

SOME ASPECTS OF THE DIAGNOSIS  
OF  
PULMONARY TUBERCULOSIS.

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"This is the Tenor of my belief; wherein, though there be many things singular, and to the humour of my irregular self; yet if they square not with maturer Judgements I disclaim them, and do no further father them, than the learned and best judgements shall authorize them."

Religio Medici.

## INTRODUCTORY.

The beginnings of human tuberculosis lie beyond all written records. Centuries before the Greek physicians described the salient features of the disease, its victims were known to the embalmers in Egypt (1); and it was doubtless long before the age of the Pharoahs that the tubercle bacillus assumed the parasitic mode of life and began its baleful work among men. In the absence of statistical evidence we can only speculate as to the extent of its ravages in the past, but if we come to comparatively modern times and look at the list of great men who have died of consumption we can form some vague idea as to how gravely it has crippled mankind at large. The history of Medicine, too, with its changing doctrines of cause and cure bears witness to the extent to which the disease has engaged the attention of physicians in the past; though it cannot be said that their efforts were crowned with conspicuous success. Indeed, Metchnikoff has admitted that the failure of our attempts to deal with tuberculosis constitutes one of the most plausible arguments of those who are sceptical of all scientific progress (2).

Yet the story is not wholly one of ignorance and error, for even among the most ancient writers strikingly "modern" views were not wanting. A belief in the contagious nature of the disease, for instance, was apparently held by some of the Greeks (3), and persisted with more or less acceptance until substantiated by accurate research. Nevertheless, in spite of the fact that its infectivity was proved by the labours of Villemin and others (4), the general opinion up to the year 1882 was that the disease is a manifestation of some intrinsic constitutional defect and not an infection from without (5). The magistral work of Koch demonstrated the true nature of the disease, revealed the essential unity of the various lesions, and led to the recognition of the different types of the bacillus.

Since then controversy has narrowed upon two most important questions; the relative parts played in human tuberculosis by the bovine and by the human bacilli; and the mode of infection in man. With regard to the first question it is now generally agreed that while the bovine bacillus is responsible for some cases of tuberculosis (6) - especially "surgical"

tuberculosis in children - the great majority of cases of pulmonary phthisis result from infection by the human type. On the second question different views have been accepted at different times. A belief in congenital transmission was once very generally held and was later as widely repudiated. But certain cases of congenital tuberculosis have survived the tests of scientific criticism (7), and ante-natal infection has been experimentally produced in animals. These facts together with an increasing recognition of the possible latency of tuberculous infection have led some recent writers to qualify their views as to the possibility of congenital transmission in man. (8)

With regard to the acquired form of the disease, there are two main theories, - the Inhalation doctrine and the Ingestion doctrine. The former was held by Koch (9), but increasing favour was subsequently accorded to the view that it is by means of the alimentary tract that the germs gain entrance to the body (10); At present it cannot be said that the controversy is settled, though there are indications that we are returning to the belief that the respiratory tract is the main portal of infection, the disease being thus acquired from bacilli either in dried, dustborne sputum, or in the minute droplets ejected by the consumptive during such acts as coughing. (11)

While our knowledge of tuberculosis in various respects thus awaits further elucidation, it has long been sufficient for the needs of practical hygiene. We know the essential cause of the disease, the various sources of infection, and the possible portals of entry in the human body. Pasteur said that it is within our power to make all parasitic diseases disappear from the earth; yet today, almost 30 years after the discovery of the bacillus tuberculosis the facts are black enough. In the report of the Registrar General for the year 1916, 53,848 persons are stated to have died from tuberculosis in England & Wales, and of these deaths 41,545 were due to phthisis: and these figures compare favourably with those of other civilized countries. When we interpret such statistics in terms of human suffering, or try to grasp their meaning in our national economy the appalling nature of the problem becomes more apparent. It has been said that in the United States the real loss of life from tubercle is represented by some 4,800,000 years per annum (12); and in the case of

England and Wales the direct and indirect economic loss from this disease has been estimated at 7 million pounds annually. (13)

In recent years the increasing attention which has been paid to matters of public health has emphasized the importance of tuberculosis as a preventible cause of loss of life, and for half a century the death rate from that disease has been falling at an ever-accelerating pace. This decline was in evidence before the discovery of the specific bacillus or the institution of sanatorium treatment and does not appear to have been appreciably enhanced by either of these facts but to have been due to the general improvement in the sanitary condition of the people and to the partial segregation of infectious cases which has been incidentally effected by institutional treatment in general hospitals, infirmaries, and asylums. (14). Since the year 1865 the actual number of deaths from tubercle has diminished by about 20 per cent, and, in view of the increase of the population in the interval, the death-rate from this cause has fallen to a much greater extent - about 50 per cent. In view of these facts there were good grounds for hoping that with a wider recognition of the infectious nature of the disease and increased facilities for the treatment of actual cases, tuberculosis would be as rare as leprosy by the end of the present century. (15). The advent of the War has unfavourably affected the outlook and may continue to do so to an extent we cannot at present foresee. The condition of France with regard to tubercle has lately been shown to be terrible. (16), and since 1915 our own mortality figure has been rising. Our nation will probably not be the worst sufferer in this respect but there is already evidence enough to show that tuberculosis will be one of our gravest after-war problems.

The problem may be regarded from two standpoints:-

1. That of national Hygiene.
2. That of the individual case.

With the former aspect the following pages do not profess to deal. But one may perhaps express the conviction that civilized nations will not for ever allow their populations to be decimated by a preventible disease, and that, in default of efficient curative measures, one cardinal feature in any crusade against tubercle must be the adequate isolation of actively infectious cases for as long as they are infectious. In this respect the present state of affairs leaves much to be desired.

With regard to the individual case opinion has changed much within the past eighty years. Even as late as the first half of the nineteenth century a diagnosis of phthisis was regarded as tantamount to a sentence of death (17). More recently there has been a marked reaction from such gloomy views and the general opinion has become much more optimistic - too optimistic it may be, for here as elsewhere, undue optimism has its dangers. A patient is often told that a few months in a sanatorium will "put him right" and experience too frequently shows that he is doomed to disappointment. In dealing with cases of phthisis one finds nothing more impressive than the remarkable way in which sanatorium treatment can improve the general health and energy of the patient while the physical signs in the lungs remain obstinately the same: indeed increase in the extent of the physical signs may proceed hand in hand with a general improvement. In such cases, of course, the disease is essentially less active, but their subsequent history very often proves that the remission is only temporary. Thus, while there may be much truth in the dictum of Brehmer, "Tuberculosis primis in stadiis semper curabilis," the cases we actually meet in practice do not commonly proceed to cure. And the explanation is not far to seek; for such cases are rarely "in the first stages". The fact is notorious that by the time a patient is advised to seek admission to a sanatorium he is very often too far advanced to derive more than temporary benefit from the very limited sojourn which can now be allowed him in view of the shortage of accommodation from which all Local Authorities suffer. In the administrative County of Lancashire during the past five years the insured applicants for Sanatorium Benefit were classified as follows in the Turban-Gerhardt scheme:

	Stage I	Stage II	Stage III
1914	298	314	547
1915	434	466	426
1916	500	479	296
1917	527	433	218
1918	519	459	179

In a series of a thousand such cases examined by the writer during those years the stages were represented as follows

Stage I	Stage II	Stage III
305	405	290

This phenomenon is not an isolated one, for similar figures are found all over the country: and there is therefore little need of apology for again drawing attention to some of the diagnostic aspects of pulmonary tuberculosis. The desirability of early diagnosis has been repeatedly emphasized in recent years, and various new refinements in clinical examination have been brought forward as tending to this desired end. There is indeed some danger that the general practitioner - who must, as Osler says (18), be the leader in any crusade against the disease, and in whose armoury early diagnosis is the most powerful weapon, - should find himself at a loss to decide upon the merits of the various diagnostic aids, and lose confidence in the older methods of proved utility.

The following pages, based upon the writer's experience with cases of adult phthisis during the past six years, are intended towards the elucidation of this question, and <sup>as</sup> contribution to the general diagnostic problem in pulmonary tuberculosis.

For our present purpose it will be found convenient to classify our diagnostic methods under the following heads.

1. Diagnosis from Physical Signs.
2. Diagnosis from Laboratory Methods.
3. Diagnosis from X-Rays.
4. Diagnosis from History and Symptoms.



DIAGNOSIS FROM PHYSICAL SIGNS.

"Nil sapientiae odiosius acumine nimio."

Seneca.

Diagnosis from physical signs practically means diagnosis based upon the results of inspection, palpation, percussion, and auscultation; for such minor procedures as cyrtometry and spirometry are rather clinically impressive than actually helpful. Inspection and palpation must have been employed in a general way ever since physicians looked at their patients or sought by touch for the source of their ailments. Percussion of sorts was used by the Greeks, but its real value was demonstrated only with the publication of Auenbrugger's volume in 1761, while the recognition of the diagnostic worth of auscultation was due to the work of Laennec as late as the beginning last century. To us who are wise after the event, it seems surprising that no earlier worker stumbled upon these methods of examination, and indeed there are indications that some previous writers were within an ace of such a find (19). Among these must be numbered Leonardo da Vinci whose various interests included a knowledge of some of the medical sciences. It is a pity that he did not utilize his then unrivalled knowledge of the human frame when he wrote: "If you cause your ship to stop, and place the head of a long tube in the water, and place the other extremity to your ear you will hear ships at a great distance from you. You can also do the same by placing the head of the tube upon the ground, and you will then hear anyone passing at a distance from you". (20) But then the great Florentine had many irons in the fire.

There is no need here to discuss the general significance of these diagnostic methods or the particular rules for their application in practice. Our special concern at present is with the aid they yield in the diagnosis of early phthisis, and on this question there are various and emphatic opinions, for tuberculosis, in the matter of diagnosis as in that of treatment, has been rich in conflicting enthusiasms.

Inspection, though it does not lack its prophets, hardly be claimed as the prime method in the physical diagnosis of early tubercle. While we must admit that in incipient cases there may be retraction or delayed expansion over the affected apex, we must also recognize that such findings are not invariable. Local alterations in apical contour and expansion are often due to other than intra-pulmonary causes: depression of the apices may be natural to the patient - witness the "salt-cellars" of the ball-room - or may be found as the result of simple old age, while such causes as slight scoliosis, wry-neck, or previous pleurisy may

produce a "suspicious" apex over a guiltless lung. In any case it is not an easy matter to observe slight differences of apical expansion, for the eye can look only at one apex at a time. Even inspection of the chest as a whole is almost as likely to lead to error as to truth, for tubercle is often found in a chest of healthy appearance, and not every "typically phthisical" thorax is tuberculous. Indeed one might almost say that as much information may be got from the inspection of the patient's general mien and bearing as from a meticulous attention to local inequalities. Such at least is the experience of the present writer, who has come to regard inspection as of very limited value and useful only as ancillary to other methods.

Palpation demands no lengthy discussion, for there can be no doubt as to its subsidiary usefulness in helping us to distinguish between intrapulmonary consolidation and extrapulmonary effusions; in confirming the results of inspection; and in enhancing the value of percussion when we recognize differences in resistance through the pleximeter finger. Pottenger, who has drawn attention to the changes in the tissues of the chest wall which accompany pulmonary inflammation, is persuaded that the investigation of these changes by palpation affords valuable assistance in the early diagnosis of tubercle(21). By this means he believes that we can find evidence of pulmonary inflammation in the spasm of the overlying muscles where the disease is acute, or in their atrophy where the process is more chronic. In cases of long-standing disease, where the other chest findings are pronounced, the truth of his opinions is obvious; and even where the lung signs are very slight the wasting and lack of tone in the muscles of the pectoral girdle is often appreciable by sight and touch. Moreover, in early cases we do often perceive a "kick" in the muscle on percussion, but the present writer at least still awaits conviction as to the worth of the light palpation of individual muscles which Pottenger recommends. Percussion is believed by many physicians to afford the earliest indications of lung involvement, and it is claimed that some alteration to skilled percussion can be found over every diagnosable lesion(22). The value of light percussion in the diagnosis of incipient phthisis is universally admitted, and it has been made the basis of certain special methods of apical examination which aim

at greater accuracy of result.

Goldscheider, by the use of a special pleximeter, sought to map out the actual anatomical apex of the lung (23), and then compared the findings on the two sides. Kronig's method depends upon the accurate delimitation of apical resonance; when the lung is healthy this method reveals in the supraclavicular and supraspinous fossae resonant fields which are continuous above through a narrower isthmus, while the presence of disease is manifested by <sup>an</sup>attenuation of this resonant area or a "blurring" of its border line at one or other side (24). In his Bradshaw lecture on the diagnosis and treatment of incipient pulmonary tuberculosis, Dr. D.B. Lees emphasized the value of light percussion, and stated that it enabled him to recognize in early cases certain well-defined areas of relative dullness. (25)

These areas are situated as follows:- one at the inner and one at the outer end of the first intercostal space; one at the inner and one at the outer part of the supraspinous fossa; and of these four the inner and the outer pairs respectively correspond. Thirdly, there is a similar dull focus at the vertebral end of the scapular spine over the apex of the lower lobe. He also describes several other such spots of less prominence and importance. And on the recognition of these areas he greatly depends in the early diagnosis of phthisis, while he further believes that their variation in size - he measures to a sixth or even an eighth of a fingerbreadth - affords a valuable record of the progress of the case.

Now, what is the practical value of these refinements of examination? In answering this question we must remember the large personal equation in percussion. As we all differ in our appreciation of musical sounds, so here different observers have different "faculties"; and every man must work out his own percussion. Nor should our preference for the light percussion "tap" blind us to the fact that a heavy "follow-through" stroke will often decide a doubtful finding.

Goldscheider's method is tedious in its application. Theoretically, its importance is lessened by the fact that the earliest tuberculous lesion is not at the extreme anatomical apex but at some distance below it; and, practically, few physicians have it of real clinical service. With Kronig's method, which does not profess to define the actual apex, the case is different, for its value has been attested by many competent authorities (26). Nevertheless, the present writer, though he still employs

it in doubtful cases, must confess that he has not found it of unimpeachable value. Narrowing of the resonant area must mean contraction of the lung apex - otherwise there would be an invasion of the general body of the resonance and not merely an encroachment from the side - and this implies some definite degree of fibrosis. Now, while it is quite true that tuberculous inflammation is a chronic inflammation it is also true that "fibrosis is the past tense of tubercle" rather than the present. On this question the writer's experience coincides with that of Bonney (27); "While it is impossible to state that the shrinkage is of long standing, it is undoubtedly true that in the majority of instances the tuberculous process is of fairly remote rather than of recent origin. It is more a matter of clinical interest than of actual diagnostic value, for the reason that a tuberculous change in the apex sufficient to produce a well defined variation from the normal percussion outline must almost invariably be attended with auscultatory signs capable of ready recognition." Further, we may regard narrowing of the resonance bands as expressing in one dimension of space what visible apical sagging expresses in another, and we are therefore not surprised to find that disparity of the apical resonances may exist in the absence of tuberculous deposit and owe its origin to other causes. We need hardly pause to challenge the expression "blurring of the line", which can convey a meaning only to those whose percussion attains a Euclidean accuracy. On the whole, then, though with a proper diffidence, one is constrained to place but a minor value on the method of Kronig.

The views of Dr. Lees are useful as emphasizing the favourite seats of the incipient disease - in the apices of the upper lobes and of the lower lobes as described above. But it is certainly not an easy matter to discover the many subsidiary areas to which he refers and which he figures in his published lecture. One is inclined to say that if these areas have any meaning pathologically then an "early" case must have a very extensive system of lesions. Nor does the existence of these areas appear to have been confirmed by other workers either at the bedside or in the deadhouse. Also it may be remarked that in the great majority of the cases he cites there were auscultatory evidences of local lung disease, - the importance of which, indeed, he fully admits.

Thus the writer's experience has led him to the conclusion that in the

careful comparison of the apices by light percussion it is not usually necessary or helpful to adopt any of the above special modes of examination; but that the apical areas of Lees should always be rigorously questioned before excluding phthisis. One other reflection is surely pertinent; if these methods of percussion are necessary for the diagnosis of incipient phthisis those of us who have placed reliance on the ordinary routine percussion of the apices must often have failed to detect phthisis in patients who have subsequently developed it beyond question. Now this is not a common experience, for failure to diagnose the beginning disease is not usually due to lack of specially directed percussion but to lack of attention to significant symptoms with consequent omission to examine at all.

Whether auscultation or percussion yields the earlier evidence of lung disease is still a question at issue among experts, and the answer is probably personal to each observer. For the ordinary physician, however, auscultation may claim this advantage, that whereas percussion deals essentially only with the character of a note, auscultation directs its inquiries along several lines from any one of which valuable information may be derived. Through it we investigate the intensity of the voice sounds and of the breath sounds, we note the character and relation of the two respiratory phases, and we seek for modifications or adventitious accompaniments of the normal respiratory murmur. We need not pause to dwell upon its importance in the differentiation of definitely established chest conditions such as massive consolidation, cavitation, and abnormal conditions in the pleura; but we may relevantly note its service in revealing the increase of vocal resonance which often - but by no means invariably - accompanies an incipient lesion, and also in the detection of pleural friction either at the apex or at the base. For our present purpose, however, its most valuable office is found in the investigation of the three questions to which we ought specially to attend:-

1. The Intensity of the breath sounds.
2. The character and relation of the respiratory phases.
3. The presence or absence of adventitious sounds.

1. With regard to the first inquiry we may safely state that in early phthisis there is very generally a diminution of the breath sounds over the affected area. Stokes (28) declared that "Of the different signs of

incipient phthisis there is none more important than this", and the experience of the present writer is thoroughly consonant with this dictum. Stokes further asserted - in reference to the lungs as a whole and not merely to the apices - that there is often a natural disparity in the intensity of the respiration in the two lungs "and in such cases, with scarcely an exception, the murmur of the left is distinctly louder than that of the right lung". Subsequent experience has not confirmed this statement, and indeed we now recognize that over the right apex the respiratory murmur is usually more intense than over the left. But the observation of Stokes was not wholly at fault, for there is often a relative diminution of the respiratory intensity over the right base in normal chests. On this point the present writer has no doubts, as he had often noted it and puzzled over it until he learned that his experience was not unique.

Grancher (29), who has usefully emphasized the importance of "single phase" auscultation in the early diagnosis of tubercle, believes that the diminution of intensity primarily affects inspiration. On this point the present writer is not convinced, as he has not found the diminished intensity always confined to inspiration. And if lessened intensity means lessened air-entry lessened air-entry also implies lessened air-output.

The alteration in the breath sounds in early phthisis may take the form of an increase in intensity. In the writer's experience this is much less common than the former change, and he believes that in the catarrhal mode of onset of the disease - which is a very common one - diminution is the rule. Increase of breath sounds may be got in those cases where fibrosis is a feature, and also in patients where the history suggests a previous attack of tubercle which has not been diagnosed and which is perhaps recalled as a "bad influenza".

2. The character and relation of the respiratory phases; - Prolongation of expiration is in the experience of the writer not a common early sign. It is certainly not always present, especially where the breathing is reduced in volume, and it would seem to be best exemplified in the chronic cases with much fibrosis which we have noted above as presenting also an increase in the respiratory murmur; so that the resulting breath sounds approach the bronchial type. To the various types of breathing

intermediate between the vesicular and the bronchial different names have been applied but the fact to be utilized here is that any departure from the normal relation of the two phases is worthy of note.

3. The presence or absence of adventitious sounds: - Mainly owing to the work of Grancher we have come to recognize that in early phthisis the first modification of the breathing affects the inspiratory phase. The attempt to define this modification has given rise to various terms which have served mainly to darken knowledge; but we may describe it as a "roughening" of the inspiratory sound provided we note that "roughening" does not connote any increase of intensity. It frequently accompanies diminution of the breath sounds in early phthisis and gives to the inspiratory murmur a "granular" quality which tempts one to describe it as a series of half-formed, embryonic rales. At a later stage we are presented with the fully fledged rale, which is of a "fine" type and is perhaps better termed a crepitation. Though Williams has stated that these are audible at first only with expiration, there can be little doubt now that they are primarily and predominantly inspiratory. They may accompany both phases where the process is advanced or very active. The fact that these crepitations may be revealed by a cough when they have not yet appeared with normal respiration is one of extreme importance. It is always taught but it certainly is not generally utilized in practice, for it is a very common occurrence for a "suspicious" case to be presented "with no physical signs" where this device provokes a shower of characteristic crepitations. It is now customary to say that when such crepitations have appeared the case is no longer incipient. From the pathological standpoint this is doubtless true; and certainly we ought not to wait till crepitations appear before we diagnose tubercle. But the fact remains that a case which has not passed this stage has as a rule quite a good outlook; and this is a statement which cannot be made of the great majority of the cases notified today.

Apart from these characteristic crepitations we may find other adventitious sounds, - rales to which we may apply one or more of such terms as "large", "scanty", "clicking", "illdefined", "creaking"; or rhonchi of various kinds, - and we are often at a loss to decide upon their significance. They are especially noteworthy when they are localized and persistent and therefore unlike the various adventitious sounds



which we get with the first full expansions of the lung.

