Brit. Med. Journ.*, 1889, p. 1385.

³ Kingston Fowler, *Brit. Med. Journ.*, 1891, pp. 940 and 941.

⁴ Sydney Martin, *Brit. Med. Journ.*, 1891, p. 944.

⁵ Heitler, *Vienna Klinik*, 1879.

and instructive fact that while the cases of affection of one lung only were about equal, they were together far fewer than those in which both lungs were affected—*e.g.*, in Fowler's own cases it was 71 to 106; in Heitler's, 134 to 655; although in Martin's it was 21 to 21. We are therefore amply justified in believing that such cases of local or apical tuberculosis, which, although ultimately obsolete, must at some time during the patient's life have been living and active processes, are not uncommon. Unfortunately, the clinical history of such cases is either unattainable or silent as to any symptoms or signs referable to the lungs. They may have been wholly latent during life, leaving only an indubitable anatomical record of their existence. In answer to the question, Are they clinically recognisable? Grancher¹ says:—"In almost all cases the tubercles are small and separate, incapable in the state in which they have been found, as well as in the course of their development, of modifying the respiratory sounds or vibrations. They are generally small masses of the size of a pea, at the extreme apex of the lung, and surrounded by healthy crepitant lung-tissue, or they are isolated fibrous tubercles scattered in small number in the centre of the lung." Now, as this condition can hardly be looked upon as quite the beginning of the lesion, it is hardly surprising that he holds, and many with him, that the "stage of germination," or "occult" stage of consumption, as it has been called, is quite beyond the recognition of the physician. He says, in fact, "In an individual suspected or not of tuberculosis, a few tubercles begin to develop slowly; embryonic cells and giant cells form and group themselves together, so as to constitute the follicular tubercle—that process lasts a long time, and is silent—and nothing appears changed in the health of the man doomed to phthisis; sometimes a little anæmia, a little debility, a slight cough, a little quickened respiration, nothing more." This is not much, certainly, and yet it is enough to make a watchful physician suspicious; and if he finds in addition, as he will often do, other abnormalities in the respiratory sounds, such as harsh, low-pitched, or jerky inspiration localised to and more or less constant in any particular area, I think he may venture upon a diagnosis of phthisis as at least probable. If this be so in the "stage of germination," it is equally or, indeed, more probably true in the somewhat more advanced stages which the obsolete tubercle just referred to represent. In some of these cases, at any rate, the skilled and careful clinician would be able to detect some sign of their presence, especially during the period of their activity, were his attention only sufficiently aroused to look for them. I am tempted, therefore, to give the following instance here:—Robert A., aged 54, was under the care of Drs James and Stockman, in the Royal Infirmary, for a combined heart and kidney lesion. Both of these physicians independently noticed a little dulness with some irregularity in the breath

¹ Grancher, *Maladies de l'appareil Respiratoire*, p. 140.

sounds at his right apex, and suspected an old apical lesion. His sputum was examined two or three times for tubercle bacilli, but none were found. He died on 13th January of the present year. The sectio showed, besides valvular heart lesions and chronic nephritis, a cavity about the size of a hazel nut at the right lung apex, containing a very small quantity of cheesy material, and communicating at its lower and outer margins by a small aperture with a small bronchus. Its wall was not thickened, hence, perhaps, the absence of the clinical signs of a cavity; and a few cheesy tubercular points lay around it. It was within $\frac{1}{4}$ of an inch of the pleura, which was much thickened by a simple chronic pleurisy in this region. I have reproduced the condition by means of the Photograph, Fig. 2.

Here, then, is an instance of one of these obsolete tubercular foci, perhaps a little more pronounced than usual, being in a sense diagnosable, and diagnosed during life. I made careful inquiries, with a view to ascertaining whether his clinical history revealed any symptoms referable to this lesion, and got nothing even so definite as in the well-known case of Sir Astley Cooper, whose body was opened after death in pursuance of his own wish, in order, if possible, to clear up certain phenomena which occurred during his lifetime. One of these was a hæmoptysis in his youth. He believed that he had suffered from an early phthisis. The result was that "at the superior and posterior part of the right lung was a depressed and somewhat contracted surface about the size of a sixpence; a section of which exposed a calcareous mass very uneven upon its surface, and about equal to the size of a small pea. It was placed about three lines distant from the pleura." (*St George's Hospital Reports*, vol. vi. p. 230.)