Nowadays less importance is attached than formerly to "interrupted", "jerky", or "cog-wheel" breathing. Williams (30) has stated that "it is nothing more than the respiratory sound modified or divided by the pulsations of the heart". This explanation accounts for some such cases, and in these the cause is readily recognized. In other instances it is due to the fact that the patient breathes in ~~sh~~ halting or jerky manner under the excitement of examination; or it may be that he is one of those whom we can hardly get to breathe properly at all. When this finding is localised and persistent it should be seriously regarded.

The physical examination of the chest does not constitute a complete examination of the patient, and indeed it may leave us in uncertainty; for tubercle may give rise to any abnormal finding and there is no physical sign pathognomonic of that disease. In appraising the results of physical examination we should never forget that the value of any sign is directly proportional to the degree in which it is localized and persistent and corroborated by other findings.

Difficulties of diagnosis from physical signs may arise under two conditions:- 1. Where the existence of abnormal signs is doubtful.

2. Where actual physical signs are misinterpreted.

The first class is largely composed of cases in which the normal disparity of the two apices has not been recognized and in which the diagnosis is that of tuberculosis of the right apex. There can be no doubt that scores of patients are annually condemned to years of more or less crippled life merely on account of findings which are quite compatible with the physiological peculiarities of the right upper lobe-increase in the breath and voice sounds, prolongation of expiration, and, perhaps, some dulling of the percussion note. This is no light matter. Yet it is certainly remarkable to what a degree these peculiarities may be present.

Case 1. M.T., a female mill-worker of 25 years of age was seen on Decr. 1st 1916 complaining of langour and pains in the right chest of some ten months duration. Her medical attendant had diagnosed phthisis of the right apex. She had had a "nervous breakdown" when a child; and had undergone operations for dysmenorrhoea, rupture, and appendicitis, pain having been the main symptom on all three occasions. She wore eye-glasses prescribed for headache. She stated that she had lost energy, weight, colour, and appetite, but these had not been marked features in her illness. She had only a casual cough and no regular sputum. Otherwise her history was not typical of tubercle. Over the right apex before and behind expiration was prolonged to a more than usual degree, but there

was no abnormal increase in vocal resonance, no impairment of the percussion note, and no adventitious sounds were noted there at any time. Kronig's band was not shrunken on percussion. Under observation she ran a perfectly normal temperature. No tubercle bacilli were found in her sputum when any was available. The chest pain had no special relation to the respiratory act and was not confined to the chest wall but was complained of in the right arm also. Some degree of anaemia was present and she appeared to have considerable pain with menstruation. She was highly neurotic, and this together with her eloquent past history and the fact that she was always accompanied by her mother on her visits to the dispensary, made one conclude that this was one of those cases where phthisis is a diagnosis of despair. She has kept well until the time of writing.

In shunning Scylla we must beware of Charybdis; and the knowledge of the normal peculiarities of the right apex must not blind us to the fact that phthisis often does attack there. It is in the presence of a quiescent and long overlooked lesion that this mistake may be made.

Case 2. O.R., a paper-worker aged 64 was seen on the 22nd April 1918 complaining of weakness, loss of flesh, dyspepsia, and a cough which had been aggravated by a recent series of colds. As a youth he had "inflammation of the lungs", but his history was otherwise satisfactory and he had remained free from chest or general symptoms until the insidious onset of this illness some 6 months before being seen. His complaints were more indicative of gastric disease than of lung trouble; his temperature was normal and his pulse 108. Over the right apex before and behind the percussion note was impaired, though there was no marked diminution of Kronig's area; expiration and vocal resonance were unduly enhanced and after cough there were a few large dry rales. Above the inner end of the left clavicle there was a hard walnut-sized gland, and in the epigastric region there was an egg-sized mass movable with respiration. He had very little sputum but it contained tubercle bacilli in small numbers.

The subsequent history of this case showed it to be primarily a case of gastric cancer in which the recent "colds" had drawn attention to the chest with the resultant discovery of a focus of long quiescent tubercle. It is also of interest as exemplifying the importance of unsuspected sources of infection in senile patients who are usually labelled bronchitic if they show chest symptoms at all.

The present paper does not profess to deal with tuberculosis in childhood but from the examination of many hundreds of school children the writer has found that the diagnosis of tubercle is often made through inability to recognize puerile breathing, and that here, as in the adult, the diagnosis made is that of right apical phthisis.

The lesson of such cases is that we ought to be particularly careful in diagnosing phthisis of the right apex on the ground of physical signs.

Apart from mal-diagnosis from the physiological findings at the apex, another common source of error is found in the presence of the so-called "collapse rales" which are found in a considerable number of healthy chests - Cabot (31) gives the percentage as 61. The

fine rales which we get above or below the clavicle with the first few inspirations are well recognized though they are still a source of disquiet to some. Such rales are also got in the lower axillary regions as well as at the bases, and in "suspicious" cases with unimpeachable apices they are sometimes fixed upon as indicative of local disease. Generally speaking this error may be avoided by recognizing that such rales are found on both sides of the chest, that they often clear up with full expansion, that they do not select the usual sites of tubercle, and that they are not supported by other physical signs. They are not always transient, however, and in several cases the writer has found persistent fine rales which though unsupported by other clinical findings proved a source of concern. Only a lengthened period of observation may enable one to treat such rales with the contempt they deserve.

Case 3. Mrs. P. a housewife was seen on February 28th 1917 with a history of a rightsided pneumonia beginning 5 weeks before. Her father died of phthisis and her brother was definitely phthisical. Her previous health was good except for a similar attack of pneumonia (side not known) two years before. The "present illness" in onset and course was typical of a lobar pneumonia, and she stated that she now felt perfectly well, but that she was perhaps a little breathless on exertion. Her temperature in the evening was 100 and her pulse 110. She had no cough and no regular sputum. The front of the chest was clear but behind the right base was distinctly dull, with slightly prolonged expiration, somewhat increased voice sounds, and some medium inspiratory crepitations. In both suprascapular fossae there were fine crepitations which did not clear up with cough, but which were not supported by any other sign of local disease. During several months' observation she remained perfectly free from complaints, the basal signs cleared up completely, and the temperature and pulse returned to normal. What sputum she raised was repeatedly negative. But the fine crepitations remained and remain to this day, though she has developed no untoward symptoms. In her case therefore one may safely assert that these crepitations are not significant of any disease.

2. So far we have dealt with spurious physical signs in healthy chests; but it is in the presence of actual physical signs due to disease that we commit our chief sins of omission and commission in the physical diagnosis of tubercle. No exhaustive exemplification of this fact can be attempted here, and the following cases of tuberculous and non-tuberculous affections have been selected from hundreds of "contacts" and "suspects".

Case 4. P. O'N. a theatre attendant aged 45 was seen on the 16th of June 1916, with the diagnosis of phthisis of the left apex. "He

gives a history of a "cold" of one month's duration during which he has lost some weight, appetite, and energy. He has had no haemoptysis or sweats. His temperature and pulse are normal. His family history is clean; but his personal history includes a "stroke" nine years ago, and he is still hemiplegic on the left side." All over the left lung expansion was visibly and palpably poor, and the respiratory murmur was diminished. Inspiration in the left lung was rather halting in character but this feature was not localized; and there were general rhonchi heard occasionally over both lungs. The heart was enlarged and had a well defined mitral systolic bruit.

Here in the presence of a hemiplegia one hesitated to diagnose phthisis on the paralysed side. And the findings in the left lung were such as one might expect in a hemiplegic chest during a transient catarrhal condition, while the undue duration of the "cold" could be accounted for by the obvious cardiac insufficiency. The patient stated that he was definitely recovering, as he had done on similar previous occasions, and further observation and bacteriological examinations yielded no evidence of tuberculous mischief. A casual examination confined to the apices was probably the cause of the diagnosis of phthisis.

Case 5. E.C., a mill girl of 23 was seen on the 6th of Sept. 1915. Her previous history includes operations for dysmenorrhoea and appendicitis and she wears spectacles prescribed for headache. Two years ago she was operated on for a rib injury but the wound did not heal satisfactorily until a rib resection was done a few months ago. Since the operation she has not recovered her usual health but has lost energy, weight, colour and appetite. She has developed a cough but has no sputum, and has had no haemoptysis. She complains of giddiness and amenorrhoea and seems to suffer considerably from pains in the abdomen in the region of the appendicitis scar and also in both sides of the chest though the latter are not typically pleuritic in character. She is admittedly "very nervous" and acts as though the pressure of a binaural stethoscope on the chest were painful. Under the right breast is the scar of the last operation and over the right lung generally expansion is appreciably diminished with some reduction of the respiratory murmur, but no adventitious sounds. Under the left clavicle at its inner end the breath sounds were distinctly reduced and inspiration was granular in character. Her temperature and pulse remained normal under observation until she had a definite attack of pleurisy 3 weeks after admission, and about this time also crepitations first appeared after cough under the left clavicle and in the left supra-spinous space in which places there was now some impairment of the percussion note. Some days later she raised a small amount of sputum which revealed on examination tubercle bacilli in small numbers.

This case was sent with the presumptive diagnosis of phthisis of the right apex, but the abnormalities on that side could quite well be accounted for by the operation, where two ribs had been resected; and the first appearance of unequivocal signs of disease was at the left apex. Not until many months later did corresponding signs of disease appear at the right apex and to this day the disease is much more marked in the left lung. This case was very similar to Case 1 given above; and the danger in such females is that of diagnosing hysteria. But hysteria is

a diagnosis that is usually best left unmade, and in this case with the definite history of chronic bone trouble, and the group of tuberculous symptoms it was wholly insufficient to account for the facts.

Curvature of the spine, especially scoliosis, often gives rise to difficulty in diagnosing or excluding tubercle, a difficulty which is increased by the fact that the original cause of the curvature is often a tubercular affection. In such cases inspection, palpation, percussion and auscultation of the lung on the compressed side will often yield signs which are quite consistent with the diagnosis of phthisis, especially in the presence of a superadded catarrhal condition; so that the diagnosis must not be made as it frequently is, on the basis of physical findings alone, but may only be delivered after a period of observation of the symptoms and other clinical and bacteriological data. It is not necessary to give examples of such cases but the writer has had 7 such patients under his observation in all of which the diagnosis of phthisis had been made. In only 2 of these was the diagnosis confirmed. In the presence of gross physical deformity the most careless observer may well be expected to pause before pronouncing his diagnosis, but even in its absence we may get definite findings on physical examination which may mislead us.

Case 6. A.D., a coal miner of 35 with an excellent personal and family history was seen on the 30th of November 1917 as a questionable case of phthisis. "Thirteen months ago he had a seemingly typical attack of lobar pneumonia involving the left upper lobe. Since then he "has never felt quite himself". He has had no fever and his pulse rate has been normal. His weight has definitely increased, and he has not lost appreciably in energy, appetite, or colour. Ever since the pneumonia he has had slight cough and spit, and on rare occasions he has noticed blood specks in the sputum. He complains of dyspnoea on exertion. Inspection and palpation reveal deficient expansion of the left apex; and all over that lung there is relative dullness which is marked almost to the pitch of flatness under the clavicle, where also respiratory murmur and vocal resonance are distinctly reduced. These findings are present to a less degree in the left supra-spinous fossa. Two-phase rales and rhonchi are audible over the whole of the left lung but they are not specially localized. The heart is normal."

His sputum was frequently examined and always with a negative result. Further observation failed to reveal evidence of active tuberculosis, and at the present time he is not losing ground. One concluded that in this case we had to deal with a fibrotic process following upon a local acute inflammation, though on the ground of physical signs alone the diagnosis of phthisis was quite reasonable, and, indeed, might have been

in the best interests of the patient, for such a chest as his may very well develop tubercle at some future time.

Case 7. J.W., a cobbler of 28, was seen on the 16th of June 1916 as a case of "acute phthisis". His father and mother had both been "weakchested" though not apparently tuberculous; and his wife was a consumptive with a positive sputum. He had always been prone to winter "colds", and six months before he had had an illness which kept him in bed for three weeks and in which the main feature was pain in the left side of the chest. "He has not been in his usual health since. Four weeks ago he became suddenly ill with shivering, cough, and left-sided "pleurisy-pains". He took to bed and has remained there. His medical attendant has not observed any signs of pneumonia in the chest or sputum, and there was been nothing suggestive of a crisis in his history. The temperature still reaches 103 in the evening and the pulse is proportionately rapid. He has lost energy weight, colour and appetite; cough is troublesome and the muco-purulent sputum has been slightly blood-streaked on a few occasions. He sweats at night. Obvious dyspnoea and slight cyanosis are present. All over the lungs there are two-phase rales and rhonchi; they are more marked on the left side but without apical concentration. The left base is markedly dull with great reduction of a respiratory murmur and voice sounds." Puncture in the dull area revealed pneumococcal pus, a considerable amount of which was voided through the trachea a day or so later. He made a good recovery and has kept well ever since though he is prone to bronchitis in damp weather. His sputum has always been negative.

Here the contact and personal history of the patient as well as his appearance when first seen favoured the original diagnosis, but the marked basal findings made one hesitate to confirm it. His illness could be accounted for by an attack of bronchitis with a concomitant pleurisy, though one still has doubts as to the existence of an initial and perhaps atypical pneumonia.

With a frank lobar pneumonia difficulties in diagnosis do not often arise. Acute pneumonic phthisis, which must be a rare condition, is usually ascribed to the pneumococcus and this is quite a pardonable error for the true nature of the affection is only made clear by time. It is in the presence of the complications of pneumonia that we most often go astray.

Case 8. B.H., a mill worker of 40 with a good family history was seen on the 17th Of October 1917 as a case of "phthisis following pneumonia". He stated that he had been perfectly healthy until an attack of bronchial catarrh two years before, which had left him with a tendency to catch cold readily. "This illness began suddenly and in its onset and character was a typical lobar pneumonia. He has had no crisis, however, and the evening temperature still reaches 102. Over the lower zone of the front of the right chest there are some medium rales and distinctly tubular breathing; the right base is frankly dull with marked reduction of respiratory murmur and voice sounds, and the breathing there is distant and tubular". Puncture there revealed pus which was subsequently coughed up and a good recovery was made.

This is a typical case of post-pneumonic empyema where the persistence of the pyrexial features of the disease led to the fear, and the diagnosis, of tuberculosis. Delayed resolution in lobar pneumonia frequently leads to a suspicion of phthisis, as in Case 3 above, but this

suspicion is rarely justified, and indeed such patients do not seem to have much general or pulmonary disability such as we expect in incipient phthisis. The relation of lobar pneumonia to tubercle is a question we have frequently to consider; and the writer's experience is thoroughly in accordance with the pronouncement of Osler; - "Ordinary fibrinous pneumonia never terminates in tuberculosis. The instances of caseous pneumonia and softening which have followed an acute pneumonic process have been from the outset tuberculous." At the same time one cannot but be impressed by the frequency with which the "Previous History" in incipient phthisicals includes an attack of pneumonia "a few years ago", an attack which is often said to have lowered the general level of health. It is therefore wise to attach the weight of suspicion to such a record.

Case 9. D.H. a weaver of 16 with a good family history, was seen on the 23rd of April 1917 with the diagnosis of "Gallop Consumption". Her only previous illness had been measles in childhood. "She has been vaguely ailing for about a year, but did not call in the doctor until last month. Her symptoms include loss of energy, weight, colour and appetite; she has occasional pains in both sides of her chest but these have not been severe; she has a cough but raises no sputum. She looks acutely phthisical and on examination her temperature was 100.6 and her pulse 120". Inspection and palpation revealed deficient expansion of the left lung which was dull on percussion almost to the level of the clavicle. The breath and voice sounds were much reduced and the breathing somewhat tubular in type. The signs were most marked at the base where puncture revealed serous fluid. The right border of cardiac dullness reached two inches to the right of mid-sternal line. There were no definite adventitious sounds in the chest.

These signs, in a patient who was obviously dyspnoeic, plainly indicated a big effusion; and on the following day the chest was aspirated at a general hospital, some three pints of serous fluid being removed. She was seen three times before her admission to sanatorium, and on each occasion she had lost ground though signs of intra-pulmonary disease were not at all marked, and the slight sputum she then raised did not contain tubercle bacilli. She did not respond to open air treatment and was discharged with a grave prognosis. Her sputum was then copious and contained tubercle bacilli in large numbers. Both lungs showed marked evidence of tubercular mischief, the signs being more advanced on the left side. She died on the 7th of July, 1918. In this case the original diagnosis of acute phthisis was not warranted on the grounds of physical signs, though the girl was obviously and acutely tuberculous. The stealthy development of the large effusion is characteristic of tuberculosis. And the case may perhaps be regarded as an example of the disastrous effect which may follow drastic aspiration in tuberculous effusions of large amount.

Case 10. A.B., a scavenger of 64, who had been a stone mason for 18 years of his life was seen on November 8th 1916. His previous health had been good except for an attack of "bronchitis and influenza" two months before. He appeared, however, to have made a good recovery; and, when seen, he did not complain of any great disability. He had lost slightly, if at all, in weight and energy. He had little cough, and no spit, sweats or bleeding. There was some degree of exertional dyspnoea. His temperature was 99.8 and his pulse 108. Otherwise his symptoms were not suggestive of active tuberculosis. The first mitral sound was somewhat impure and the second aortic was slightly accentuated; his arteries were thickened, but there was no albumen in his urine. Over the front of the left lung there was diminished expansion and marked dullness; respiratory murmur was distinctly reduced, vocal resonance was slightly impaired, and expiration somewhat prolonged. Here also there were a few dry creaking rales. There were also some fugitive rales over the right front. Behind there was relative dullness over the whole of the left lung, especially above; and respiratory murmur was correspondingly reduced, while vocal resonance was diminished to a less degree. In the left suprascapular fossa expiration was prolonged and some dry medium rales were audible after cough. At both bases there were occasional rales and rhonchi, but these were not marked or constant. Physical examination was otherwise negative.

This case was sent with the presumptive diagnosis of cancer of the thorax. But with local signs so marked a cancerous patient would have shown more constitutional decline than was apparent in this patient. The record of his temperature, his "bronchitis and influenza", and his previous occupation of a stone mason made one venture on the diagnosis of tubercle with much fibrosis and pleural thickening. He declined the offer of sanatorium and remained at work. His condition did not alter during three months - a fact which ruled out thoracic cancer - and he lost only one pound in weight. An X-ray examination by a recognized authority gave this report:- "Left side of the chest more or less opaque; diffuse thickening through the lung and ? abscess cavity high up. Right side of the diaphragm pushed up and not moving well. Suggestion of secondary deposits in the liver. It looks like a case of secondary deposits in the liver and lungs." It may be stated that there was no venereal history, and the Wassermann reaction was negative. On the 17th of May 1917 he raised some sputum which revealed the presence of tubercle bacilli in small numbers. When last seen he was at work and free from complaints except for dyspnoea which was apparently increasing, and for a more troublesome amount of coughing in the mornings. It must be said that in this patient the dullness on percussion over the left front of the chest was almost malignant in its flatness, and the suspicion of cancer was not unreasonable.

Case 11. R.C. a labourer of 59, of sound previous health and family history was seen on the 16th of August 1916 complaining of illness of about



two months' duration. His symptoms had appeared insidiously and included loss of energy, weight, colour and appetite; cough, spit, haemoptysis, chest pains, slight night sweats, and dyspnoea. His temperature and pulse were normal. There was deficient expansion over the right apex, and under the right clavicle the percussion note was distinctly dull; here also respiratory murmur was reduced, vocal resonance diminished, and a few inconstant crepitations were heard. There were some scattered inconstant rales over the left front. Behind, there was an increase in the percussion pitch in the right supra-spinous fossa, but there was no appreciable impairment of voice or breath sounds, though a few rales were found there and at the left scapular angle and left supra-spinous fossa. Examination was otherwise negative; and there were no pressure signs or evidence of secondary growths. His sputum was examined for tubercle bacilli with a negative result. X ray examination could not be arranged for, and as his home conditions were poor he was sent to sanatorium while the diagnosis was still uncertain. Here his case developed into one of unmistakable cancer and he died on the first of November 1916. Post mortem there was found a carcinomatous growth originating in the mediastinum and involving the greater part of the right lung as well as pressing on the great veins and other structures of the thorax. There were no signs of tubercle.

In this case one ought to have paid more attention to the marked nature of the dullness and the paucity of adventitious sounds. The pains complained of were not described as typically pleuritic, but as darting pains. The local signs were consistent with the diagnosis of quiescent phthisis but there was no history of a previous chest illness.

Case 12. J.C., <sup>act. 45</sup> a labourer of good family history was seen on the 22nd October 1915 complaining of illness of some two months duration. He had had a similar illness in the previous year but had recovered and returned to work. His main symptoms when seen were weakness and "pleurisy pains" in the left side, and he stated that he had had similar illnesses at intervals for several years back. The history of his present illness included loss of weight, appetite, colour and strength; slight cough and spit and a tendency to night sweats. But the prime complaint was the left sided pain which did not appear to be typically pleuritic, having no relation to the respiratory movements. His temperature and pulse were normal and his sputum did not contain tubercle bacilli. Indeed, physical examination revealed no cause for his symptoms and the diagnosis of tuberculosis was not therefore confirmed. He was again referred to a colleague of the writer on the 14th of January 1916 and again the physical findings were not definite. He returned to work having distinctly recovered; but had a haemoptysis in August 1916 and was notified as phthisis several months later. He was finally seen on the 12th of December 1916 when he was obviously cachectic and very ill. He complained bitterly of chest pains boring in character and shooting through to the back. His sputum was of the red current jelly variety which is said to be diagnostic of malignant disease. There was flat dullness over the left front accompanied by great reduction of the breath and voice sounds, though at the apex respiratory murmur was bronchial in character. These findings were less marked behind in the left supraspinous fossa. In the region of the right scapular angle respiration was somewhat bronchial and was there accompanied by some rales. There were occasional general rhonchi in the chest but no localized crepitations suggestive of a tuberculous process. In the left axilla there was a hard malignant like mass and the heart was now displaced downwards and outwards compared with previous examinations. He complained of his previous symptoms but to a more marked degree and he had polyuria in addition. There was now no doubt of the diagnosis, - he had no specific history, - but his sputum was again examined for tubercle bacilli and again with a negative result. He died on the 8th February 1917.

Case 13. J.T. a leadworker of 55 with a good personal and family history was seen on the 30th of May 1916, complaining of weakness and pain in the left chest of one month's duration. He had had some slight

sweatings at the beginning of his illness but these had not been marked or regular. There was no unusual cough, no spit, haemoptysis or great loss of appetite. He had lost distinctly in weight. The chest pain which was the chief complaint was not specially related to breathing and was not pleuritic in character. His heart and pulse were normal: the apices looked rather shrunken but not to an abnormal degree in a man of his years: there were no evidences of pleura thickening or pleural friction. The only local finding was illdefined dullness under the left clavicle where also there was a few fine creps and some reduction of respiratory murmur. In view of his marked decline in health these signs were agreed to be indicative of early tubercle and he was offered sanatorium. He did not accept the offer and was seen on the 26th of July 1917 when it was plain that he had made a good recovery. He had regained his usual weight and strength, could walk ten miles, and was at his work and felt no undue fatigue. He had no complaints at all; but there were still some vague findings at the left upper lobe as before. He still had only a casual cough and no sputum. He had no pains, and his recovery had been progressive and uneventful. He was not seen again until the 12th of February 1918, when he was obviously very ill. He stated that for three months he had been losing ground, and he had lost a stone in weight. His temperature and pulse were normal. He had a cough which was troublesome and his sputum was found on inquiry to be frequently bloody and of the red current jelly kind. He had a good appetite and did not complain specially of his chest pain. Expansion over the left upper lobe was visibly and palpably impaired. There was flat dullness over the left front and there also voice and breath sounds were almost smothered. No definite adventitious sounds were found anywhere. Over the left upper lobe behind there was distinct impairment of the percussion note; but reduction of the voice and breath sounds was not at all appreciable. The heart was displaced downwards and outwards. There was a hard marble-sized gland in the left axilla, and the along the anterior border of the left sternomastoid muscle small, hard, shot-like glands were felt. There was slight relative dullness at the right base with doubtful reduction of the breath sounds; puncture there was negative. His sputum did not contain tubercle bacilli; and intra-thoracic cancer was the most obvious diagnosis. An X-ray examination gave this report; "Presumably the condition is due to neoplasm but there is a small deeper shadow corresponding approximately to the position of the branching of the bronchi on the left side which might quite well represent an inhaled body about the size of a small bean". Though the history and symptoms of the case did not at all correspond with those of a foreign body in the lungs, it was thought advisable to give the patient the slender chance of operation. This was done but no foreign body was found. The case was one of carcinoma rising from the mediastinum and spreading to the left lung. He died a few days after.

Case 14. J.C. a farm labourer of 47 was seen on the 30th of March 1916 complaining of illness of about two months' duration. His personal and his family history were good. The main feature in his symptoms was a very irritating cough which raised a disproportionately small amount of sputum. He had lost slightly in energy and weight but was still fit for work. There was little loss of appetite, no sweats or haemoptysis. He had developed an appreciable degree of dyspnoea on exertion. He was occasionally hoarse, and had some difficulty, but no pain, in swallowing. There was no ulceration in the larynx which was reddened generally and there was perhaps some lagging of the left cord. The heart was displaced downwards and outwards, and there was epigastric pulsation; the heart sounds were clear. Coarse general rhonchi were audible all over the chest, and at both apices there were rales and rhonchi more or less localized. At the apices, too, the voice and breath sounds were damped, and there was also some relative dullness over the left. The most marked clinical finding, however, was that of frank dullness over the manubrium sterni. There were no corroborative signs there or in the pulse or pupils of aneurism; while in the neck along the sterno-mastoid border there were small hard glands palpable. When asked he stated that he had noticed some swelling of his face in the morning. He did not complain of pain. His temperature was 99.6 and his pulse 100. There were a few small hard glands in the left armpit. The diagnosis of mediastinal tumour was made but his medical attendant adhered to his diagnosis of tubercle. His

sputum was examined with a negative result. And arrangements were made for an X-ray examination. This was not done as he died suddenly and without haemoptysis.

There can be no reasonable doubt that this was a case of mediastinal tumour, all the observed features in the patient's condition and history being consistent with this diagnosis, and there being no evidence of any other possible source for his symptoms. The intrapulmonary signs were due to mechanical pressure, and probably accounted for his slight temperature. The manner of his death is also in favour of this diagnosis (33) This patient complained of polyuria, a symptom which was present also in Cases 12 and 13, and which is often found in chest cancers. When such growths involve the lungs the diagnosis usually made is that of tubercle for the simple reason that chest cancer is rare and tubercle common. In two of the above cases the writer made this mistake; and the lesson of this is that we ought to raise the question of cancer when we meet with patients over forty complaining of general decline in Health and atypical "pleurisy pains", if there is no obvious cause to account for these. An X ray examination was unfortunately not available in all the above cases or perhaps the diagnosis could have been made much earlier. Two of the cases here recorded resemble each other in the remarkable remissions\* in which they recovered their usual health - in one case apparently completely, in the other to a less degree - and which are not easily understood if we ascribe their original symptoms to malignant disease. It has been said (34) that a diagnosis of intrathoracic cancer means death within three months; but we probably underestimate the duration of malignant disease in the chest as we do in the abdomen and from the above cases one may assert that with the aid of a competent X ray operator the disease could be diagnosed much earlier, and the above dictum proved unsound.

In point of physical signs the remarkable features of chest cancers involving the lungs are the flat nature of the dullness and the extreme paucity of adventitious sounds. These findings could be observed in a healed phthisical lesion but they would then probably be accompanied by loud bronchial breathing and perhaps by an increase in the vocal resonance; and this is not the case in cancer. The secondary nodules in the neck noted in some of the above cases might tend to an earlier diagnosis and help one to exclude tubercle with an easier mind when the other findings

are equivocal. In any case, it is no great source of harm to diagnose chest cancer as tubercle; indeed when we are in doubt between two diagnoses one of which has a hopeless prognosis it is sound clinical pragmatism to base our treatment on the more hopeful view.

Case 15.J.W., a miner of 37 was seen on the 22nd September 1915 complaining of left sided "pleurisy" of nine months duration. His health had been good until influenza six years before which had left him with a regular winter cough. "During this illness he has lost two stones in weight. He has had only casual cough and spit; and no haemoptysis or sweats. He has lost somewhat in appetite. He has noticed his voice weak on occasion. The chief complaint, however, is of pain in the left side of the chest; this pain is of a shooting nature and has no relation to the respiratory act. At times the pain shoots down the left arm on the inner side. His pulse and temperature have been normal. Anteriorly the left apex expands poorly and is relatively dull, and over the left upper lobe the breath sounds are markedly subdued, and the voice sounds are also impaired. Both respiratory phases are accompanied by illdefined rales. Posteriorly these signs are less marked over the left upper lobe, but there is still distinct reduction of the respiratory murmur. There is dullness over the manubrium sterni and to the left of it, and in the second and third interspaces there palpation reveals pulsation. The heart is slightly displaced outwards; there is accentuation of the second aortic sound but no definite murmurs. The pupils and pulses are equal. The left vocal cord lags somewhat in action." An examination of the slight sputum was negative.

This case had been diagnosed as phthisis by a consultant physician at a chest hospital; but the nature of the pain did not suggest pleurisy, but rather some cardiac affection. The small displacement of the apex beat forbade one to regard the palpable pulsation in the interspaces as a secondary result of pulmonary retraction. A diagnosis of aneurism was made; and a subsequent X-ray examination revealed an aneurism of the arch and the beginning of the descending aorta. This case exemplifies the sound rule that when we are at a loss over chest findings we ought to think of aneurism, a condition which we probably often overlook. The loss of weight here is also noteworthy, as it is a possible source of error in the clinical differentiation of aneurism and mediastinal tumour.

The above cases will serve as examples of the commoner difficulties of diagnosis in the presence of disparities revealed by inspection, palpation and percussion. But it is with adventitious sounds of a more or less persistent character that most of our mistakes are made. When we consider the numerous consumptives who are allowed to drift to their death under such complacent diagnoses as "bronchitis", "bronchial catarrh" and "bronchitis and pleurisy", we need not labour the importance of the differentiation. It is well known that many phthisicals attribute the onset of their disease to a cold or a series of colds, yet it is not often that a case of a simple common cold is referred to us with the

suspicion of tubercle attached. The onset and symptoms of a common cold are familiar to every one, and the chest signs, if any, are those of bronchitis of the larger tubes, and not at all similar to those of incipient phthisis. The writer makes a practice of keeping under observation for several weeks cases of this kind which are referred to him and in which the family history has led to the fear of a superadded tuberculous infection. In the case of "influenza" we ought to make our diagnosis as certain as possible, especially in the absence of an epidemic; and this must be done from the patient's history and symptoms, as the bacteriology of the disease must now be regarded as undemonstrated. During the epidemic of 1918 the writer had convincing experience of the disastrous effects of influenza in many cases of actual phthisis, and of its evil influence in stirring into activity a latent tuberculous focus in healthy people. When, therefore, we meet a case of genuine influenza in which the chest symptoms have not cleared up we ought to be more than usually careful in canvassing the question of phthisis.

In a general way it is easy to differentiate between bronchitis and tubercle; the age of the patient, the character and basal location of the chest signs, the absence of consolidation findings, the less serious constitutional effect, the influence of weather and the time of day, are among the recognized marks of bronchitis as distinguished from the graver affection. But such general truths are not always applicable to a particular case. And here, as elsewhere, we should not decide wholly on the basis of physical signs. The presence of bronchitis by no means excludes that of tubercle, though it often obscures it.

Case 16. - E.J., a painter, 32 years of age and of good family history, was seen on the 1st of November 1916, having been discharged from the army as a case of pulmonary tuberculosis. Except for a proneness to chest colds his previous health had been good. "The present illness began in France with cough, spit, and dyspnoea; and he says he had lost slightly in weight, energy and strength. His appetite is variable. His main trouble however is the dyspnoea which is accompanied by wheezing and tightness in the chest and this is worse in the morning and at night. Sometimes he has asthmatic attacks at night. The weather affects his condition markedly. He is not much troubled with his chest in the summer but cold wet days or fog upset him greatly. His sputum varies in amount and character, and it has been blood stained in strenuous bouts of coughing. He cannot stand cold well and his feet are always cold. There is a slight degree of cyanosis in the lips. The heart is free from murmurs but the second pulmonic sound is enhanced. All over the chest there are rales and wheezing rhonchi which are not specially localized though the apices are relatively clear. There is some obvious dyspnoea, but percussion and palpation are negative. Under observation for several months he ran a subnormal temperature; but when

his chest signs varied for the worse the thermometer occasionally reached 100 degrees. He gained slightly in weight, and was discharged with the diagnosis of phthisis not confirmed after a distinct improvement in his lung and general condition. In the summer of 1917 he again joined the Army, and in the October of that year he was again discharged for phthisis. Further observation failed to confirm this diagnosis; and about a dozen negative results were given from his sputum examination.

This patient is a fairly typical example of bronchitis where the persistence of the signs and symptoms lead us to fear the presence of tubercle. Yet the character of the complaints, their variation, and the nature of the local findings were obviously those of the milder malady. The amount of the bleeding was slight and could quite well be accounted for by the physical strain of coughing; and in such cases where the lungs are clogged with catarrh this seems to be a fairly common symptom, though one learns to be very chary of excluding tubercle in the presence of any haemoptysis. The nasal septum in this patient was distinctly deflected and he often had complained of nasal catarrh. This feature is very common in such obstinate and deep seated bronchitis and has some diagnostic value in the differentiation from phthisis. One noteworthy point is the fact that under improved conditions of life and a greater supply of nourishing food he increased in weight only a few pounds. Under similar conditions we expect an afebrile consumptive to increase in weight strikingly. And this difference in response to treatment gives us more assurance in our decisions.

In bronchitis the most marked finding in the presence of adventitious sounds, especially rhonchi. In most cases these are heard generally and are most marked at the bases. But we sometimes meet with cases where they are crowded over one area - usually one base - and there we may also get some reduction of the respiratory murmur or even slight dullness. These signs are consistent with the diagnosis of a superadded patch of tubercle; and we are often at a loss to decide. Observation of the progress of the patient's general health, the variability of the local findings and the results of bacteriological examination and of thermometry may demand some time before we can be sure. This is especially the case where the localization is over an upper lobe or part of an upper lobe.

Case. 17. W.B., a cotton operative of 67 with a good family history was seen on the 3rd of May 1915 complaining of cough, spit and dyspnoea of nine weeks' duration, these symptoms being most troublesome at night and in the morning. "He has lost slightly in weight, energy, and appetite; and tends to sweat freely when coughing hard. There has been no haemoptysis

His temperature and pulse are normal. All over the chest there are rhonchi and rales. Over the front of the left side under the clavicle and for some two inches below it there is slight impairment of the percussion note; and there and in the left supraspinous fossa there is reduction of the respiratory murmur and crowding of the adventitious signs." Other physical findings were normal in a man of his years.

Here the physical signs were consistent with the diagnosis of bronchitis with a superadded patch of tubercle in the left upper lobe. But the evidence of constitutional decline was not proportionate to a lesion of such considerable extent; and his sputum was examined on at least four occasions with a negative result - which is not common with so large a lesion in phthisis. He was kept under observation and in a few months his chest signs cleared up and he regained his usual health. He has kept well ever since. This was probably a case of bronchitis with a patch in the left upper lobe where the catarrh was more deep-seated. We fairly often get such patches in the lower lobes in children, where the local signs are consistent with the diagnosis of tubercle but vary and disappear as the local findings in tubercle do not.

The snoring or whistling character of the sounds in bronchitis is a commonly recognized diagnostic point. But in a bronchial catarrh affecting the smaller tubes we often find small rales or crepitations predominating over the rhonchi. And such sounds sometimes lead to the diagnosis of advanced phthisis. In such cases however the behaviour of the affection is more like that of bronchitis than that of tubercle, and the constitutional disturbance is not so marked or so acute as in extensive tuberculosis. In point of physical findings, the small rales tend to accompany both respiratory phases in a way that is not usual in tubercle. We do get two phase rales in phthisis but in such cases the disease is usually very active and the patient is obviously acutely ill, while the rales are coarser in character. And in early tubercle the rales are almost invariably inspiratory.

Case 18. J.F., a female mill-worker of 31, was seen on the 13th of April 1917 complaining of illness of two and a half years duration. During that time she had suffered from cough, spit, and dyspnoea, and had lost energy, weight, colour and appetite. There had been no bleeding, but she had sweated at nights when coughing strenuously. Her personal and family history were good. "Her general condition is poor; she is obviously dyspnoeic and somewhat cyanosed. Her temperature is 100 and her pulse 90. There is appreciable dullness over the right upper lobe especially in front, and over the whole of that lung there is diminished air entry. Moderately

fine two-phase rales are heard all over both lungs, and these are more crowded over the dullish area, where also the reduction in respiratory murmur is more pronounced. The second pulmonic sound is accentuated. Physical examination is otherwise negative except for a bad prolapse of the uterus."

Here the predominant condition was clearly one of bronchitis. But the findings in the right upper lobe pointed to a possible focus of tubercle, and the history, and general appearance of the patient, as well as her evening temperature, were distinctly suggestive of phthisis. Her sputum was negative on at least six occasions. She was sent to sanatorium as her home conditions were bad and returned much improved in her general health and also as regards the local chest findings, the impairment on percussion being less marked, and the rales everywhere fewer. She has declined in health since but is still much better than she was when first seen. An X-ray examination by an expert gave an opinion in favour of phthisis superadded to bronchitis. And as that diagnosis is compatible with all the facts except the sputum result it is probably the correct one though that of pure bronchitis is tenable.

We are often faced with cases of "bronchitis which has not cleared up". These fairly frequently turn out to be tuberculous disease; but in other instances we find some slight valvular defect which probably causes the undue length of the catarrhal condition. Here, also, we must pronounce our decisions with care.

Case 19. S.J. an engineer of 18 with a good family history was seen on the 15th of February 1918 complaining of illness of two weeks' duration. At the age of 11 he had had "double pneumonia", and four years later he had an attack of "gastric catarrh" lasting for some weeks. He had been subject for several years to winter cough which cleared up in summer. "The present illness began two week ago with cough, spit and pains in the right side. The pains lasted for several days and caught him when breathing or coughing. There has been slight loss of weight, appetite and colour. He is somewhat breathless on exertion. There has been no haemoptysis. His temperature is 98 and his pulse 68. There are rales and rhonchi all over both lungs; the percussion note is impaired over the right upper front, where the adventitious sounds are more crowded and the rales smaller than elsewhere. The heart dullness is increased, extending from the midsternal line to the nipple line, and there is a distinct systolic bruit heard best in the mitral area. Physical examination is otherwise negative."

In this case the short duration of the complaints, the slight degree of constitutional decline, the temperature and pulse record, the heart condition and the evident bronchitis all pointed to the diagnosis of bronchitis with some degree of cardiac insufficiency. The right apical findings might be amenable to this diagnosis also but with the history of definite pleurisy



pains one inclined to suspect tubercle in addition. The sputum was slight but on examination it was found to contain tubercle bacilli.

In patients where the heart symptoms are more pronounced the differentiation is easier as a rule.

Case 20. M.T., a charwoman of 32 was seen on the 6th of September 1916. "She was healthy until about four years ago since when she has been more or less ailing and during that period she has lost three stones in weight. She has also lost colour, energy, and appetite. Cough is troublesome and spit is moderate. She has dyspnoea and is visibly cyanosed. She states that she sweats unduly at nights. Since her last confinement 6 weeks ago all her symptoms have worsened and she has had a definite haemoptysis. Her ankles tend to swell after exertion. She has a malar flush. Her temperature is 98; her pulse 100, small and slightly irregular. All over the front of both lungs especially in the lower zones there are fine two-phase rales and occasional rhonchi; these signs are also found behind most markedly at the bases. The right base is dull with reduction of the breath and voice sounds, and puncture here reveals fluid. There is some cardiac enlargement on percussion the borders of dullness being at the midsternal line and the nipple line. In the mitral area there is a well marked presystolic roll giving a palpable thrill and here also the second sound is often reduplicated. The second pulmonic sound is accentuated". Three examinations of the sputum were negative.

This is a fairly typical instance of a very common error - the diagnosis of phthisis where the real condition is one of mitral obstruction. In the great majority of such cases the condition is obvious enough if the heart is examined. But sometimes the signs of mitral disease are not at all marked; there may be a slapping first sound and an accentuated pulmonic second sound, with slight enlargement of the cardiac dullness to the right, and few adventitious sounds in the lungs. These cases often present themselves with a history of a recent haemoptysis, and one has to consider the history and symptoms carefully in deciding the diagnosis; for the symptoms are those of cardiac insufficiency rather than those of incipient tubercle. It is usually said that mitral stenosis inhibits the development of pulmonary tuberculosis; and this statement is certainly in agreement with the writer's experience; for he has seen scores of cases of mitral obstruction where the diagnosis of tubercle has been suggested or made, and he has not been able to confirm that diagnosis in a single instance. To say that mitral stenosis absolutely precludes tuberculosis is doubtless to say more than we are warranted in saying; patients with both affections are not unknown. The two conditions can present very similar sets of symptoms, and the question of their relationship is therefore often before us; but where the diagnosis of mitral obstruction can account for all the facts we are logically bound not to invoke the diagnosis of tubercle without very strong evidence, -

perhaps not without the presence of the specific bacillus in the sputum.

Case 21. A.C., a mill girl of sixteen with a good family history was seen on the 29th of October 1915 complaining of cough, spit, and dyspnoea of three weeks' duration. There had been no appreciable loss of energy, weight appetite or colour; and her history was also negative as regards haemoptysis and night sweats. She had been weak-chested from infancy and had had repeated attacks of "bronchitis and asthma" with symptoms similar to those of the present illness. "Her temperature is 98 and her pulse 100. Her right shoulder is drooped and there is dorsal scoliosis with the convexity to the left. The right side of the chest is obviously shrunken and deficient in expansion; all over it the percussion note is dulled especially at the base. Physical examination of the left lung is negative except for non-localized and transient bronchitic sounds, but cardiac dullness is not found in the usual situation and the heart sounds are best heard to the right of the middle line. Over the right lung there are also bronchitic sounds generally distributed; expiration and vocal resonance are somewhat enhanced over the right upper lobe but the breath sounds are not there increased in intensity. In the region of the right scapular angle there is loud cavernous breathing and marked increase in the spoken and whispered voice sounds over an area about the size of the palm of the hand. Below this level there is frank dullness with absence of all auscultatory findings."