I have been led thus shortly to review these lesions, as the suggestion has occurred to my mind that the case under discussion at present may really be an instance. The physical signs are fleeting and of the slightest, but in their absence, from the characters of the sputum and abundance of the bacilli, we may make certain valuable deductions. The majority of clinicians are of opinion that the presence of a bacillary sputum signifies that destruction of lung tissue has taken place, and that the formation of a cavity has followed, communicating with a bronchus. Others, *e.g.*, Kidd and Taylor,¹ prefer to withhold their judgment. They say, "Whether it is necessary to assume the existence of a softening process in the lung in all cases where bacilli are expectorated we are not prepared to say." Theodore Williams,² on the other hand, holds that they may be found in connexion with tubercle formation and not only with softening and excavation,—for out of 106 cases of phthisis in which he found tubercle in the sputum,

¹ Kidd and Taylor, *Med. Chir. Trans.*, vol. lxxi., 1888, p. 351.

² Theodore Williams, *Med. Chir. Proc.*, vol. vi., 1884, p. 371.

9 were in the stage of early consolidation. This is further supported by the frequent occurrence of the bacillus in the sputum in cases of acute miliary tuberculosis. I have not yet personally found the bacillus in such a case where softening had not occurred, but numerous instances are on record, and I have, further, made post-mortem examinations upon several cases of this nature without visible signs of softening, in which the physician under whose care the patient was has assured me that the bacillus was indubitably present in the sputum. I have looked for, but not found, the minute bacillary ulcers in the bronchioles found by Kidd and Taylor¹ in some of their cases of this kind. They suggested the probability of the discharge of the bacilli by these channels during life. The mere presence of the bacillus would not, therefore, entitle us to infer a cavity in our case, but when the great numbers are taken into account along with the amount of daily discharge, I think we may consider it certain that pulmonary excavation has taken place, and that at least a small cavity has been formed which is in free communication with a bronchus. The transient presence of moist sounds towards the apex of the right lung perhaps indicates that this cavity may be seated here. Experience teaches that such a cavity may exist and go on discharging for long periods of time without undergoing any material enlargement. The case of Robert A., of which the photograph has been given, may be taken fairly as an instance. It is practically a chronic abscess which secretes pus, but does not increase in size.

The question of the possibilities of cure in Phthisis is of the greatest importance. Many physicians at the present time hold that it is incurable after it has reached a certain stage, *i.e.* after it has become well established; and while this may not be the opinion of all, it is unfortunately too true that general clinical experience has not so far entitled us to take so favourable a view as is suggested by the observations of the post-mortem room. An undoubted disparity at present exists between clinical and pathological experience in this respect. Can any physician point to such a result as 19, 12, 9, or even 4 per cent. of cures in his cases of well-established phthisis? The very fact that Nature so frequently establishes such cures is most encouraging to us, and strongly suggests the advisability of doing more than is at present done in dealing with the disease. Not only are separate hospitals necessary, but much good might be done by the establishment of bands or homes of nurses trained in the treatment of phthisical cases, who could be sent to treat, or at any rate inspect, superintend, and guide the treatment of such cases among the poor in their own homes. I need not point out how little is done at present towards the treatment or amelioration of the immense numbers of cases of phthisis among the poor of our large towns. What an immense boon it would be to them and to

¹ Kidd and Taylor, *loc. cit.*, p. 352.

mankind if a system were established by which they could all be controlled and supervised.