This case was kept under observation for many months at the Dispensary and in sanatorium and was discharged from the latter institution as a doubtful case of phthisis and with the presumptive diagnosis of bronchiectasis. Her temperature varied with the amount of bronchitis in her chest; her sputum was also correspondingly variable in amount; but did not suggest bronchiectasis in its mode of expulsion, in its microscopic or macroscopic appearance, or by its smell. About twenty examinations for tubercle bacilli gave negative results. There was no variation in the cavity-like findings in the right lower lobe where, it may be stated, the bell-sound phenomenon found in pneumothorax was not obtainable. Her fingers showed no suggestion of clubbing. The complaints varied in intensity from time to time but usually her general condition was good except for some exertional dyspnoea, and she was able to engage in her work. Her sputum was occasionally found to be streaked with blood after a bout of hard coughing in a bronchitic attack. She was examined on two separate occasions by two different experts in radiology. The reports are as follows:-

25-12-17. "The examination of this very interesting case shows that the heart is in the position of the left (? right) lower lobe of the lung, and the apex hardly reaches to the middle line. The arch goes upwards and to the left, and descends behind the heart. There is fairly marked scoliosis and evidence of whole collapse of the 6th dorsal vertebra. There is no indication of active phthisis in the lungs."

18-10-18. "The screen examination made yesterday shows a complete collapse of the right lung, with very marked scoliosis, and also displacement of the heart to the right, the whole organ being well well to the right of the spine. I do not think there is any air entry into the right lung, and the

signs suggesting cavitation are probably due to air in the pleural cavity (pneumothorax). It is impossible to say now whether the collapse of the lung was due to tubercular disease, and I could find no definite evidence of the tuberculosis in the left lung."

It may be said that there is no indication in the patient's previous history of spinal disease, or of acute pneumothorax. The symptoms from which she suffers at intervals are almost certainly not tuberculous in origin; now can the diagnosis of bronchiectasis be regarded as satisfactory.

That of pneumothorax as suggested in the second of the above reports is on the whole the most probable.

Bronchiectasis is not a common disease and the marked physical signs which it presents sometimes leads to the diagnosis of phthisis, though the symptoms of the two conditions are not alike.

Case 22. - W.B., a foundry worker of 31, whose brother is a definite case of tuberculous peritonitis, was seen on the 19th of April 1918 complaining of cough, spit, and dyspnoea of over a year's duration. He had been healthy till he had an "influenza cold" two years before. "Since then he has always been weak chested and his complaints have been more marked in wet weather and in winter. There has been no appreciable loss of energy, weight, colour, or appetite; and no haemoptysis or night sweats. His temperature is 99.4 and his pulse 84. There is some degree of nasal obstruction. All over the chest there are catarrhal rales and rhonchi. These are more marked in two areas - under the right clavicle where also there is perhaps some slight dullness and reduction of the breath sounds; and over the left base where the dullness is distinct and where there is cavernous breathing and marked increase in the whispered and spoken voice sounds. The catarrhal sounds are also more crowded at the right base than at the right apex. The heart is normal."

This patient had been diagnosed as phthisis and ozaena. His sputum was characteristically bronchiectatic in appearance, smell, and mode of expulsion; and the physical findings varied in a way pointing to that affection. His fingers were clubbed. Tubercle bacilli were never found in his sputum; and he was discharged as a case of bronchiectasis. He died of influenzal pneumonia during the pandemic of 1918.

In a straightforward case like this there should be no difficulty in the diagnosis. In adults basal phthisis is a rare condition and the disparity between the cavitation signs and the good general condition is a further point in favour of bronchiectasis in such a case as this. Even a good general condition and clubbed fingers are not inconsistent with the presence of phthisis.

Case 23. S.H., a butcher of 31 was seen on the 30th of August 1918 having been rejected by the recruiting authorities. "His family history is good. He states that he has had no serious illness, but that he is prone to colds and has a habitual cough and spit with occasional blood

streaks. There has been no progressive development of constitutional decline and he is at work and feels quite fit for it. His temperature and pulse are normal, and indeed he presents no symptoms of active disease except those already mentioned. His fingers are distinctly clubbed. There is deficient expansion of the left side of the chest, and the apex beat is displaced outwards. The heart sounds are pure. All over the left lung there is dullness with reduction of the breath sounds, some increase of expiration, and medium inspiratory rales. These signs are most marked over the upper lobe where also vocal resonance is distinctly increased."

The signs here pointed to a chronic inflammation of the left lung, and the condition was therefore probably tuberculous. The lack of constitutional symptoms and the clubbed fingers made one hesitate in this diagnosis though both of these findings are quite consistent with it. Bacteriological examination of the sputum revealed the presence of tubercle bacilli in small numbers.

Case 24, - E.W., a coal miner of 33 was seen on the 2nd of November 1918. "His family history is good and his health was excellent until some nine months ago when he began to be troubled with bronchitis. Two months ago he was discharged from the army on account of shrapnel wounds of the head and chest. Two weeks ago his cough became suddenly worse and feverishness and weakness compelled him to take to bed. Since then his course has been steadily downward; he has lost flesh, appetite and colour, and is now obviously dyspnoeic and acutely ill. He has occasional shiverings and he sweats heavily both night and day. His cough is paroxysmal in character and his sputum is copious and is practically pure pus in appearance; it is occasionally blood stained. The sputum and the breath are very offensive and the foetid odour is appreciable throughout the room. His temperature is 101 and his pulse 130. Some small pieces of shrapnel are palpable under the skin on the left side of the back of the chest; but the history does not suggest wounding of the lung substance, and all the wounds are now soundly healed. The heart is normal. Over the left upper lobe anteriorly there is marked shrinking and dullness; the breath sounds there are cavernous in character and the whispered voice well heard; and in this area, too, coarse rales are localized. Over the left supra-spinous fossa there is relative dullness and a relative concentration of rales; and these signs are also found at the left base where respiratory murmur is subdued. Transient rales and rhonchi are found over both lungs."

The signs here indicated extensive inflammation in the left lung with cavitation in the upper lobe, and were quite consistent with the diagnosis of tubercle. The foetid sputum and the septic features of the case made one think of a suppurative process either primary or superadded to previous lung trouble. Physical examination failed to reveal any nonpulmonary focus of suppuration. The sputum was examined for tubercle bacilli but these were not found, as they probably would have been with an acute tuberculous process which had advanced to cavitation. There were many pus cells and pyogenic cocci in the sputum and some elastic fibres were also found. The diagnosis made was that of pulmonary abscess, though the precise mode of its development was not clear. The patient died the day after he was seen by the writer; and a blood examination was not therefore

done. He was too ill for examination by radioscopy.

Case 25. - J.B., a sailor of 37, with a good family history was seen on the 5th of January 1914 complaining of cough, spit, dyspnoea, and occasional haemoptysis of several months duration; during that time also he had lost energy, flesh, colour, and appetite. The haemoptysis had been slight, and there had been no definite night sweats. He had been perfectly healthy until an attack of pneumonia nine years before, and a few months after that illness he developed syphilis for which he underwent treatment of sorts. In 1913 he had a second attack of pneumonia, and since then he has had a habitual cough which has been worse in winter. "His pulse and temperature are normal. The heart sounds are pure. There is poor expansion at both apices and the percussion note there is not fully resonant, while at the left apex there is slight impairment of the respiratory murmur. Rales and rhonchi are found over the chest generally, but are most crowded at the bases, and at the right base the breath sounds are unduly subdued and there is slight dullness. On the upper and posterior aspect of the right shoulder joint there is an ulcerated area surrounding a sinus, and the shoulder joint is stiff. Physical examination is otherwise negative."

The sputum in this case was repeatedly examined for tubercle bacilli and always with a negative result. His blood reacted positively to the Wassermann test, and he was put upon anti-syphilitic treatment. This greatly improved his general condition, and the shoulder sinus healed up completely though the joint remained fixed. His lung complaints also distinctly lessened, and his chest signs cleared up to an appreciable extent. The diagnosis of tuberculosis was not confirmed; and he was discharged as a case of bronchitis with a fair amount of fibrosis which was perhaps partly syphilitic in nature, though the local findings were not such as are usually described under that rare disease, pulmonary syphilis.

In the above cases the writer has tried to show the grounds for his belief that in the diagnosis of phthisis from physical signs the long recognized methods of physical examination applied with care and common sense are adequate to almost every case. It is desirable, of course, that our cases should be diagnosed where the signs are slight or even absent; but, as a matter of fact, by the time a patient consults us there is usually evidence of pulmonary damage and we ought to be able to appraise that evidence at its true value. The laudable desire for the earliest possible diagnosis has led some writers to that folly of extremes which seems specially to beset the tuberculosis expert, so that we commonly read nowadays that all physical signs in phthisis mean disease already advanced. To the present writer this seems foolishness. The difficulty with many chests is that they show little physical inequalities.

which may or may not be significant of tubercle. Any one who has had occasion to examine many healthy chests will agree that the range of the normal in lung findings is tolerably wide. Darwin has taught us that no two peas are exactly alike. We are prone to forget that this is true of lungs also.

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DIAGNOSIS FROM LABORATORY METHODS.

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Interim, si quid in theoria erraverim, et veniam rogo, et melioribus  
judiciis me cessurum polliceor; fortassis etiam sponte mea aliter  
posthac de rebus hujusmodi cogitaturus.

Sydenham.



Since the discovery of the tubercle bacillus in 1882 laboratory methods have greatly developed and multiplied and have proved of much service in various fields of medicine. Their application to the diagnostic problems of tuberculosis may be described as involving the following procedures:-

1. The examination of the sputum.
2. The examination of the constituents and reactions of the blood.
3. The investigation of the response of the body tissues to the application of the growth-products of the tubercle bacillus.

1. With regard to the examination of the sputum several lines of inquiry may be followed.

(a). We may investigate its bacteriological content with special reference to the presence of the tubercle bacillus. The importance of this method of investigation needs no emphasis for the presence of tubercle bacilli in the sputum - perhaps one ought strictly to say, the continued presence of living tubercle bacilli in the sputum from the lung - is the sole pathognomonic sign of pulmonary tuberculosis. It is often said that when the bacillus appears in the sputum the disease must already be advanced. This, however, is by no means always the case. It is possible - and it is desirable - to make our diagnosis of phthisis before the bacillus can be recovered from the sputum; but this organism is at work in the most elementary focus of the disease and whether it does or does not appear in the sputum primarily depends not upon the extent of the disease but upon the more or less accidental relation of the focus to the air passages. When bacilli are present in the sputum the disease is certainly "open", but "open" is not synonymous with "advanced". That this is so is plain from the fact that we do meet with cases where in the absence of physical signs and in the presence of ill-defined symptoms the tubercle bacillus is found in the sputum. Such cases are rare - in six years the writer has not met with more than half a dozen - but they point to the necessity for examining the sputum of even the most "unpromising" suspect when there is any genuine sputum at all. In the routine examination of the sputum of all cases referred to him during the past six years the writer has been very much impressed by

the rarity of a positive result in school children. He has not had more than six such findings in many hundreds of children under the age of thirteen, and in every one of them the chest signs were well marked and indicated phthisis of the ordinary adult type. This anomaly of course is due to the fact that in childhood pulmonary tuberculosis is commonly hilus in character so that we rarely find any appreciable signs of involvement of the lung parenchyma on physical examination. Thus the routine examination of the sputum in children is of much less value than such examination in adults - indeed the writer is inclined to say that in children with no signs of lung involvement the routine examination of the sputum is hardly worth while, though it helps us to exclude tubercle in atypical cases of bronchitis, in pulmonary fibrosis, and in bronchiectasis that is to say in cases where we look for a negative examination to support our diagnosis.

In dealing with doubtful cases in general we usually find it much easier to decide that tubercle is present than to be certain that it is absent. This is also true of sputum examination. A positive result is definitive and admits of no argument, but the value of a negative result is a very uncertain quantity. Absence of proof is no proof of absence: and when we read of a positive result being obtained only on the twentieth examination we may be inclined to doubt whether negative results have any value at all. Such an attitude is hardly justifiable. We must remember that a negative result has different meanings in different hands. When the sputum contains tubercle bacilli these are usually found by the ordinary smear preparations but where they are present only in small numbers the modern methods of sedimentation increase our chances of finding them and consequently lessen the proportion of our negative results. Further, there is no recognized time limit for the examination of a specimen, and, as there can be no doubt that the longer we search the less is the possibility of our missing the bacillus, we must recognize that in this respect also the results of various workers are not comparable. There is therefore a need to define the conditions under which a negative result is obtained; and Pottenger suggests that in the matter of time limit fifteen minutes should be devoted to each preparation (35). It is still too common a practice to exclude phthisis on the strength of one negative examination, and we not infrequently meet

with advanced cases who tell us that "There was no trace of consumption in the sputum last year". But if a single negative result is a treacherously a series of such results is not without value, and the greater the number of negative results the less is the probability that we are dealing with a case of phthisis. The writer finds that after three consecutive negative results a positive finding is very rare unless there are intercurrent developments in the case. Only in three cases out of many hundreds has he obtained a positive result after three negative examinations; and in all three cases the diagnosis of phthisis had already been made on other grounds. Thus he has come to regard such three negative results as fair warrant for excluding tubercle in the absence of other significant findings in the chest or in the history.

Patients whose symptoms and signs point to active and defined phthisis but whose sputum is repeatedly negative are also rare. The majority of the writer's negative results in patients whom he diagnosed as tuberculous have been obtained either in early cases where the diagnosis was made from the history and symptoms rather than from the chest signs or in long standing cases of arrested disease. The fact that we do meet with cases in which we cannot doubt the presence of phthisis and in which, while the physical signs point to active disease, the sputum is repeatedly negative naturally raises the question of the value of Much's staining, for we cannot commonly appeal to animal inoculation in our diagnostic perplexities. Since Much announced that by his method of staining he revealed the presence of tubercle bacilli of various forms and in specimens where the ordinary Ziehl-Neelsen method was negative his claims have been investigated by several workers but there has been no general acceptance of his views. Bittrolff and Momose (36), Boehm, and Macalister (37) were led by their investigations to the conclusion that no other form of tubercle bacillus could be demonstrated by Much's method than was revealed by the common carbol-fuchsin staining. On the other hand many observers believe that they have confirmed the results of Much; and Muir and Ritchie (38) conclude that "There seems to be no doubt that in certain conditions more tubercle bacilli can be demonstrated in the tissues by Much's method than by the Ziehl-Neelsen method." On the rare occasions on which the writer has tried Much's staining he has not met with any

decisive result. The method has difficulties in technique and interpretation so that it is probably not unjust to conclude that so far it has not qualified as an indisputable advance in the diagnosis of tuberculosis.

The examination of the sputum for bacteria other than the tubercle bacillus is hardly relevant to our present purpose: though it is plain that in such conditions as pulmonary gangrene and pulmonary abscess the absence of this bacillus from sputa of septic and other organisms has a certain differentiating value. It may be noted, however, that in gangrene of the lung acid fast bacilli allied to the tubercle bacillus have occasionally been found.

(b) The cellular content of the sputum has been investigated for diagnostic purposes in cases of pulmonary tuberculosis. Wolff-Eisner believes that in tuberculous sputum there is a relative preponderance of lymphocytes and he therefore regards such a preponderance as suggestive of that disease. Other observers, however, assert that the cells in question are not lymphocytes but are alveolar in origin though they admit that their presence in the sputum may be helpful in diagnosis as affording evidence of inflammation of the lung. It does not appear that the matter has been sufficiently investigated to yield any results which may be generally agreed on as being of diagnostic service.

It has been recognized from pre-bacillary days that the presence of elastic fibres in the sputum means destruction of the lung tissue such as we get in abscess, gangrene, and tuberculosis. Usually gangrene and abscess on the one hand are really distinguishable from tubercle on the other by the history and physical signs, so that even to-day the finding of elastic fibres in the sputum of a doubtful case is presumptive evidence of phthisis. Generally speaking there is no need to search for these fibres as the specific bacillus is usually obtainable in cases of active disease. When both fibres and bacilli are found it gives us sure proof that the disease is advancing and to this extent also the finding of elastic fibres is still valuable.

(c) The chemical examination of the sputum has been directed chiefly to the determination of its albumin content (39). And among all workers there is a general agreement that the presence of albumin in

the sputum favours the diagnosis of tuberculosis as against that of bronchitis (40). Practically every case of active phthisis reveals albumin in the lung secretions; and a series of negative examinations for albumin supports negative examinations for the tubercle bacillus. Unfortunately other lung affections give rise to albumin in the sputum—bronchiectasis, pulmonary congestion, acute bronchitis with much pus in the sputum may each yield more albumin than a case of early phthisis — so that we cannot found a diagnosis on the albumin examination alone and we must consider each case from every point of view. The examination for albumin cannot of course compare in importance with the bacteriological examination of the sputum, but in view of the great difficulty in excluding tuberculosis a negative albumin examination gives us additional confidence in making this decision. In such a case as No. 16 reported above the writer has occasionally employed this test as a safeguard; and to this extent we may say that the chemical examination of the sputum has a subsidiary value.

All methods of sputum examination are obviously applicable only to cases in which sputum is available and are therefore not of any help in many early cases where the diagnosis must be made on other grounds. It is possible that as our ability to recognize tubercle in its earliest stages increases all such methods will lose much of their present importance.

2. The examination of the constituents and reactions of the blood:—  
The anaemia which often attends tuberculosis has no specific characters which might be turned to diagnostic ends and the routine examination of haemoglobin and erythrocytes is therefore not worth our while in the diagnosis of phthisis. Where the diagnosis lies between tuberculosis and one of the anaemias a blood count is obviously indicated, and the examination for a leucocytosis is a common-sense measure where there is a danger of confusing a concealed suppuration with active phthisis. In a pleural effusion it has long been recognized that an excess of lymphocytes in the aspirated fluid is suggestive of a tuberculous condition, and as we ought to treat a tuberculous pleurisy as we treat an intrapulmonary focus of the disease this finding is one of some importance. It was not until Arneith's work (41) in 1904 that the polymorphs came into prominence as possible aids in the diagnosis and

prognosis of tuberculous disease. He divided the neutrophile polymorphs into five classes according to the number of segments in the nuclei and showed that in normal blood these classes are represented in very constant proportions. His five classes are as follows:-  
 Class I has an undivided nucleus.  
 Class II has a bipartite nucleus.  
 Class III has a tripartite nucleus.  
 Class IV has a quadripartite nucleus.  
 Class V has a nucleus of five or more segments.

In normal blood he found the percentage of these classes to be thus distributed.

Class I	Class II	Class III	Class IV	Class V.
5	35	41	17	2

In certain morbid conditions he found that the percentage of polymorphs in the left-hand columns was distinctly increased, and tuberculosis as one of those conditions has been specially investigated by various workers. This "deviation to the left" as it is called is not of course confined to tuberculosis and indeed is not to be regarded as pathognomonic of any affection. In early tubercle there may be a deviation to the left but this cannot assure us that the condition is tuberculous, and we must decide the diagnosis on other grounds. In the matter of prognosis the Arneth count in skilled hands has proved of value in phthisis and other conditions; it is an index of the patient's resistance rather than a diagnostic guide. If in a case already diagnosed as tuberculous we find very little deviation to the left we believe that the resistance is good and the outlook correspondingly fair. In cases of phthisis it may not be easy to decide how far this phenomenon is due to the tubercle bacillus and how far to secondary infection; but prognosis in phthisis is always a hazardous venture and for his aid in this respect it would appear that Arneth deserves our thanks. The strictly diagnostic use of the Arneth blood count is obviously inconsiderable.

The reactions of the blood serum in suspected cases of tuberculosis have been investigated in the hope of discovering early indications of the disease; and in this connection there are two methods which have won at

least partial approval. These are the Opsonic method and the method of Complement Fixation.

The Opsonic method is due to the work of Wright (42) on the phenomenon of leucocytosis. His investigations led him to the conclusion that in the ingestion of bacteria by the phagocytes a cardinal part is played by the serum, and he evolved the theory that in the serum there are certain "opsonins" to which this special property of the serum is due. The opsonin in the serum prepares the bacteria for ingestion by the phagocytes. On this basis he elaborated the opsonic technique for the determination of the so called "Opsonic Index". In its application to tuberculosis the procedure may be shortly described as follows; of the patient's serum and of the serum of a healthy person equal quantities are taken and each is treated with equal quantities of healthy leucocytes and of an emulsion of tubercle bacilli. In each case after the same period of incubation the total number of bacilli ingested by a fixed number of leucocytes is counted and the number ingested per leucocyte is calculated. The opsonic index is the ratio of this last number from the suspected serum to that from the healthy serum the latter being taken as unity. In a healthy person there is a fairly wide range in the opsonic index thus found and it is agreed that any figure between .8 and 1.2 must be taken as normal and therefore not indicative of any disease. In tuberculosis the opsonic index is found to be varied. A low index is believed to indicate the presence of tubercle or a proneness to the infection; it does not tell us beyond dispute that the case is one of active tuberculosis. A high index is found in healing cases and in chronic cases where the resistance is good, but in such cases we naturally have easier methods of diagnosis. A normal index may be obtained in a case of phthisis and therefore cannot exclude the disease. In cases of active disease the index is found to be fluctuating and inconstant, but here again such cases also are precisely those which present more palpable evidence of tubercle. Heating normal serum deprives it of most of its opsonic power but in the case of tuberculous serum heating markedly enhances this power. Such workers as Birkett and Ross, however, find that in cases yielding this heated serum reaction there are generally grosser evidences of active disease (43). The opsonic index in a tuberculous person is affected by auto-inoculation through exercise

or by inoculation with tuberculin in a much more marked manner than the index in healthy persons. On this basis some have hoped for a definitely helpful indication of the activity of the disease; and it is probably the most useful application of the opsonic technique in the diagnosis of tubercle. Even so, its results are not conclusive. In twenty suspicious cases of Powell's all reacted to this test and of these nine later developed phthisis with a positive sputum. When we reflect that we naturally expect a fair number of "suspicious" cases to turn out actual cases of tuberculosis we will hardly be disposed to maintain that this application of the opsonic method is of superlative value. And in any case this determination of the effect of inoculation upon the opsonic index implies a series of determinations of the index and renders more laborious still a procedure already sufficiently tedious. The opsonic method as applied to tuberculosis has largely fallen into disuse. We have already seen some of its limitations, and when we find that the same serum gives widely different results in the hands of different workers (44), and that even with the same sample of serum one worker may get unaccountably fluctuating figures (45) we are justified in concluding that the practical value of the opsonic method is very doubtful. Moreover it could never be a method available for the general physician as it demands a skilled worker in a well-equipped laboratory.

Nor can it be said that the other great method of investigating the properties of tuberculous serum- the method of Complement Fixation - has yet been shown to be of decisive service. The kindred test which goes by the name of Wassermann has established itself in the other great granulomatous infection and is now in everyday use. In phthisis the method of complement fixation has been investigated for many years since the basic work of Bordet and Gengou. The percentage of positive results in the hands of earlier workers such as Calmette and Szaboky was small and the latter also obtained positive reactions in about half the number of clinically non-tuberculous persons examined. The results of later workers have been better owing largely to the employment of improved technique notably the use of an emulsion of tubercle bacilli as antigen. Radcliffe obtained a positive percentage of 90 in one investigation (46) and others have claimed an even higher figure. In a recent investigation (47)



Fidlar obtained 74 and 77 per cent positive results by two slightly different methods; but like some earlier workers he found the test positive in about 21 per cent of healthy persons. Moreover there is the further handicap that the test is not absolutely specific since the phenomenon of cross-fixation is often obtained. The test for tuberculous fixation was positive in 21 and 43 per cent of syphilitics examined by Fidlar by two different methods; and he concludes that the Wassermann reaction of a patient should be known before we attach any significance to the result of the complement fixation test for tuberculosis. Nor is it the case that a positive result indicates active tubercle; and in our consideration of the diagnostic difficulties in tuberculosis we can never too often insist that what we seek is not evidence of the historical fact of a tuberculous infection in time past but evidence of active disease causing symptoms and demanding present treatment. With this test, then, we may get a positive result in a healthy person or in a person labouring under another affection; and it may also fail in the presence of active tubercle. It is not too much to say, therefore, that the claims of this reaction to general usefulness still await confirmation. Nor could complement fixation with its present technique ever become a generally practicable procedure.

The agglutination test which has been of such signal service in enteric fever has been investigated in tuberculous disease, but there is a general agreement that here it is of no definite service. And the cobra venom test of Calmette may be dismissed in a word as not having been confirmed by later workers.

3. The work of Koch on the tubercle bacillus led to the production of tuberculin which in its original form was a six weeks' old culture of tubercle bacillus in 5 per cent glycerin bouillon evaporated down to a tenth of its original volume and filtered after killing by heat. This is the substance which has been generally employed in the various tuberculin tests though other preparations have been used by many workers. As regards the tuberculin test all tuberculins are essentially similar, for like the original product of Koch they possess the remarkable property of acting as an intense poison to tuberculous persons and animals while being non-poisonous to the healthy. It is this peculiar property that lies at the root of all the tuberculin tests.

As a diagnostic agent tuberculin may be applied in several ways:-

- (a) To the unbroken integument.
- (b) To the deeper layers of the skin.
- (c) By subcutaneous injection.

(a). Moro's test consists in the application by inunction into the unbroken skin of an ointment composed of equal parts of old tuberculin and anhydrous lanoline. A positive reaction appears within 48 hours as a crop of red spots or even papules over the site of the inunction. This test is now little used as it has been shown to be unreliable by many workers; in 100 phthisical adults with positive sputa Bandelier and Roepke found that only 54 reacted (48). It is less reliable than the von Pirquet test; and the writer was not impressed by his experiences with it. The conjunctival test of Calmette which consists in the instillation of one drop of a one per cent solution of tuberculin into the conjunctival sac of one eye may be regarded as essentially similar to that of Moro.

Here a positive reaction is manifested by a more or less slightly marked conjunctivitis. It is a test of much delicacy and it has the disadvantage of all delicate tuberculin tests in that clinically non-tuberculous persons often respond to it. On rare occasions also it has resulted in severe damage to the eye; and these disadvantages have brought it about that the test is not in common use nowadays among clinicians.

(b). The cutaneous test of von Pirquet which consists in the application to the scarified skin of old tuberculin either undiluted or in a 25 or 50 per cent solution has been extensively used all the world over since its introduction in 1907. A positive von Pirquet reaction is shown by the appearance within 48 hours at the site of inoculation of an area of inflammation which, when the response is strong, may proceed through papulation even to vesication. It is generally agreed that such a positive reaction yields reliable evidence of the presence in the body of a focus of tubercle. Unfortunately it does not tell us where that focus is nor does it tell us whether it is active or not. Post-mortem statistics have shown us that almost every adult has at one time or other harboured the tubercle bacillus, and is therefore capable of responding to this test: and as a matter of fact he does thus respond. Hence a positive reaction in an adult is well nigh valueless, for the end of our search.

as we have seen is evidence of active disease. "No one in these days" it has been said "can rely on a positive von Pirquet reaction as evidence of active tubercle and retain our respect for his intelligence". The writer has used the von Pirquet test at intervals for the past ten years and his conclusions agree with those now generally held, - that a positive result means little and that a negative result when obtained is useful as excluding tubercle, and exclusion which we have seen is not an easy matter clinically. In children under four years of age - when any tubercle is ipso facto probably active - a positive von Pirquet is valuable evidence in diagnosis, especially when we consider how unsatisfactory are our methods of ordinary clinical examination when applied to tuberculosis in childhood. There is one fallacy which besets all tuberculin tests. If we get a positive result in a child or adult with doubtful lung signs we are not bound to assume - as we are prone to do - that the response is due to our lung findings; for it may be due to an undetected focus of tubercle which is clinically without significance. In a child however, where any focus of tubercle probably needs treatment this fallacy is not of much practical importance.

Attempts have been made to escape from the indiscriminating sensitiveness of the original von Pirquet test by making a series of simultaneous inoculations in graduated dilutions so that a measure of the sensitiveness of the tissues may be obtained. This modified test has been used chiefly as a guide to the therapeutic use of tuberculin, but it has also been applied to diagnostic purposes. The method of Ellermann and Erlandsen (49) is the best known. It is based on the Weber Fechner law which is familiar to physiologists and psychologists and which states that where the strength of a stimulus increases in geometric series the magnitude of the response will increase in arithmetical series. Tuberculin dilutions are made in a geometrical series and simultaneously inoculated; the papules appearing at the inoculation sites are measured at their full development and their differences in size calculated. From these figures can be estimated the tuberculin dilution at which the response would disappear in that particular patient and the reciprocal of that dilution is taken as the measure of the sensitiveness of his tissues: thus a patient reacting at the lowest to a dilution of 1-100 is said to have a

sensitiveness of 100. By this method it can hardly be claimed that our results are absolutely reliable for our interpretation is beset by several fallacies. Different papules take different times to develop fully and this renders accurate comparison difficult; the site of the inoculations is a determining factor; and unaccountable discrepancies occasionally appear. Further no two tuberculins of the same kind are of the same strength as there is no standard of strength which we can fix with certainty. These variations in the two essential factors of the test - the stimulus applied and the responding tissues - go far to disqualify it for clinical service. Moreover its fundamental assumption is that the activity of the disease and the sensitiveness to tuberculin vary directly; and it is known to every one who has worked with tuberculin that this assumption though of general, is by no means of universal, validity.

One may perhaps mention the intradermal tuberculin test in which the injection is made into the substance of the skin. It is said to be even more delicate than the von Pirquet reaction; but it may cause considerable pain and it does not appear to have been much used by clinicians. It may give a positive result where the von Pirquet fails to do so; but as we have already seen that the von Pirquet test is sensitive enough in all conscience it is plain that the field for the intradermal test could never be wide.

(c). The original subcutaneous test of Koch has been much employed since he first introduced it and various opinions have been expressed as to its worth and safety. Different dosage - limits are recommended by different workers as it is generally taught that the dose may be increased if the initial amount fails to give a response. Usually 1-100 cc is used as the amount which ought to bring about a reaction in the tuberculous within 48 hours. The temperature should be taken every two or three hours for a day or two before applying the test. The reaction may present three elements.

1. The Local Reaction; - This appears at the site of the injection, It is not regarded as of much importance as it does not differ essentially from the von Pirquet.

2. The General Reaction; - This consists in a rise of temperature of at least one degree Fahrenheit; and during this pyrexial period the

patient often suffers from various influenza-like symptoms. It does not necessarily mean that there is active tubercle present for there is no dosage limit which can enable us to differentiate between active and extinct disease. All we can say is that the quicker and smarter the response the greater is the probability that we are dealing with an active process.

3. The Focal Reaction; This is manifested by the appearance of more definite signs in the suspected area of the lungs. The writer when he used this test did not find it an easy matter to decide when a focal reaction was present. It is difficult if not impossible to carry a percussion note in the memory for several days and then use it reliably for purposes of comparison. We are on surer grounds with adventitious sounds, and where these appear for the first time or when they are definitely multiplied especially if at the same time the amount of sputum raised is increased we may be sure that the focal reaction is real. Sometimes tubercle bacilli are found for the first time in the sputum from a reacting focus. The focal reaction has been described as the very marrow of the subcutaneous tuberculin test; and it is believed to furnish definite evidence of at least potentially active tubercle. But it does not appear that because a focus in the lung is rendered hyperaemic by an injection of tuberculin we are logically bound to conclude that that focus is one of active disease and is responsible for the patient's symptoms. At the most such a conclusion has a probability which must be checked by other data. But a negative result with the subcutaneous test is very strong evidence against the diagnosis of tubercle.

In the subcutaneous test we find the only source of danger in the diagnostic use of tuberculin, a danger which has been variously estimated by different authorities. In 12,000 subcutaneous tests Bandelier and Roepke never saw any harm done; and their experience is not unique. On the other hand the test has been condemned more or less vehemently by workers of great experience. Sahli (50), for instance, is absolutely opposed to diagnostic tuberculin injections; "No definite result can be drawn from either a negative or a positive result of the so-called diagnostic injections; apart from this I consider the risk attending their use sufficient argument for their rejection. In the diagnostic use of tuberculin one is aiming at the very thing that is known to be dangerous - overcharging the body with

toxin to make it react, and if this is not successful the first time, a second and third attempt is made, often with a dose many times as large again. This does not seem admissable in the treatment of human beings: the result is not even conclusive, and the measure is almost always superfluous." The writer's experiences with the subcutaneous test did not include any disasters but he certainly did have cases where the test did the patient no good; and we still meet with persons who have vigorous views as to the baneful effects of the reaction on their disease. The writer argues that if the present system of tuberculin treatment based upon small doses and the avoidance of reactions is the correct one - and the great majority of tuberculin therapeutists say it is - it is worse than illogical to inject a relatively great dose of tuberculin into a person who is a suspected case of tuberculosis. Moreover, a smart reaction is no pleasant thing for the patient, and in the matter of diagnosis as in that of treatment we ought always to consult not only the cito but the tute and the jucunde as well. It is now generally agreed that the subcutaneous test is contraindicated in certain circumstances - in the presence of fever, haemoptysis, or grave organic disease, for instance - and many believe that it is permissible only in a small number of cases where diagnosis is ~~a~~ matter of urgency. Obviously such urgency cannot lie in the acute nature of the illness; and this is the main source of urgent considerations for the practitioner. The writer has not personally used the test for years and believes that the necessity for its application should arise very seldom.

The ideal test for tuberculosis should fulfil certain definite conditions;

1. It should reveal the presence of active disease and ignore all extinct lesions.
2. It should act only in the presence of tuberculosis and fail to respond to all other diseases.
3. It should reveal tuberculosis before our other methods of examination can do so.
4. Its use should be without danger to the patient.

This review of the various laboratory tests will suffice to show that these conditions have been fulfilled by none.

DIAGNOSIS FROM RADIOSCOPY.

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Every great advance of science opens our eyes to facts which we had failed before to observe, and makes new demands on our powers of interpretation. This extension of the material of science into regions where our great-grandfathers could see nothing at all, or where they would have declared human knowledge impossible, is one of the most remarkable features of modern progress.

Karl Pearson.

("The Grammar of Science")



Since Roentgen announced his discovery of the X rays in 1895 they have become unquestionably established as valuable aids in medicine and surgery. In this country Dr. Hugh Walsham drew attention to their use in the diagnosis of pulmonary tuberculosis at the British Congress of Tuberculosis held in 1901 (51). He proposed three questions:-

- (a). Can the Roentgen rays show tubercle in the lung?
- (b). If so, at what stage of their development?
- (c). Can the rays detect tubercle in the lung before the other means of physical diagnosis at our disposal?

The first question he answered in the affirmative; in answer to the second he gave reasons for stating that such detection of tubercle may be made in an early stage of the disease; and he dealt with the third by showing the grounds for his belief that the rays can detect tubercle at least as early as the stethoscope.

It may be generally stated that subsequent experience has gone far to establish the truth of these conclusions though the third answer must now be qualified, for while it is beyond doubt that the rays can detect early tubercle, even when it missed by ordinary examination, it is also true that in many cases of demonstrable disease they fail to yield a positive finding, so that no careful physician would nowadays diagnose or exclude phthisis on the ground of radioscopy alone.

A complete radioscopic examination demands the use of the screen and the photographic plate. With the former we observe the movements of the lung in respiration, and where disease is present we may discover the failure of the affected apex to brighten on inspiration and the limitation of the movement of the diaphragm on the affected side. These phenomena singly or together are not sufficient to justify the diagnosis of active tubercle; the value of the diaphragm sign has been doubted in any case, and obviously both findings may be due to obsolete disease. Where the intrapulmonary shadows are definite the focus of disease may be readily recognized, but here again it is not always easy to distinguish between active and extinct processes. The photographic plate reveals details which are missed with the screen and its fuller data may be studied at our leisure so that it is the best means of communication between the radiographer and the physician.

As was natural excessive claims have been made as to the usefulness of radioscopy in the examination of the chest; and even today there is considerable disagreement among X ray workers about the interpretation of some of their findings. The limits of the normal chest picture are not agreed upon, the hilus shadow and the radiations from it being the main source of dispute. Some hold that these radiations always indicate disease while others regard them as clinically non-significant and due to normal structures. In view of the proved frequency of anatomical tuberculosis in adults there may be an element of truth in both contentions, but the practical point for the physician is that we ought to be chary of a diagnosis of pulmonary tuberculosis based upon the interpretation of such disputed phenomena. Such matters of debate apart, the great worth of radioscopy in chest work remains. On one point there can be no question, and that is the value of the rays in the diagnosis of pulmonary tubercle. in children. In such young subjects there is generally no genuine lung sputum available for bacteriological examination, and we rarely find definite evidence of lung involvement from our ordinary physical examination of the thorax, so that our diagnosis is rather a matter of suspicion than of scientific demonstration. The examination of the hilus by the fluoroscope often serves to dispel our doubts; and in such cases the differentiation of active from obsolete tubercle naturally causes us little concern.

On the question of the diagnosis of phthisis in adults one point may be emphasized. The ultimate decision has to be made by the physician and ought to be made from a review of all relevant data. We ought not to accept the ipse dixit of any X ray operator. There seems to be a tendency among such experts to describe as "tuberculous" the shadows which are revealed by the rays when they have no scientific grounds for the use of any such adjective. For instance, the writer has had several cases in which the history and signs were predominantly bronchitic but where over an apex or a base there was a concentration of the signs. In such cases and in cases of fibrosis the tuberculous character of which could not be proved he has always been told that there was evidence of "tuberculous" infiltration in the area in question. In none of these cases has conclusive proof of tubercle subsequently appeared, so that he now preserves what he conceives

to be a proper scepticism when he is presented with such a report in similar cases. Even in the differentiation of tuberculosis from other gross conditions of the chest expert radiographers are not infallible as some of the cases quoted above will serve to show. In untrained hands radioscopy is often worse than useless. During the war the writer had occasion to examine scores of soldiers who had been discharged from the army on the ground of tubercle. In not a few of these cases the ultimate decision had been made by X ray examination: and in the great majority of such cases the writer has failed to find any clinical grounds for confirming that diagnosis even after months of observation.

Case 26. J.R. a soldier of 24 with a good family and personal history was discharged from the army on the 6th of Septr. 1917 as a case of phthisis. He had caught a cold in France and was admitted to hospital after being slightly affected by "gas" shortly after the "cold". His history is negative with regard to loss of energy, colour, flesh, or appetite: his cough lessened in severity in a short time, and when seen on the 12th of October 1917, he had no more cough than he usually had had and very little if any sputum. Indeed he had no complaints at all. And physical examination was negative. Six sputum examinations were also negative. The X ray plate revealed definite darkening and mottling over the right upper lobe.

This patient has kept free from symptoms till the time of writing; and the diagnosis of pulmonary tuberculosis, does not seem to have been justified by anything except the X ray finding.

The writer has had experience of radioscopy in various institutions: and he has recently had his doubtful cases examined by two recognized authorities in X-Ray work. He does not profess to be able certainly to diagnose early tubercle by this means, and he believes that the ordinary clinician cannot readily become - and need not become - an expert in the use of the rays. The conditions in which he finds them of service are usually such as follow.

1. Cases in which a particular apex has been questioned by a competent physician and where the local signs are doubtful and the symptoms equivocal.

Case 27. J.G.F., a clerk of good family history was seen on the 20th of August 1918 as a case of notified phthisis. "He has been quite healthy, but for the past two winters he has been troubled with bronchitis which cleared up in the summer. This illness began with bronchitis 7 weeks ago. He is recovering his usual health as on previous occasions and at present has little cough or spit and only slight dyspnoea. These have been the only symptoms he has suffered from, and he does not regard them as essentially different from those of his previous bronchitis. He has been seen separately by two consultants from a Chest Hospital. One diagnosed phthisis of the left, and the other of the right, apex. His pulse and temperature are normal. Over both apices inspiration is perhaps rather

"wavy" in character but there are no localized signs of tuberculous disease, and except for transient basal rhonchi the chest is sound. Physical examination is otherwise negative".

In view of the fact that this patient's illness began during an influenzal epidemic his sputum was examined on at least four occasions with a negative result. His temperature record was obtained for three weeks and showed no evidence of active tubercle. His history was not suggestive of tuberculosis: and his chest findings did not indicate anything beyond bronchitis. He was submitted to X ray examination, and was reported on as follows: "There was no definite evidence of any active tubercular mischief in this case. The bronchi were thickened at the roots, and there was a suspicion of old tubercular mottling at the upper parts of both roots. The apices were quite clear and the diaphragm moved well on both sides."

There did not appear therefore to be sufficient grounds for confirming the diagnosis of phthisis and the patient was returned as a case of bronchitis. He has kept well till the time of writing.

2. Cases of ostensible bronchitis where the persistence or the severity of the symptoms, or the presence of local concentration of the physical signs has been sufficient to rouse the suspicion of phthisis. Case 16 above may serve as an instance of this.

3. Cases where the diagnosis lies between incipient tuberculosis and ill-defined mitral stenosis. Such patients usually present themselves with a history of a recent haemoptysis and we may be uncertain as to its source.

Case 28. Mrs. C.H., a weaver of 37 was seen on the 21st of October 1918 with a history of having coughed up a pint of blood a month before. "Her family history is good and she has enjoyed excellent health except for some slight rheumatism several years ago. She has not felt ill either before or since the bleeding. Her history is negative as regards loss of energy, colour, appetite, or flesh. She has no unusual cough and little if any sputum. Her temperature and pulse are normal. There is no definite evidence of intra-pulmonary disease. The heart is somewhat enlarged to the right but not markedly so. The first mitral sound is emphatic and the second pulmonic is rather accentuated. There is no definite murmur: but the cardiac sounds are audible in the region of the left scapular angle."