Diagnostic and Prognostic Value of the Bacillus.—The great prominence which the bacilli took in the present case leads me to make a few observations upon their importance in the diagnosis and prognosis of phthisis. Their presence in the sputum at once indubitably stamps the case as one of tuberculosis of some part of the respiratory tract. Immediately after Koch's wonderfully clear and conclusive work became known abundant corroborative evidence quickly appeared. In 1882 Heron¹ examined 62 cases of phthisis and found them in all, Balmer and Fraentzel² 120 cases with a like result, and D'Espine of Geneva³ gave a similar experience. A little later Fraentzel,⁴ in a further examination of 380 cases, found them present in all but 5 cases, which were of the non-caseating variety; Theodore Williams⁵ found them in 106 out of 109 phthisical cases, and not in 21 cases of other lung affections; and Kidd and Taylor⁶ in 91 phthisical cases, and not in 9 others not phthisical. Gabbet, Dreschfield, and Hunter Mackenzie in this country, and on the Continent Ziehl, Zahn, Leyden, Ehrlich, Güttmann, Gaffky, B. Fraenkel, Heitler, May, and a host of others have all obtained similar results. Such evidence is practically overwhelming, and entirely overrules the few isolated cases in which the bacillus could never be detected in spite of repeated examinations, although the autopsy demonstrated that they were undoubtedly tubercular. Leyden has recorded two and Ziehl one such case, and once or twice such cases have come under my notice in the Royal Infirmary. It may be that in these cases the examination was not made frequently enough, or that the sputum was not sufficiently carefully sifted. All authorities are agreed that the early morning sputum is the best, as it is free from contamination with food and has little pharyngeal mucus, and represents the secretion of some hours of the air tubes; that it should be spread out in a thin layer upon a flat glass dish with a black background (an ordinary black photograph dish does very well), and the small opaque specks or caseous pellets should be chosen; and that the examination should be repeated twelve or thirteen times if necessary. Wethered⁷ says that he failed twenty times, and succeeded on the twenty-first in finding them in a case which the necropsy proved to be tubercular.

I have not personally found the bacillus in any case which a post-mortem examination showed was not tubercular, but I have

¹ Heron, *Lancet*, 1883, p. 189.

² Balmer and Fraentzel, *Berl. klin. Wochenschrift*, No. 45, 1882.

³ *Rev. médicale de la Suisse Romande*, Dec. 1882.

⁴ *Deutsch. Med. Wochenschr.*, 1883, p. 245.

⁵ Theodore Williams, *loc. cit.*

⁶ Kidd and Taylor, *loc. cit.*

⁷ Wethered, *Med. Soc. Trans.*, vol. xv. 1892, p. 302.

once or twice been told they had been found by others in such cases where I could find no evidence of tubercle at the necropsy, and it may be useful to inquire how this may be explained. We may grant that the finder of the bacilli made no mistake about his methods, and that the bacilli were really there; nay, further, due precautions may have been taken to prevent any possibility of admixture from other sources than the patient himself, such as imperfectly cleansed spittoons, or even glasses or slides. Hadley¹ says he found bacilli perfectly stained in slides washed for some days in spirit and potash. Such sources of impurity must be carefully remembered in any large hospital; but, supposing that this has been done, and that there was no doubt about the bacilli being present in the patient's own sputum, it does not necessarily follow that the case is one of phthisis. The bacillus is ubiquitous, and therefore present in the wards of any general hospital where phthisical patients are admitted, and it is not surprising that a patient may inhale some of these germs, especially when the patient occupying the next bed happens to be a phthisical one. If long retained they are, of course, generally killed by the vital resistance of the tissues, but they may be coughed up soon after inhalation, and will then appear in the sputum. Zahn, Leyden, and Ziehl record cases of this nature; and recently Straus² has made some interesting observations of importance. He tested the dust, solid particles, and mucus of the outer nasal cavities of twenty-nine patients and ward tenders in two hospitals of Paris. The subjects of the test had all been resident in the hospitals for at least several months, but were not in any way tuberculous. The *modus operandi* was to remove the nasal contents by means of sterile cotton plugs, and transfer them to sterilised water or bouillon, which was injected into guinea-pigs. The animals thus inoculated from seven of these cases died rapidly of septicæmia or peritonitis, while those from nine others exhibited indubitable tuberculosis in from three to five weeks from the time of inoculation. The lesions were obvious, and showed the tubercle bacilli in every case. Thus nine out of the twenty-nine persons examined, nearly one-third, possessed active and virulent tubercle bacilli within their nasal cavities.