Here the symptoms of the case did not point to phthisis, her only complaint being that she was a little breathless on exertion, though this did not seem to be very troublesome. The heart findings noted above all pointed to Mitral stenosis, and this was the diagnosis made. She was

X rayed with the result that no definite evidence of intrapulmonary disease was found. The X ray plate showed enlargement of the heart more distinctly than did percussion. As enlargement of the heart is not usual in early tuberculosis, it is possible that the radioscope may be useful in the elucidation of such cases as this.

4. Cases with well marked chest signs which are not typical of pulmonary tuberculosis. Illustrative cases of such conditions have already been quoted.

5. Obscure cases of thoracic disease. Such cases commonly turn out to be aneurism or intrathoracic cancer: and the differentiation even by the radioscope is not always easy. For over a year the writer has had a case under observation in which the condition had been diagnosed in the army as phthisis and laryngeal tuberculosis.

Neither the symptoms nor the chest signs were indicative of tuberculosis and the sputum was repeatedly negative. He was X rayed by the army authorities after his discharge, and the condition diagnosed was "mediastinal tumour". That was over a year ago and the man's condition remains stationary. This by itself is enough to rule out the diagnosis of cancer: but a subsequent X ray examination by a competent radiologist confirmed one's suspicion of aneurism.

Personally the writer finds in the great majority of cases that the use of the rays confirms the diagnosis or suspicion to which he has been led by ordinary clinical examination: and he believes that even the expert application of radioscopy in the diagnosis of pulmonary tuberculosis should always be regarded as secondary in importance to a careful clinical report.

DIAGNOSIS FROM HISTORY AND SYMPTOMS.

"For a faculty of wise interrogating is half a knowledge"

The Advancement of Learning.

Thus far we have dealt with the diagnosis of pulmonary tuberculosis solely from the objective aspect, that is to say, from the evidences of disease discovered by the physician from the physical examination of the patient and elucidated by laboratory and radioscopic methods. It remains to deal with the subjective aspect, the diagnostic data obtained from the patient's story as embodied in the history and symptoms. It is the writer's conviction that in the diagnosis of phthisis this side is at least as important as the former; and that in the matter of early diagnosis it is much more so.

The History includes:- 1. The family History

2. The personal History.

1. The family history of the patient may be important for one of two reasons; it may yield us evidence of a family tendency to the disease or it may reveal to us possible sources of infection. Nor are these two things easily separable; they usually go hand in hand; so that our views on the importance of heredity in tuberculosis are largely determined by the emphasis we tend to lay on the one at the expense of the other, and in the individual case their relative effects may not be easily distinguished. The question of heredity in tuberculosis has long been a matter of discussion among physicians and cannot yet be regarded as definitely settled (52). We may safely say that the evidence for true hereditary tuberculosis - that is to say, the transmission of the disease to the offspring by the infected sperm of the father or the infected ovum of the mother - is not decisive, and, from the nature of the case, can hardly ever be expected to rank as a demonstrated fact. Some cases of antenatal infection seem to be definitely established but antenatal infection is not synonymous with hereditary disease as above defined; and in any case such instances are too rare to affect our practical outlook either on the national problem of tuberculosis or on the individual patient. The recognition of the possible latency of tuberculous disease has tended to make some writers more cautious in denying hereditary disease - "The commonly accepted dicta regarding congenital tuberculosis are probably extreme" say Warthin (53) and Cowie- but, as a matter of logic, it does not appear that the acceptance of



the doctrine of latency need exalt congenital as opposed to post-natal infection since either may remain latent to reappear in later life.

But if the disease is not demonstrably hereditary, is the "diathesis" not transmitted? Here also opinions differ. The word "Diathesis" has a sinister look, suggesting metaphysics. Dr. Leslie Mackenzie (54) has given an amusing account of his efforts to attach some meaning to it, and he concludes that its use generally involves a Petitio Principii; "The tubercular diathesis makes it easy for a person to contract tuberculosis; that he contracts tuberculosis proves that he has the tubercular diathesis". He finds that a person with the typical tuberculous diathesis is the actual victim of tubercle, that the pretuberculous state is in reality post tuberculous. There is doubtless much truth in Dr Mackenzie's contention; in practice, we are wise to treat the typically pretuberculous child as a case of actual disease. And that the endeavour to abolish "the virtus dormitiva method of describing its problems" from medicine is laudable goes without saying, - though the plain physician who endeavours to grapple with the concepts of modern Immunity problems may at times wonder if our efforts in this direction have been quite so successful as they might be. But the matter may be looked at in another way. Under the same conditions of life, nurture, and exposure to infection some people contract tuberculosis and some do not; the difference is not in the environment but in the individuals. And if we choose to describe this fact by saying that those persons who become infected are predisposed to the disease not much harm is done, provided we are prepared by parity of reasoning to speak likewise of an enteric or a small-pox predisposition; and in the case of demonstrably bacterial disease the fact might be expressed bacteriologically as an opsonic index. In some instances there is good ground for believing that this proneness to infection is a congenital character and therefore transmissible to the offspring, though we must recognize the possibility of antenatal infection by small doses of toxins from the mother weakening the resistance of the foetus to the disease. This way of stating the question enables us to attach a meaning to the term "tubercular diathesis" and this is the meaning recognized by Karl Pearson (55) in his study of family infection; "In this sense it is

probably legitimate to speak of the inheritance of tuberculosis and even of the inheritance of zymotic diseases, meaning thereby the inheritance of a constitutional condition favourable to the development of such diseases should a risk be run, which cannot in the ordinary course of life be wholly avoided". And his investigation of the problem leads him to the conclusion that "the diathesis of pulmonary tuberculosis is certainly inherited, and the intensity of inheritance is sensibly the same as that of any normal physical character yet investigated in man."

The question is by no means an academic one. If Pearson's conclusions are sound it means that in an indefinite number of the population we are faced with a tuberculous predisposition, which since it can be inherited, is not an acquired character, but is, so to speak a defect in the germ plasm; and as such it cannot be affected by any amount of bettering of the environment unless that involves the removal from the patient of the one thing that matters - the tubercle bacillus. With the metaphor of the Seed and the Soil it is much the same. We cannot materially alter the soil; but as no soil will grow wheat unless wheat is planted so in the absence of the specific bacillus the tubercular diathesis has neither meaning nor menace. If therefore we direct our efforts to the one aspect of the relationship which we can affect, - the tubercle bacillus, - we shall have the support of theory and common-sense, for, whether tuberculous disease or tuberculous diathesis be transmissible or no, one fact is clear beyond dispute and that is that tuberculosis is an infectious disease; and that it ought to be treated as such is the only practical corollary. This would mean a much greater degree of deliberate segregation than is at present possible, and until such segregation is a fact - and it need not be unkindly - one has little hopes of much decisive improvement in the phthisis death rate. Only by treating lepers as lepers was leprosy abolished; and tubercle is much more infectious than leprosy.

Karl Pearson has pointed out that our family histories of disease are of little value to the mathematician. "No record of the family history is of the least value unless the absolute number of collaterals and their ages living or at death are taken". The writer's figures come under this condemnation: but as he sought in the family history not for

evidence of the tuberculous diathesis so much as for possible sources of infection-believing, as he does, that tuberculosis is an infectious disease to an extent that matters - he does not think that he has wholly wasted his time in collecting them. The figures here given take account only of tuberculosis affecting the patient's parents, brothers or sisters. When we consider the manifold possibilities of infection in modern city life, and the possible latency of an infection, it is not to be wondered at that we are so seldom able to give any guess as to the source of a patient's disease. Out of 1000 cases of adult phthisis 370 presented evidence of the disease in the family as defined above.

2. The Personal History. The personal history of the patient is important as yielding evidence of previous tuberculous disease, or of diseases which are recognized as predisposing to tubercle. In 205 of 1000 cases of the writer's there was a history of previous tuberculous disease in bone, gland or pleura. It is important to note that such figures are very incomplete for in the previous history of a great number of our cases we find the record of an illness in which the main features were similar to those found in phthisis and which we often believe to have been an attack of tuberculosis which was not diagnosed. "Anaemia and bronchitis", "bronchitis and debility" "complete break down in health" and similar labels often appear in this suspicious manner in the personal history of actual consumptives.

The importance of a previous attack of pneumonia has already been indicated. In childhood pertussis and measles are notoriously forerunners of tuberculosis. Pure bronchitis in the writer's experience does not seem specially to predispose to phthisis, though bronchitis is often diagnosed where tubercle is present. An attack of genuine influenza followed by incomplete recovery is in the highest degree suspicious, as the writer is having daily proof at the present time. In a much less degree the same is true of typhoid fever. The writer has had three cases of phthisis following typhoid during the war. It may be stated that as far as the experience of Lancashire goes "Gassing" among soldiers has had no decided influence in inducing tuberculosis of the lungs.

The occupation of the patient is obviously a matter of importance in so far as it entails work in badly ventilated, crowded, dusty rooms or

the assumption of unhealthy postures as in compositors and the like. It is recognized that certain kinds of dust are especially prone to provoke lung inflammation and it is believed that such inflammation may take the form of a non-tuberculous fibrosis. The writer's cases do not include any such affections as the great majority of his patients are workers in cotton mills where tuberculosis is not specially prevalent, while the next greatest number are miners who suffer even less from phthisis than do agricultural labourers (56).

The age and sex distribution of one thousand of the writer's cases of adult phthisis taken at random was as follows:- \*

15-20		25		30		35		40		45		50		55		60		65		70	
M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
79	107	106	98	81	69	85	61	90	30	58	20	55	9	29	5	11	3	2	0	2	0

#### Diagnosis from Symptoms.

The writer has already suggested that in the early detection of phthisis the one great cause of delay in diagnosis is not the lack of skilled physical examination but the failure to recognize the import of symptoms and the consequent omission to examine at all. To diagnose pulmonary tuberculosis as early as possible we ought to be on the look-out for the earliest evidences of disease. Now, these evidences are presented in the first instance to the patient; that is why he consults us. And if we attend to his statement as we ought, and elucidate its details, we should be able to form a presumptive opinion as to whether tuberculosis is present or not. In some cases the diagnosis may be obvious without such a detailed catechism; but when a patient tells us that for several months he has lost energy, flesh, appetite, and colour; that he has developed a cough and spit; that he has raised some blood and noticed some night sweating, the diagnosis should be equally obvious to the most cavalier observer. Such a case, however, is not usually an early one and our diagnosis therefore may give us no reason to be puffed up at our clinical acumen. It is quite true that we occasionally meet with a patient with extensive disease who consults us perhaps on

account of a haemoptysis and who stoutly denies any other symptoms of tuberculous disease; for in phthisis as in pneumonia the extent of the disease and the evidence of toxæmia do not always go hand in hand. Yet the outstanding fact remains that as an almost universal rule the first signs of phthisis appear first to the patient and not to the physician. And the patient's best chance of recovery lies in our properly appraising the details of his story.

Not only so, but as a matter of fact symptoms in pulmonary tuberculosis almost always precede physical signs, so that from this point of view also early diagnosis must mean diagnosis from symptoms. This is not generally recognized but it has been well insisted on by Sir James Mackenzie in a passage (57) which is worth quoting for its sovereign common-sense. Of affections of the lungs, heart, and kidneys he writes; "The diseases of these organs often begin insidiously, and we fail to recognize them until they have developed so far as to alter the organ or its functions, and produce some "physical sign". It is often assumed that diseases are now recognized at the earliest possible moment at which it is possible, humanly, to recognize them, and this idea has been strengthened by the knowledge that we now possess mechanical methods to supplement our senses. But it cannot be too strongly insisted upon that these mechanical methods only elicit evidence of damaged organs and that we must learn to recognize disease before such damage is done". He looks forward to the day when we may be able to correlate the symptoms first complained of by the patient with the presence of a particular microbe "without having recourse to laboratory methods". At present this sounds Utopian; but the general trend of these remarks is sound, and their bearing on the early diagnosis of tuberculosis is, in the present writer's opinion, close and important.

Moreover we have already seen that one great defect in many of our diagnostic methods is that they do not distinguish active disease from merely historic infection. Here the presence of suffering on the part of the patient is manifestly a relevant consideration. If he suffers from symptoms - with the exception, perhaps, of dyspnoea - this means that the disease is active whatever any other test may say.

We have also seen that many of the modern methods of diagnosis demand a degree of skilled technique which is beyond the reach of the

general physician who is the first to meet with the phthisical patient. This objection cannot apply to the diagnosis from symptoms, for such a diagnosis is merely the application of elementary logic and common-sense along lines indicated by a workaday knowledge of medicine.

If then symptoms constitute the earliest evidences of disease, it is clearly of the highest importance that we should investigate the character and peculiarities of the subjective aspect of incipient tubercle; and to this end the pages that follow are addressed.

It need hardly be said that as there is no physical sign which is pathognomonic of phthisis so there is no single symptom which indicates that disease and that disease alone. It is the coexistence of certain symptoms which is significant, the presence of a symptom-complex: so that when we have heard the patient's account of himself we may be able to make a diagnosis with a certain amount of accuracy if not with absolute assurance, reaching a degree of probability which a mathematician might express as any fraction up to unity.

At the outset it is desirable to point that there is one aspect of the symptomology of phthisis which is daily overlooked with disastrous results to the patient; and that aspect is the simple duration of the complaints. Tuberculosis is a chronic disease with protean manifestations and a deceptive tendency to remissions. When therefore we have treated a patient for obscure symptoms of any kind for a month or so without improvement on his part or enlightenment on ours we ought always to raise the question of tubercle. If this were a routine matter in every consulting room the charge of delayed diagnosis could not be justly levelled against our profession as it can be today when we find that the majority of cases when notified are already hopeless of cure and that it is usually only after months of unavailing and often uncritical treatment that the possibility of phthisis is considered at all. We may consider the symptoms of phthisis as they are shown in the various modes of onset of the disease and for our present convenience we may regard its onset as conforming to one of four modes: the insidious, the catarrhal, the pleuritic, and the haemorrhagic or onset by haemoptysis. It is not of course asserted that these modes of onset are exclusive

each of the others: as a matter of fact beginning tubercle in any individual case usually partakes somewhat of all four: but these modes of onset are sufficiently distinctive to be worth recognizing if only for purposes of classification.

In 1000 of the writer's cases in which the beginnings of the disease were investigated these modes of onset were represented as follows:

Insidious	Catarrhal	Pleuritic	Haemorrhagic
454	389	80	77

We shall now discuss the modes of onset more in detail.

1. The Insidious Mode of onset is doubtless more common than the above figures indicate and the more carefully we inquire the more frequently will it appear. Its characteristic features appear to be somewhat as follows.

(a). Loss of energy and endurance. This forms one of the commonest and certainly one of the earliest symptoms in the great majority of all cases of pulmonary tuberculosis. It appears so gradually that the patient can rarely tell us when he first noticed it, so that, as Hawes (58) has well said, we ought to ask "When did you feel quite well last?" rather than "When did you begin to feel ill?" For this form of questioning will often bring out in a way which surprises even the patient how very gradually the lassitude has pronounced itself.

Loss of energy is one of the commonest symptoms in medicine generally and its mere presence therefore leads us nowhere. But in the langour of incipient tuberculosis there would appear to be certain characteristics which may prove of diagnostic value. First of these is its marked intensity; Minor has written (59); "The whole body seems filled with tiredness; even to breathe is an effort, and if the patient lies down to rest, weariness seems to run through his limbs. They ache with fatigue and seem to pin him to the bed. Later in the evening this feeling passes off and the patient often feels very well. On waking, a heretofore active man will find himself not rested or refreshed and with no ambition for work, and many such a one has feared he was getting lazy or has taken to bracing himself with alcoholics, or has had a diagnosis of neurasthenia made on account of it."

Now in other affections such a degree of lassitude commonly has a well defined cause readily appreciable. After an attack of typhoid, for instance, a man may well feel "fit for nothing". But it is characteristic of phthisis that the incipient consumptive has "nothing to show" for all his complaints: and this anomaly ought to rouse our suspicions. The quotation above has indicated another of the features of the phthisical langour - its variability. It is usually more marked in the morning or the earlier part of the day and it tends to disappear as the day proceeds. Stevenson, it is said, could write with greater facility in the evening when his temperature was raised, and this is a common experience with other consumptives. Nor is this diurnal curve the only variation, for the langour varies from day to day in a way that is not easily explained. Nothing is commoner in dealing with phthisical cases than to hear it said "Some days I feel fit for anything and others I feel fit for nothing." It may be that this change from utter weakness to a sense of well being has something to do with the so called *Spes phthisica* if there is any such thing: for in his dealings with Lancashire patients the writer is unable to distinguish that psychical trait from the stolid, cheerful outlook on life which marks the natives of that county.

In the presence therefore of a history of langour of about a month's duration, when that langour is

1. Intense.

2. Inexplicable.

3. Variable.

we ought to be alert to discover further evidences of possible tubercle. For it is here in the presence of this very early symptom that we have our best chance of making the earliest possible diagnosis with the best results to our patients. Here, too, unfortunately pseudo - diagnosis is very ready to beset us. To diagnose "Debility" whether we call it "nervous", "gastric", or "anaemic" is not a very scientific procedure; and to talk of "neurasthenia" is often little better. While to tell a man who complains of being "completely done up" that he is "thoroughly run down" is priestcraft rather than medicine.

Case 29. F.C. a baker of 26 with a good family history was seen on the 26th of Feby. 1917. His previous health had been good except for an attack of pleurisy at the age of 11. "This illness began 3 weeks



ago as a cold from which he states he is recovering satisfactorily. He has now no cough or spit; there has been no noticed loss of weight or colour. For a long time now he has been feeling run down and his appetite has been somewhat impaired, but otherwise his history is negative. Physical examination fails to reveal any evidence of disease of the lungs or elsewhere. He states that in addition to his own work which is heavier than ever he is also engaged upon war-time duties and in consequence does not get much rest and seldom more than four hours' sleep nightly".

In this case the history and chest signs were not sufficiently decisive to warrant the diagnosis of tubercle; the man was plainly overworking. He was advised to call for observation purposes at the Dispensary; and has kept well till the time of writing. During the war the writer had several such cases of overwork, and it was not always an easy matter to exclude tubercle with confidence. Cases of mal-nutrition were very rare among the writer's suspects during the war.

Case 30. T.E. a coal-cutter of 39 with a good family history was seen on the 15th of September 1915 complaining of loss of energy of several months duration. His previous health was good except for an attack of pneumonia 4 years before from which he felt that he never fully recovered. "the present illness began gradually. He has not noticed any distinct loss of flesh or colour but his appetite is not so good as it was. He has no unusual cough or spit." His temperature and pulse were normal. Chest examination failed to reveal any definitely abnormal findings and physical examination was otherwise negative. He was kept under observation for several weeks during which time no new symptoms developed though his voice was at times husky. His sputum was examined when obtainable and on at least four occasions was negative. In view however of his marked and inexplicable langour, his dyspeptic symptoms (which were not marked), and his occasional hoarseness he was sent to sanatorium, in which however, he remained only one day. He did not attend the dispensary till 18-1-18 having raised a slight spot of blood in his sputum some days before. His sputum was examined with a positive result and there were evidenced of beginning infiltration under the left clavicle. He is still in sanatorium to which he was again sent after the positive result.

This case is interesting as the patient was suffering from tuberculosis for several years before there were sufficient chest signs to justify that diagnosis and deserves notice too because of a positive sputum result after four negative examinations. Even when the bacilli were demonstrated in the sputum the chest signs were not at all marked; and at the present day they still slight.

b. Loss of Flesh. That loss of flesh is a symptom of phthisis is a matter of common knowledge which needs no labouing. Its degree varies with the acuteness of the onset, the amount of toxæmia, and the efficiency of the digestive powers. In early cases loss of weight may not be at all marked, and where the patient has been under treatment for symptoms of <sup>un</sup>recognized tubercle he may be increasing in weight when we first

see him, just as a sanatorium inmate may gain in weight though his disease is progressing. Where loss of flesh has been marked enough to attract the attention of the patient or his friends phthisis ought to be one of our first diagnostic thoughts especially in the absence of any obvious cause for this symptom. And where this feature is present to a striking degree we are often reduced to one of three diagnoses, - tuberculosis, cancer, or diabetes - the differentiation of which is usually not a matter of much difficulty. But in early cases we may have to seek very carefully for loss of flesh: and here the examination of the subcutaneous tissue in the region of the shoulder-girdle muscles seems to the writer to yield the earliest signs.

Case 31. E.H. a weaver of 21 whose brother is consumptive was seen on the 23rd of November 1917 complaining of loss of flesh and colour and "indigestion" of two months' duration. "She has had no other symptoms and has no cough or spit. Her temperature and pulse are normal. Examination of the lungs is negative and her urine has been tested for sugar but none has been found. There is epigastric tenderness on palpation and in the left of the epigastric region there is vaguely felt a nodular mass which moves with respiration." The diagnosis of gastric cancer was made and was confirmed at operation a week later.

Here the flesh loss was extremely marked - over two stones - and the symptoms were not acute enough for tuberculosis of the lungs producing so grave effects in so short a time. Gastric ulcer was considered but there has been no haematemesis and the presence of the epigastric tumour did not fit in with that diagnosis.

Case 32. E.A. a publican of 50, two brothers and one sister of whom had died of phthisis, was seen on the 22nd of June 1917 complaining of illness of four or five months duration. "His previous health has been good but last year he had an "abscess at the lower end of the bowel" which is now healed; and since then he has never been quite the same. He has had a winter cough for the past 9 years but on this occasion it has not cleared up with the summer as it has always done before. He has lost energy, and colour, and his appetite for breakfast is less than formerly. He began dieting himself to reduce his weight last year and he has fallen from 16 stones 7 lbs to 11 stones 6 pounds in 12 months. His pulse is 80 and his temperature 98.2. There are bronchitic rhonchi all over the chest but under the left clavicle there is relative dullness with reduced respiratory murmur and fine inspiratory crepitations. These signs are found to a less degree in the left supraspinous fossa. Physical examination is otherwise normal."

Any one who has tried to reduce a patient's weight would be sceptical of such a gratifying result as this patient achieved. The persistence of the winter cough into the summer with accompanying signs of general decline is also noteworthy as it is a very common record of bronchitic cases who develop phthisis. This patient's sputum was later found to be positive;

and he is still maintaining his health after sanatorium treatment, which he was advised to undergo after the above examination.

(c) Loss of Colour. The anaemia of tuberculosis is very variable and its mere intensity is rather a measure of toxæmia and prognosis than a diagnostic guide. The commoner difficulties with this symptom are easily overcome. Simple chlorosis is often confounded with phthisis and vice versa; but the recognition of the fact that in pure chlorosis loss of weight is not a feature ~~(which)~~ ought to prevent us from culpably making this mistake. The anaemia of tuberculosis is not so readily amenable to iron as is ordinary chlorosis and this sometimes will serve as a warning that the anaemia is secondary to lung disease. To diagnose anaemia in a female consumptive is sometimes pardonable; but to label a male patient "anaemic" is often risky. The usual causes of anaemia in the male are few. Pernicious anaemia is rare - the writer has not seen a case in Lancashire among his suspects - and its victims do not lose much weight. Lead poisoning also does not appear among the writer's figures. Rheumatism, nephritis, and syphilis are usually apparent from the history and the urine examination. Apart from these causes tubercle is the great source of anaemia in the male in this country; and when we find ourselves about to diagnose "anaemia", "anaemia and debility", "anaemia and bronchitis", "anaemia and pleurisy", anaemia and stomach cough" we may be sure that we are on the point of overlooking tuberculosis, especially if the patient is a male.

Unobserved blood-loss is a fairly common source of error here. We not infrequently find cases of suspected tubercle where a little questioning leads to the discovery of bleeding piles or menorrhagia sufficient to account for the patient's symptoms. With gynaecological conditions such as endometritis and other inflammations of the female genital tract one is occasionally misled as these affections are not mentioned by women unless specifically sought out, and their accompanying languor and anaemia naturally prompt one to suspect tubercle.

Amenorrhœa is a symptom of anaemia and therefore secondarily a symptom of phthisis. It was an initial symptom in many female patients, especially in the insidious mode of onset. Its presence therefore should always lead

one to consider the possibility of phthisis and to ask after other symptoms of that disease. It occasionally happens that we get pregnant women referred to us on account of amenorrhoea, with the question of phthisis raised by their medical attendants. But it is much more common for the amenorrhoea of incipient tubercle to be overlooked or treated as a symptom of simple chlorosis.

The writer has had several cases of nephritis referred to him as possible consumptives on account of their pallor: and he has made this mistake himself. It is a good rule to examine the urine in all such cases of pallor where the cause of the anaemia is not apparent in the lungs.

Case 33. L.M. a laundry worker of 24 whose father had died of phthisis was seen on the 24th of July 1916 complaining of weakness and dyspnoea of about three months' duration. "Her previous history includes measles, pertussis, scarlet fever, pneumonia, and erysipelas. She states that she has developed a cough lately, but she raises no sputum. She is fat and very pale, and though she thinks she has lost some flesh this is not apparent on physical examination. There has been no loss of appetite, no haemoptysis and no night sweating. She has not menstruated for several months. Her temperature is 99.2 and her pulse 100. There is a systolic murmur present in the pulmonic area, the only other finding in the chest being medium rales in the lower fronts of both lungs."

Under observation in the Dispensary she was found to be "faking" her temperatures and pricking her gums to simulate haemoptysis. Her blood was characteristic of chlorosis; and her chief trouble was obstinate constipation on which croton oil up to 5 minims had no effect. Under treatment for chlorosis her blood and general condition improved and she was discharged after three negative examinations of her sputum when that could be obtained. Her weight did not increase under treatment a fact which told against the diagnosis of phthisis; and as the catarrhal sounds in the lungs cleared up with her blood improvement she was returned as a case of simple chlorosis.

Case 34. Mrs. E.J.D. a mill worker of 40 whose father had died of phthisis and whose brother was definitely consumptive was seen on the 4th of July 1917 complaining of weakness and loss of weight and colour of about 6 months' duration. She also suffered from dyspnoea and has some slight night sweatings. A week before being seen she had had an ulcerated throat and at that time had noticed some blood in her sputum. "Her temperature is 98.8 and her pulse 100. Physical examination of the lungs and heart is negative. She is very anaemic in appearance; her tonsils are reddened but there is no ulceration of the throat."

In view of her family history she was kept under observation, and it was discovered that she was suffering from haemorrhoids which bled with every motion though she had not noticed this before. Her temperature was normal and her sputum repeatedly negative. She has kept well till

the time of writing. In this case the diagnosis of tuberculosis had been made on insufficient evidence; and it is a good example of the rule that we ought to exclude blood-loss before ascribing anaemia in a middleaged person to constitutional disease.

Case 35. Mrs I.H. a housewife of 37 was seen on the 26th of May 1916 complaining of weakness and breathlessness. Her family history and previous health were good. "Two months ago she had a cold but she has now no cough or spit. She thinks she has lost some weight. There has been no night sweating and no haemoptysis. She is obviously anaemic. Chest examination is negative except for a systolic bruit best heard in the pulmonic area. Her urine is normal and physical examination otherwise negative."

She raised some sputum later but it was found to be negative. On inquiry she stated that she lost blood excessively at and between her periods. This symptom was investigated and she was found to be suffering from a uterine polypus. When this was removed she recovered her normal health and at present she is well.

Case 36. E.S. a weaver of 17 was seen on the 26th of May 1917 with a history of anaemia of one year's duration, during which time she had not much improved under treatment. "Her chief complaint is of langour; she says she has become thinner, and that she has had some undne sweating at nights. There is a slight cough but no spit. Her temperature is 99.4 and her pulse 98. The chest signs are not marked but under the left clavicle inspiration is granular in character compared with inspiration elsewhere. Physical examination is otherwise negative."

After a few weeks' observation during which her temperature reached 100 on several occasions this case was diagnosed as phthisis. Her sputum was thrice examined with a negative result; but during her residence in sanatorium tubercle bacilli were found in it. In this case most of the symptoms might have been explained by pure chlorosis. But this could not account for her loss in weight which her appearance confirmed; and she ought to have more definitely improved under her treatment. The temperature and the chest finding also pointed to something further. During her residence in sanatorium she menstruated for the first time. She has kept well since her return from that institution.

(d) Loss of appetite. This symptom is usually present to some degree in beginning disease of the lungs. In many cases indeed dyspeptic features obscure the others and lead to a course of treatment which fails to benefit the patient: and they are often regarded as the cause of the general physical decline. Perhaps the most common symptom of the dyspepsia of phthisis is simple lack of appetite amounting at times to a positive aversion to food. It occurs in most consumptives at some time

or other, Even where it is denied there will usually be found some falling off in the appetite for breakfast, for with anorexia, as with langour, the patient improves as the day proceeds. We should remember that at the age period at which phthisis usually pronounces itself organic stomach disease is comparatively rare, and functional gastric disorders are usually not of long duration. Therefore in the presence of a persistent loss of appetite with perhaps post-cibal discomfort and other dyspeptic complaints we ought carefully to consider the possibility of an ulterior cause, and look especially for signs and symptoms of incipient tubercle. In early phthisis with dyspeptic features the diagnoses which usually serve to conceal the truth are such as "Dyspepsia", "gastric catarrh and bronchitic", "anaemia and dyspepsia", "a stomach cough", and "dyspepsia and pleurisy". Such at least are some of the diagnoses which have proved fatal to patients who finally came under the writer's notice.

Case 37. J.H., a moulder of 51 was seen on the 16th of May 1917 with a history of illness of 10 months' duration, beginning with discomfort after food, and followed by loss of energy, flesh, colour and appetite. "He has noticed no haemoptysis and does not sweat much at nights; but he is definitely dyspnoeic on exertion. His temperature is 102.2 and his pulse 120. Physical examination reveals infiltration of the right upper and basal lobe and of the left upper lobe." His sputum contained tubercle bacilli in large numbers.

This is a good example of delayed diagnosis on account of the early prominence and the persistence of gastric symptoms; though the other features of the case and man's appearance were typical of phthisis, and he certainly ought to have been diagnosed after ten months' treatment for his stomach without any improvement.

Case 38. T.H.B. a labourer of 43 was seen on the 20th August 1915 with a history of three year's illness beginning with flatulence and choking sensations in the throat. "His appetite is fair; there is slight cough and spit; no haemoptysis or sweats; and no noticed loss of weight or colour. His temperature and pulse are normal. Physical examination of the patient is negative; and his sputum has been repeatedly examined with negative results."

This man had been under various institutions during three years. He had refused a gastrostomy based on the diagnosis of oesophageal obstruction, and in another Infirmary he was finally diagnosed as a case of early phthisis "confirmed by X rays". But obviously early phthisis after three years suffering was hardly a satisfactory explanation, and his temperature was never above normal during weeks of observation. It was noticed

in conversation with the patient that he was in the habit of swallowing air and advice on this point speedily put an end to his troubles. He has kept well ever since. Here obviously phthisis was a diagnosis of despair; but aerophagy is not an easily diagnosed condition, and the experiences of this patient are not unparalleled in others with the same complaint.

Case 39. M.J.B. a mill-worker of 30 with a good family and personal history was seen on the 5th of May 1916. She had been healthy until two years before, but since then she has never felt well and has been much troubled with dyspepsia. "During the past four or five months she has suffered from amenorrhoea, has lost strength, colour and flesh, and has noticed some unusual sweating at night. Her voice has become uncertain at times, and she has noticed postural vertigo on occasions as a new symptom in her complaints. Her temperature is 99.4 and her pulse 90. Both apices look shrunken but present no definite indications of intrapulmonary disease. In the region of the right scapular angle there is appreciable dullness, distinct reduction of respiratory murmur, and unduly granular inspiration as compared with inspiration elsewhere. Under observation she ran an occasional evening temperature of 99-100. Her symptoms were predominantly gastric, and consisted of lack of appetite, and post-cibal flatulence and discomfort. Her sputum was twice negative, but phthisis was diagnosed and she was advised to enter sanatorium, which she would not do. She was kept under observation at the Dispensary and on the 14th of November 1916 tubercle bacilli were found in her sputum. She is at present going slowly downhill, and the evidence of infiltration in the right lower lobe is now more definite."

This case is a good example of prominent gastric symptoms obscuring the true cause of the complaints, as she had been under observation and treatment by various physicians for two years before being referred to the writer as a possible case of phthisis. She is noteworthy, too, as an instance of basal phthisis which in the writer's experience is rare in adults. He cannot recall twelve cases in 6 years tuberculosis work. And this fact tended to make him hesitate to diagnose phthisis in this case.

(e) Feverishness. This is perhaps rather a physical sign than a symptom for patients do not often complain of feverishness unless when specifically questioned; and the thermometer reading which should be taken in every doubtful diagnosis is taken by the physician as a rule. The importance of the temperature in the diagnosis of tubercle has often been emphasized; and much has been written on the best way to take it. The writer cannot readily conceive of the difference between a rectal and a properly taken mouth temperature leading to the overlooking of early phthisis and therefore all his temperatures are mouth temperatures. In doubtful early cases he gets a four hourly record of the temperature taken for a few weeks, and has found this of decisive importance on several occasions. A bare record

of a single high temperature is of little use; though when a patient has had to walk some distance to the Dispensary and his temperature is taken when he arrives it is often found distinctly elevated in a way that is helpful in diagnosis. The two characteristics of the phthisical temperatures are its susceptibility to slight influences of a physical or psychical nature, and its persistence. The exertion of walking even may, as has just been said, definitely elevate the consumptive's temperature; and the visiting day fever is often noted on the sanatorium charts. The premenstrual rise of temperature is often well marked in phthisical women and the writer has occasionally found this of service in a doubtful diagnosis. The influence of emotional disturbance was well exemplified in a patient of the writer's who was the victim of advanced tuberculosis of both lungs and whose temperature after months of rest had fallen to the neighbourhood of 99 in the evening. On the 25th of September 1916 a Zeppelin passed over the institution and dropped bombs in the vicinity. Next evening this patient's temperature reached above 100; and this level was maintained till he left in a hopeless condition; a literal instance of how the phthisical temperature is "servile to all the skyey influences". The persistence of the temperature in tuberculosis is of great value in diagnosis. Where the symptoms are not very acute it may none the less be a very definite finding and where it persists for over a fortnight in such cases it is very often indicative of tubercle; though Osler has well said that in flabby fat girls a temperature of 99.5 to 100.5 may mean nothing. In the presence of acute disease in this country a fortnight's pyrexia reduces our diagnosis to one of three conditions, tuberculosis, enteric fever, and concealed suppuration. After that period an enteric case should yield a positive Widal reaction, and the writer must say that he has not found the differentiation between enteric fever and tuberculosis so difficult as the text-books would have us believe. Looking back on the one case in which he did make this mistake - though he made it in good company - he cannot say that the error was excusable or that the affair reflected much credit on the intelligences concerned. Hidden suppuration does not long remain hidden, though in the absence of a blood count malignant endocarditis may deceive the best of us. And on the ground of mere probability, tuberculosis being so much more common than the other two affections, our



diagnosis should always incline to tuberculosis where the case is really doubtful.

It has been asserted that in tuberculosis the morning temperature is subnormal and that this fact has a diagnostic value (60). But it seems to the writer that little can be based upon a subnormal morning record. Such a finding is very common in non-tuberculous patients, and in many patients suffering from debility of various causes whose other symptoms suggest tuberculosis-cases of bronchitis, for instance. In tuberculosis it is the swing of the fever curve that matters not the record at either end of the swing, if any aid is to be sought from the temperature chart beyond the points already mentioned.

Case 39. M.R. a mill worker of 27 was seen on the 21st of March 1916 complaining of weakness, loss of flesh, loss of appetite, and night sweats of 5 weeks' duration. "She has had increasing dyspnoea and her evening temperature reaches to about 103. She has noticed no cough or spit and has had no haemoptysis. Her temperature has been high since it was first recorded three weeks ago. She is obviously dyspnoeic and somewhat cyanosed. The examination of the chest reveals fine crepitations all over both lungs especially perhaps at the right apex; but there are no definite localized signs otherwise. Her heart is rapid but free from murmurs. She has lately become somewhat delirious at nights and she then sweats heavily."

This case had been diagnosed as enteric fever, but the Widal reaction proved to be negative; and she was too ill for enteric of 5 weeks duration in the absence of some fairly obvious complication. Her lung signs were too illmarked for typhoid also; and there was nothing very typical of typhoid in her history otherwise. The diagnosis made was acute military tuberculosis; and she died shortly afterwards with meningeal symptoms; though no sputum was ever obtained. The writer has had another case where enteric fever had been diagnosed but in which the signs of lung destruction were obvious and the sputum contained tubercle bacilli in large numbers. He has had no case of malignant endocarditis in his series; and none of enteric fever. On several occasions, however, he has seen cases in which the temperature had been slightly raised for two or three weeks and in which the only apparent cause was a septic conditions of the gums; when the pyorrhoea was attended to the temperature fell to normal so that the oral sepsis was probably the cause of the fever.

(f) Palpitation and Tachycardia. Cardiac symptoms are not often mentioned by consumptives but neurotic, dyspeptic, or feverish patients sometimes complain of palpitation. The dyspnoea of phthisis is not primarily a

cardiac phenomenon. Tachycardia is rather a physical finding by the physician than a matter of complaint with the patient. But its importance in the early diagnosis, as well as in prognosis is great, for it may appear even before the temperature chart indicates any fever. A record of the pulse rate should therefore be taken in every doubtful case. Where tachycardia is due to an intrinsic heart affection this is usually apparent from the physical examination; and other affections which cause rapidity of the pulse are as a rule differentiated from tubercle without difficulty. The writer has sometimes found that the possible presence of exophthalmic goitre is a source of confusion; and this is especially so in Lancashire where some enlargement of the thyroid gland is much more common in women than it is in Glasgow. The single record of a pulse rate at the first examination is of little use and may be worse than useless for the fear of being discovered to be consumptive is enough to raise the pulse rate of most people. Nor is the regulation pulse of 72 per minute a law of nature.

Case 40. W.R. a miner of 58 with a good personal and family history was seen on the 10th of October with a history of general decline in health of some six months duration; during which period he had lost energy, flesh, colour, and appetite, had developed a cough and spit and had noticed increasing dyspnoea on exertion. "He states that his feet swell slightly at night. His temperature is 99 and his pulse rate consistently remains about 120. The heart dullness is enlarged somewhat but not to a marked extent, and the first mitral and the second aortic sounds are accentuated. His arteries are thickened and there is a trace of albumin in the urine. Both lung apices are shrunken in appearance and at both the breath sounds are poor; this is more noticeable at the right where also there are some localized but vague rales. There are occasional bronchitic sounds at the bases".

In this case the majority of the symptoms could quite well be explained by the simple diagnosis of arterio-sclerosis with cardio-renal disease in a man older than his years. But the temperature and the pulse made one pause before excluding tubercle, though the chest signs were rather ill-defined for six months' active phthisis. There was not enough bronchitis in the chest to account for the temperature; and in cases with a high tension pulse, unless compensation has failed much more markedly than it had here, we expect rather a slow than a rapid pulse. The diagnosis was held over for a week when the record of his pulse and temperature was found to suggest tuberculosis, and tubercle bacilli had by that time been found in his sputum. Since then he has gone steadily downhill, having refused all institutional treatment.

(g) Dyspnoea. The dyspnoea of tuberculous lung disease varies with the precise character of the lesions. In acute miliary tuberculosis it forms with cyanosis twin symptoms of great diagnostic importance. In advanced consumptives and in fibrotic cases its source is easily discovered. In early phthisis dyspnoea as a diagnostic symptom has had different degrees of importance attached to it by different writers. Some deny that it is present in early phthisis at all. The writer cannot agree with this assertion for he finds that shortness of breath on exertion is present in the majority of his early cases. If we ask a case why he cannot walk so far as he once could we get one of two answers, "Weakness" or "Shortness of breath". The dyspnoea of early tuberculosis of the lungs is not due to tissue destruction; nor does it appear to correspond with the degree of anaemia present: nor is it due to intrinsic affection of the heart. In default of a better explanation we must refer it to toxæmia. But whatever its cause, the writer believes it to be a fact; and he always expects his early cases to tell him that when ascending an incline they have dyspnoea to a degree hitherto unknown to them... And it is to such new developments in the patient's experience that we ought specially to attend.

Case 41. S.M. a millworker of 49 whose family and previous histories were good was seen on the 1st of November 1915 with a history of dyspnoea, cough and spit of three or four years duration. "His cough is worse in fog and wintry weather and clears up somewhat in the summer, but his dyspnoea is always present and is becoming more troublesome. There have been <sup>no</sup> symptoms of general decline and he has had no hæmoptysis. He is slightly cyanosed, but is generally well <sup>fed</sup> and the dyspnoea is not obvious when he is at rest. His temperature and pulse are normal. The chest is barrel shaped and the respiratory expansion is poor. The heart dullness is illdefined and the heart sounds are poor, but free from murmur, the second pulmonary being distinctly accentuated. The percussion note is hyperresonant; the breath sounds are poor with prolongation of expiration, and there are sibilant rhonchi audible all over the chest."

This case had been notified as phthisis; but the symptoms and history did not indicate tuberculosis, nor was there anything in his temperature or pulse records to corroborate this diagnosis. His sputum was repeatedly negative, and he was returned as a case of emphysema and bronchitis. The reasons for the diagnosis of phthisis were not clear; but the dyspnoea was marked enough to render him permanently unfit for work, and, as this is unusual with pure bronchitis, tuberculosis may have been invoked as the cause of it. When the diagnosis of phthisis is made on the ground of obvious dyspnoea the true condition usually bronchitis secondary to cardiac insufficiency.

(h) Sweats. The characteristic night sweats of phthisis are found in rapid and in progressive disease. Their presence in early phthisis has been denied; but the writer finds that in many early cases occasional night sweating is found on inquiry to be present, and to have been noted by the patient when he had no suspicion of being the victim of the disease. Such a question is therefore worth putting to suspect cases. The tendency to sweat varies very much in different people, and we often find sweat dropping from the elbows of patients under examination even when such patients are not tuberculous at all. The record of night sweating in children has of course a much less diagnostic value.