In unskilful hands the sources of error in the staining of tubercle bacilli are numerous. None find out how numerous these may be, and sometimes how ingenious of discovery, better than the teacher of students. It is not always in unpractised hands that these mistakes arise. It is not a little startling to be told, as I have known happen in the case of perfectly sound men, that you had tubercle bacilli in your sputum. Such mistakes may arise through a want of knowledge of the *why* of the process, though the *how* may be well enough known. I can best illustrate this by a short

¹ Hadley, *Med. Soc. Trans.*, vol. xv. 1892, p. 305.

² *Archiv de méd. expér. et d'anat. pathol.*, July 1894.

summary of the steps to be followed in the process of staining. The Ziehl-Neelsen carbol fuchsin solution is the one I usually employ. The fixed cover-glass film is held by a pair of bacteriological forceps, and a little carbol fuchsin filtered on to the film, enough to completely cover its surface. It is then held over the flame of a bunsen till the steam rises. This should be repeated two or three times during the space of two or three minutes. The cover-glass must not be allowed to get dry. The carbolic acid combines with the aniline salt fuchsin (hydrochlorate of rosanilin) to form a bright red pigment, and also makes the capsule of the bacillus easily penetrated by the dye which becomes deposited in fine particles within its protoplasm. The stain is then poured off, and the cover-glass rinsed in water. A 25 per cent. solution of sulphuric acid is next added, and the red colour at once changes to a pale yellow. It acts by converting the pigment in the cells outside the bacilli into a colourless, readily soluble, triacid salt. Hence everything but the bacilli (the sheaths of which it cannot penetrate) are decolorised. This is by far the most important part of the process, and must be carried out carefully. Imperfect decolorisation is the most fruitful source of error. There is little fear of over-decolorisation, although it may occur, for after a time the acid seems to be able to penetrate the bacillary capsule, and then, of course, will act upon the pigment within the bacilli in the same way as it does upon that outside them. We can easily ascertain if the decolorisation has been carried far enough by rinsing the cover-glass in water, when, if imperfectly accomplished, some red colour will return. The water decomposes the colourless triacid salt into a mon-acid red salt and free acid. More acid may now be added, and the cover-glass again rinsed in water. This should be repeated until no colour reappears on washing. The danger of over-decolorisation is very slight, though it undoubtedly exists, and at times happens more quickly than at others. If there is any reason to fear it, the last stages of decolorisation may be accomplished by washing with methylated spirit; but in all cases it must be complete. It is better to run the risk of over than under decolorisation. After complete decolorisation and subsequent thorough washing in fresh water to remove all trace of the acid, a solution of methylene blue is added for a few seconds. The cover-glass is again rinsed in water, and placed at once upon a slide and examined; or if a permanent preparation be wished, it is allowed to dry in the air, and mounted with a drop of Canada balsam. The whole process is simple, and may easily be accomplished within three to four minutes. Having thus stained and found bacilli, can we venture upon any further opinion than that the case is one of tubercular disease of some part of the respiratory system? Does their number, arrangement, or special characters in any way guide us as to whether the seat of the disease is the larynx or the lung, or whether the case is acute,

chronic, or stationary or advancing? As already mentioned, Hunter Mackenzie¹ says, "In the sputum of laryngeal phthisis, especially if at all acute, bacilli are frequently present in enormous numbers." Kidd and Taylor² deny this; but it is at once evident that, as pulmonary sputum also may contain enormous numbers, and as laryngoscopic examination is available, it is of little value, whether true or not, as a means of differential diagnosis. In the early part of our present case the mucous scanty sputum, with its very abundant bacilli, did suggest to me a laryngeal origin, but the laryngoscope negatived this. The bacilli were therefore of pulmonary origin (as I think we may exclude primary tubercular ulceration of the main air-passages, which is extremely rare), and their presence in such vast numbers was naturally suggestive of an acute process, and of a somewhat grave prognosis. The subsequent history of the case shows that this supposition would have been incorrect; but there are many other considerations which will guide us here, and prevent our attaching much importance to the numbers and characters of the bacilli in the sputum. Their multiplicity in the sputum may certainly point to their multiplicity in the lung, but the converse would be a dangerous doctrine to hold. A simple consideration of the relation of the bacilli to the various pulmonary tubercular lesions, as shown by sections, will at once demonstrate this.