(i) Giddiness. The writer is not sure that giddiness is a genuine symptom of early tuberculosis of the lungs; and it does not appear to be claimed as such by any authority. But on one occasion he examined an early case of phthisis in which the sputum was positive and in which the "presenting symptom" - as Cabot happily calls it (61) - was that of giddiness. Since then he has asked his patients whether they had similarly suffered. It seems to be present in many early cases to varying degrees. In many it was noted only or chiefly on changing to the upright position; but in others it was definitely troublesome. It seems to last only a few seconds: but it is a new development in the patient's life and as such it deserves attention. One patient who was a window cleaner gave up his occupation on account of it; and in another it was marked enough to cause occasional difficulty in getting to and from his work. The tuberculous toxin is a powerful vaso-dilator, and it is possible that this action may give rise in some cases to vertigo. Giddiness may be due to many causes, but the writer has found it present along with other symptoms of phthisis in so many of his early cases that he makes a point of questioning his suspects as to its existence in their personal history. It was present in at least half of cases in which it was specially sought for.

Case 42. W.D. a clerk of 29 whose family history was good, and whose personal history included an attack of rheumatism three years before was seen on the 15th of May 1918. "For many years he has been troubled with winter bronchitis but recently he has had very little cough or spit. Two months ago he consulted his doctor on account of giddiness which had appeared for the first time and had become distinctly troublesome. He says he has had no definite loss of weight or colour; and only slight loss of energy and appetite. There has been no haemoptysis. His temperature and pulse are normal, his heart sound<sup>s</sup>

and his urine clear. There are rare general rhonchi in the chest, but under the left clavicle there is reduction of the respiratory murmur with localized and persistent inspiratory rales. His sputum contains tubercle bacilli."

Whether the giddiness here had anything to do with the chest findings or not the writer is not prepared to say. But it was a very definite symptom and it had no obvious cause in the ears or nervous system.

Case 43. E.J. a miner of 48 whose father and brother had died of phthisis was seen on the 26th of July 1918 complaining of weakness of indefinite duration and cough and spit of one month's duration. "His cough is now lessening and his sputum is much less than before. He has been much troubled with giddiness for many months and also with "pleurisy pains" in both sides of the chest. His health has been good until three years or so ago when he began to be troubled with "rheumatism in the legs" which is still present at times. He has obvious double ptosis which he and his friends have noticed as a new development in his case. Examination of the lungs and heart is negative. But investigation of the "pleurisy pains" makes it plain that these are of the nature of a girdle sensation, while his leg rheumatism turns out to be lightning pains. The light reflex is lost, and the knee jerks gone; there is a tendency to a positive Romberg sign. When specially questioned he admits having had a chancre twenty years before, which he did not think worth mentioning "as it went away". He was returned as case of diagnosis not confirmed, tubercle bacilli not having been found in his sputum; and the cause of his symptoms being plain.

The symptoms reviewed above appear to the writer to form the main features in the insidious onset of pulmonary tuberculosis. There are others, no doubt, but they do not appear frequently enough to deserve a diagnostic mention; pains in the legs, for instance, have been noted as the chief complaint in three or four early cases of the writer's. But attention to those we have just considered would lessen greatly the number of patients whom we unwittingly permit to drift into incurable consumption.

2. The Catarrhal Mode of Onset. We have every-day experience of the catarrhal mode of onset in phthisis: and we have frequent occasion to note that in the presence of long-standing cough and spit super-added to some of the symptoms dealt with above the diagnosis made is not that of tubercle but of some lesser ailment. The differentiation of the various catarrhal affections of the chest has already been considered and need not be further discussed. In the catarrhal mode of onset the duration of the symptoms ought specially to be considered, for we cannot tell whether a "cold" is merely a "cold" or the beginning of consumption until we have watched the progress of the patient for several weeks. If the catarrhal symptoms persist for a month without abating we should set ourselves to discover the cause of this; and

in particular we ought always to look for the evidences of phthisis. "Bronchitis" or "Bronchial Catarrh" are two very common labels for what subsequently turns out to be tuberculosis; and we have already seen the points of difference between them and the graver disease. Pseudo-diagnosis in this mode of onset is very common; "Bronchitis and anaemia", "bronchitis and pleurisy", "bronchitis and gastric catarrh", "bronchitis and influenza" are in the writer's experience the commoner of such "symptomatic" diagnoses which conceal the presence of tubercle. "A cold that did not clear up" and "One cold on the top of another" are the usual accounts given by the patients of the catarrhal onset of phthisis. This mode is hardly in need of exemplification for the one great lesson to learn from it has already been indicated - that the persistence of a chest catarrh should rouse our suspicions that the condition is more than a transient catarrh of the bronchial tubes.

In this connection also there falls to be emphasized the great importance of laryngeal symptoms in early tubercle of the lungs. Consumptives are notoriously prone to laryngeal catarrhs which are by no means always specific, and such catarrhs not infrequently precede definite evidence of lung mischief. A definite functional aphonia is also found in many such patients especially in women, and the writer has found such conditions of distinct help in deciding on the presence of pulmonary disease. There may be merely a slight huskiness leading to a frequent clearing of the throat, but the important point is that this has been a new development and of sufficient mark to be readily recalled by the patient when questioned. Even when other laryngeal symptoms are denied there will sometimes be found a loss of the singing voice, and to this also the writer has come to attach some diagnostic importance: some of his cases had definitely to give up singing on account of this symptom even before they had any suspicion of suffering from any disease. All such laryngeal symptoms therefore should be carefully investigated in the presence of a story of general decline in health.

Case 44. W.Mc. a bank clerk of 21 whose father had died of phthisis was seen on the 25th of August 1915 as a case of tuberculous neck glands. His previous health had been good. The glands had been prominent for three years, and had been operated on in January 1914. There were not

troublesome and he was advised to attend the Dispensary for observation purposes: which he did until June 1918. During that period he kept well and presented no signs of active disease in his glands, chest, temperature or symptoms. He was again seen on the 18th of September 1918, when he stated that he had had influenza six weeks before which had produced a cough and spit; but that these were now practically gone and that he felt better than before: he had increased half a stone in weight in the three months. He looked better than formerly; but as his voice was distinctly more husky than before, he was again examined and under the right clavicle there were dullness, reduction of the breath sounds and fine crepitations after cough. He was advised to enter sanatorium, and his sputum was later found to contain tubercle bacilli.

In this case it was the alteration in the voice alone that made one suspect tuberculosis of the lungs, even though the other features of his recent history seemed to indicate improvement. His case is also noteworthy for the evidently good resistance to tuberculosis of the lungs shown by a patient who had been the victim of previous tubercle and who had recently passed through an attack of influenza. Most of the writer's tuberculous cases who were attacked by Influenza fared very badly indeed.

Case 45. Mrs E.M. a weaver of 32 was seen on the 5th of August 1918 complaining of general decline in health and hoarseness of some fourteen months' duration. Her family history was good; she had always been anaemic and had inflammation of the lungs at 18. During this illness she has lost energy, colour, and flesh; her appetite has remained good. She has had some recent cough and has noticed her sputum slightly stained on two occasions. There are no other definitely phthisical complaints. Her temperature is 98.8 and her pulse 112. Chest examination reveals nothing definite though there is some doubtful dullness at the left posterior apex. There is a slight mitral systolic bruit but no cardiac enlargement. Laryngeal examination revealed superficial ulceration of the lingual side of the epiglottis and some reddening of the cords anteriorly."

Here the chest signs and general condition did not correspond with phthisis of 14 months' duration and with laryngeal involvement; and the throat appearance suggested syphilis. On further inquiry she stated that her husband had treated her for "rheumatism" eighteen months before, the treatment taking the form of a popular "Blood Mixture" in which potassium iodide is the chief ingredient. Her sputum was negative; and her blood gave a positive Wassermann reaction.

It need hardly be said that any kind of cough or spit may be found in pulmonary tuberculosis. In the early cases however cough and spit may be denied - in rare cases they may be actually absent - though some clearing of the throat is usually admitted.

"Congestion of the lungs" in an expression the loose use of which is fraught with much danger in early phthisis. Congestion of the lungs is a pathological condition; it is a sign, and a sign to be explained: it

is not a diagnosis. Too often its use is the cause of fatal delay in diagnosing consumption.

Case 46. V.B. a mill worker of 20 with a good family history was seen on the 5th of April 1917 with a history of illness of ten months' duration. Her previous health had been good until an attack of appendicitis seven years before following which she had "nervous debility" for several months. "In May 1916 she had a bad tonsillitis and her recovery from this was not complete when she began to suffer from left sided "pleurisy" pains". Her symptoms include loss of energy, flesh, appetite and colour; she had initial amenorrhoea and has noticed definite hoarseness; she has a slight cough and spit which has sometimes been blood stained. Her temperature is 99.4 when at rest in bed and her pulse is then 110. On examination there was distinct dullness with reduction of breath sounds and increase in vocal resonance and expiration over the left basal lobe. The apices were clear. Physical examination was otherwise negative. Her sputum contains tubercle bacilli.

This case had been seen by a consultant physician five months before and he was stated to have diagnosed congestion of the lungs. It is noteworthy also as a definite case of phthisis beginning at the basal lobe; and the previous history of "appendicitis" may be significant especially when followed by nervous debility. The initial tonsillitis may perhaps also be noted as it seems to be not uncommon in the catarrhal onset of pulmonary tubercle. The writer can recall about six cases where such an attack immediately preceded the first evidences of chest trouble.

3. The Pleuritic Mode of Onset. Almost every consumptive at some time or other in the course of his disease complains of pleuritic symptoms: and a definite attack of pleurisy may prove to be the herald of intrapulmonary mischief, though it often follows vague symptoms of general decline in health. The causes of definite inflammation of the pleura are not many, and of these tuberculosis is one of the most important and perhaps the least readily recognized. The tubercle bacillus may give rise to any kind of pleurisy and to any kind of pleuritic effusion; but the stealthy onset of a large effusion is characteristic of tuberculous disease, and equally so is the presence of a definite apical pleuritis. Where pleurisy asserts itself "for no particular reason" tuberculosis is the most probable cause; and in such cases, more especially if there are other evidences in the chest or history which are consistent with the diagnosis of phthisis, we ought to base our treatment on that diagnosis. If we omit



to do this we shall almost certainly have cause to regret it.

We have already seen that pleurisy-like pains may be complained of in intra-thoracic cancer; but the most common errors in diagnosis here appear to be due to treating the pains as rheumatic in character, and calling the condition "Rheumatism of the muscles" or even "Rheumatism in the shoulder". "Pleurodynia" is a loosely used term which often serves to conceal the true condition. And herpes before the appearance of the eruption may lead us to diagnose pleurisy if we do not inquire into the precise nature of the pain and its relation to the respiratory movements.

Case 47. W.W. a carter of 17 with a good family and personal history was seen on the 30th of July 1918 complaining of illness of five weeks' duration. "The illness began suddenly with shivering, headache, and pains in the right side of the chest. It was followed by slight cough and spit which is now lessening; and he states that he has lost energy, flesh, colour and appetite, though these symptoms have not been marked. He has some dyspnoea on exertion, has noted some initial night sweating, has been unusually hoarse at times; and has been subject to transient vertigo. His temperature is 99 and his pulse 112. The apices are clear but at the right base there is some appreciable dullness with adventitious sounds accompanying both respiratory phases. These sounds strike one as pleuritic though he has no chest pain at present. There is no reduction of voice or breath sounds over the dull area. Physical examination is otherwise negative and his urine is clear. He was recommended for sanatorium".

In the meantime he left the district having improved markedly in general health and having increased in weight by over a stone. His sputum had been twice negative, and before he left his cough had gone and his chest was almost normal on examination. He returned in February 1919, and stated that his cough and spit had reappeared and that he was feeling run down. Physical examination revealed a definite patch of infiltration at the right apex: and his sputum was again examined and tubercle bacilli were found. Here the pleurisy definitely preceded any evidence of intrapulmonary disease: and the remarkable improvement in general health was perhaps confirmative of the diagnosis of tubercle.

4. The Haemorrhagic Mode of Onset. When haemoptysis is the first warning to the patient that something is amiss we often find that other evidences of disease are present either in the history or in the chest. But it is not uncommon for a patient to consult us on account of a lung bleeding when, if we are honest with ourselves, we cannot make out any definite

signs of localized chest mischief. Such a case is therefore an early one, and by treating the haemoptysis seriously we have the best chance of affecting a cure. It is still too common a practice to dismiss such a bleeding as "a burst blood-vessel"; a course which often spells disaster for the patient.

The bleeding of early phthisis may consist of mere streaks in the sputum, such as could be accounted for by severe coughing in any lung affection. In the absence of any indication of symptoms or signs of phthisis, it may be justifiable to pursue a watching policy in such a case. But certainly the patient should not be lost sight of: and where the writer takes this risk he advises the case to call for periodic examination. for a year or so. Where there is raising of a drachm or more of blood the problem becomes that of eliminating non-pulmonary sources of bleeding and, when that can be done, the diagnosis of phthisis should be made. Any other course is almost certain to cause subsequent regrets. In the writer's experience heart disease - especially mitral stenosis - is the commonest cause of phthisis being diagnosed erroneously on the ground of haemoptysis: and as a rule the heart condition only needs to be sought to be discovered. Bleeding from the stomach has rarely caused confusion in his cases, though the mistake of referring a true haemoptysis to the stomach is fairly common. Bleeding from septic teeth occasionally causes a wrong diagnosis; and he has had two cases where the source of the bleeding was the nose. Pharyngitis appeared to be the cause of streaked sputum in several instances. And it has already been pointed out that in persistent and deep-seated bronchitis we get haemoptysis with greater frequency than is generally recognized. The writer has under observation at present a case of almost daily haemoptysis, which has persisted for years, and in which the chest condition is one of bronchiectasis. The red current jelly sputum of lung cancer though not often seen appears to be diagnostic in some degree. The diagnosis of "vicarious menstruation" should not be applied to haemoptysis as it sometimes is, though there is this justification for that diagnosis that pulmonary haemorrhage seems to be more frequent at the time of the periods. In the bronchiectasis case just mentioned there is a definite monthly exacerbation of the bleeding, while another case of the writer's

had a monthly haemoptysis for over a year. Her chest signs were variable and bronchitic in character and her sputum was repeatedly negative; but as her brother had died of acute phthisis a few weeks before she was seen, she was treated as a case of tuberculosis as was the only safe course. Sanatorium treatment restored her normal menstruation and put an end to her haemoptyses.

Case 48. T.S., a clerk of 22 with a good family and personal history was seen on the 11th of August 1916. "He states that he has been run down for some time and has noticed a slight cough and spit. He is stout and says he has not noticed any loss of flesh, though there appears to have been some wasting in the region of the pectoral girdles. He thinks he has lost colour. A week ago he coughed up about a tea-spoonful of blood without any straining. His history is otherwise negative; and his temperature and pulse normal. The only chest finding is that of slight relative dullness in the left supra-scapular region where also there is some reduction of respiratory murmur, and vague inspiratory rales. As no other source of the bleeding could be found the diagnosis of phthisis was made; though his medical attendant was sceptical and diagnosed the case as "sexual neurasthenia", for which indeed there was some justification in the patient's history and his obvious nervousness about himself. His sputum was negative."

This patient went to sanatorium and did well in spite of his over-anxiety about his condition. On the 4th of April 1918 his sputum was examined with a positive result, though his chest signs had not much altered in the meantime. At present he is maintaining a fair level of health.

Case 49. Mrs L.W. a milliner of 35 was seen on the 18th of September 1917 having coughed up a few drachms of blood a week before. "She has had a tendency to bronchitis since childhood but was otherwise healthy until three years ago when she developed exophthalmic goitre the cardinal signs and symptoms of which are still present. She thinks she has lost some energy lately, but there has been no noticed loss of flesh, appetite, or colour. She has always been somewhat short of breath; she has not noticed any increase in sweating during the past few months. She has a cough and spit. Her temperature is 98.6 and her pulse 110. The heart sounds are pure and there is no marked enlargement of the cardiac dullness. All over the chest there are bronchitic sounds, more marked at the bases especially the right, but no localized evidence of lung destruction. Her history is not otherwise suggestive of phthisis; and except for the signs of exophthalmic goitre physical examination is otherwise negative. Her sputum does not contain tubercle bacilli."

The bleeding had occurred in an attack of "acute bronchitis". Under observation the chest signs cleared up and <sup>she</sup> regained and still maintains her normal level of health. Her sputum has never been positive nor have signs of intra-pulmonary disease ever been detected. The symptoms of Grave's disease are less active now than when she was first seen, so that it is possible that the primary cause of the haemoptysis was an attack of cardiac dilatation such as occasionally gives rise to lung bleeding in that affection. At all events her course has been observed

for many months and nothing has appeared to substantiate the diagnosis of phthisis.

It is evident from the cases quoted above that the conditions which we usually confuse with tuberculous disease of the lungs are not out-of-the-way affections like hookworm disease and echinococcus but plain, everyday maladies, the recognition of which generally demands no unusual skill. In a series of 500 patients who had been wrongly diagnosed as consumptive the real conditions were found to be as follows.

Bronchitis, 137, Mitral regurgitation, 66. Mitral stenosis, 54. Gastric affections, including gastric ulcer, 35. Gynaecological conditions, 19. Arterio-sclerosis, 14. Cancer, 14. Asthma, 11. Laryngitis, 11. Nasal conditions, 9. "Colds", 9. Rheumatic affections, 9. Lobar and lobular pneumonia, 9. Spinal curvature, 7. Nephritis, 6. Menopause, 6. Neurasthenia, 6. Bronchiectasis, 6. Pharyngitis, 6. Unobserved blood-loss, 6. Syphilis, 6. Naso-oral bleeding, 5. Diabetes, 5. Empyema, 4. Aortic disease, 4. Influenza 4. Oral sepsis, 3. Pregnancy, 3. Aneurism, 3. Locomotor-ataxy, 3. Chlorosis, 3. Exophthalmic goitre, 3. Myocarditis, 2. Emphysema, 2. Hodgkin's disease, 2. Epilepsy, 2. And one case each of Neuritis, Purpura, Acromegaly, Hepatic Cirrhosis, Lung abscess, and Progressive Muscular Atrophy.

The symptoms of pulmonary tuberculosis which we have just reviewed may be tabulated as follows.

1. Loss of energy
2. Loss of flesh
3. Loss of colour
4. Loss of appetite
5. Pyrexia
6. Tachycardia
7. Dyspnoea
8. Sweats
9. Vertigo (?)
10. Cough
11. Spit
12. Pleuritic symptoms
13. Haemoptysis

It is not suggested that this is the order of their appearance, or that they rank as of equal value. A definite, inexplicable haemoptysis, for instance, is the most conclusive of all, and forms the nearest approach we have to a symptom pathognomonic of phthisis. But any or all of these symptoms may precede the appearance of physical signs in the chest; and the greater the number of them present in any doubtful case the greater is the probability that the case is one of phthisis. In the presence of a group of such symptoms one is well-advised to ask himself the question: "If not tubercle, what?"

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SUMMARY AND CONCLUSIONS.

In the preceding pages it has been sought to show:

1. That the need for early diagnosis in pulmonary tuberculosis is still as insistent as ever.
2. That the more modern methods of examination have dealt with the objective aspect of the diagnostic problem. And that of these methods
  - (a) The refinements of ordinary physical examination of the chest have added little of value to the recognized methods of proved utility.
  - (b) The methods based upon laboratory procedures, with the exception of the bacteriological examination of the sputum, are generally either indecisive or over-complicated, or both: and that their value is still in debate among experts.
  - (c) The tuberculin tests are chiefly valuable when negative, and none of these can safely assure us of the presence of active tubercle which is the end of our diagnostic search.
  - (d) That the radioscope has a limited value in the diagnosis of early phthisis, that its use should be confined to experts, and that the results obtained by them should be utilized only as ancillary to the ordinary clinical examination.
3. That all such methods based upon objective findings do not aim at the beginnings of tuberculous disease.
4. That as the first evidences of lung disease appear to the patient in the form of symptoms, it is to the analysis of these symptoms that we must look for the earliest diagnosis in phthisis. This contention is further strengthened by the facts:
  - (a) That in pulmonary tuberculosis symptoms do generally precede evidence of physical damage to the lung.
  - (b) That the presence of symptoms indicates active disease, in which particular many of the objective methods fail.
  - (c) That such diagnosis from symptoms is available to the general practitioner who first sees the phthisical patient and who has therefore the chance of the earliest diagnosis.
5. That as no one symptom is pathognomonic of phthisis it is the presence

of a group of symptoms that we must seek.

6. That such groups may be found among the long recognized symptoms.

(a) of general decline in health, including pyrexia, tachycardia, dyspnoea and sweats, and perhaps, vertigo.

(b) of pulmonary catarrh.

(c) of pleuritic manifestations.

(d) of pulmonary haemorrhage.

7. That the simple duration of such symptoms has a distinct diagnostic value.

8. That while all available data from all available methods of examination should be utilized when necessary in the examination of the patient, it is possible often to make a certain diagnosis on the basis of symptoms alone while the other methods are negative.



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