In that most acute form, the acute miliary tubercle, and in early caseous tubercle, the lung lesions show immense numbers of bacilli, whereas the sputum may show none; while in fibroid tubercle, lung lesion and sputum alike show very few, or none. Again, in cases of rapid softening, both lung and sputum may show great numbers, or the reverse may be found, as in many cases of chronic cavities. Further, the lung may show many and the sputum few, and *vice versa*. Clinical observations on this subject are equally definite, for while in cases running an extremely rapid and acute course the sputum often shows abundant bacilli, it may show few; and further, while in chronic cases it frequently shows few, it may fairly teem with them.

Earlier observers, indeed, were led to different conclusions. Thus Heron,³ from his 62 cases, concluded—(1), that if bacilli are persistent for some weeks in small numbers the case will probably run a long course; (2), that if they are present in large numbers in the early history of the case it will probably run a short course. He considered them to be few if only three or four were present in a microscopic field, numerous if thirty or forty were present. Balmer and Fraentzel,⁴ from their 120 cases, concluded—(1), that when bacilli are numerous and well developed the prognosis is bad; (2), that they are exceedingly abundant in

¹ Hunter Mackenzie, *A Practical Treatise on the Sputum*, p. 49.

² Kidd and Taylor, *loc. cit.*

³ Heron, *loc. cit.*

⁴ Balmer and Fraentzel, *loc. cit.*

the most acute cases of phthisis; (3), that their number is greater when the destruction of the lung is rapidly progressing, and that the number is greatest toward the end of the disease. Further evidence was rapidly forthcoming, and on nearly all hands showed that such opinions were really untenable. The numbers and characters of the bacilli afford no valuable evidence of the severity or activity of the disease or of the gravity of the lesion. This is all the more obvious when we remember the varying relation shown by tubercular foci and cavities to bronchi, the unequal and varying powers of discharge shown by the same or different patients, the great possibility of variation of vital activity which the bacilli may possess in no way related to any physical differences they may show, and, lastly, the great difficulty of arriving at even an approximate estimate of the numbers present in any given quantity of sputum. While, however, we can place but little reliance upon the bacilli for the purposes of prognosis, we may make certain general inferences which may be of use to us. We cannot hold that there is any definite ratio between activity of disease and number of bacilli; but I think we may hold that, as a rule (which has many exceptions), they are numerous in acutely progressing cases, and scanty in chronic cases, that their steady diminution in number possibly means a tendency towards recovery, and that their complete disappearance is a good sign, indicating a retrogression of the disease, or at least a quiescent cavity. During the only period of their apparent steady diminution in the present case, whilst the patient resided at Torquay, there was a marked improvement in his general condition. Diminution in amount of sputum and numbers of bacilli occurred at the same time as the general improvement in his bodily health; and I have more than once thought that a relapse in the latter has been accompanied by an increase in both of the former. I have also seen this in other cases.

I do not mean to overrate either the diagnostic or prognostic value of the presence of tubercle bacilli in the sputum. The general condition of the patient and the physical signs are far truer indications of the extent, rate, and progress of the disease. In the great majority of cases the physician will value, and rightly too, these signs and symptoms far more highly than a bacteriological examination of the sputum, though the latter may often enable him to convert a mere suspicion into a certainty, or, as in the present case, where not even a suspicion existed, indicate at once the true nature of the case,—a discovery pregnant with importance alike to the expectancy of life and the prolongation thereof.

