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## THE BACTERIOLOGY OF TUBERCULOSIS.

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IT is, to-day, but a few months under twenty years, since Robert Koch first published the results of his investigations upon the etiology of tuberculosis, in the *Berliner klinische Wochenschrift*, and although our knowledge of the disease and its bacteriology has slowly progressed since that date, his work remains as one of the best examples of careful and thorough investigation before publication, that we know of. In the case of no other disease have the foundations of etiology been so well laid; in fact, if we seek for comparisons, the best is Koch's own work on anthrax, the publication of which led to his removal from a country practice to the directorship of the Hygienic Institute in Berlin.

As a result of these studies we were taught how to recognize the bacillus in the tissues, and how to cultivate it in artificial media and although we now have a variety of staining methods, they are all largely based on the indications given in Koch's early articles; and whilst we have found that the demands of the bacillus in regard to food *in vitro* are much less exacting than believed by him, still for luxuriant culture our best methods approach those given in 1882.

It is hardly necessary in this article to give a detailed account of the processes of staining and cultivating the bacillus, which may be found in any elementary textbook, but it may be well to touch briefly on certain points which seem to have a bearing on the etiology of the disease and on the relationships of the organism to other forms.

As first described, we recognized the bacillus of tuberculosis as a slender, unbranched rod, straight, or slightly curved, which took the stain used to demonstrate it with difficulty, but which retained that stain with marked tenacity when subjected to decolorizing reagents such as alcohol or acids.

It was however soon noted by a number of observers, that the organism did not always show this unbranched character, but that sometimes in the tissues, more often in the cultures, it showed a tendency to form short branches, which led to a doubt as to the advisability of classifying it with the other bacteria. Whether this branching is to be considered true branching or not, its existence is undoubted, and gradually extending observations have shown that not only the bacillus of tuber-

culosis but a number of other forms, such as the actinomyces organism, the smegma bacillus, and such organisms as Rabinowitch's butter bacillus, and those found by Møeller in grass and fæces show the same branching. On this account and on account of a resemblance in staining and cultural characters, but more important still because of a tendency which they all have of giving rise to a chronic proliferative inflammation with the formation of granulomata more or less like the typical tubercle, these organisms have been classed together. Lehmann and Neumann suggest that all these organisms be classified apart from the typical bacteria as Mycobacteria; by others they have been called Streptothricaceæ.

Although these facts are of interest in determining the affinities of the bacillus, they do not, of course, in any way affect its position as the cause of the disease tuberculosis, but on the other they give us, in our ability to study its near relatives, a means of throwing light upon such biological problems as the production of proliferative inflammations by bacteria, and the question of natural and acquired immunity to these organisms.

In the first morphological studies upon the bacillus of tuberculosis, it was observed that certain oval areas could not be stained by any possible method, and subsequent observations showed that these areas, although not always found, were often present in old or degenerating individuals. These were interpreted by Koch to be spores, similar in character to the spores of the anthrax bacillus; the spores of the anthrax bacillus are more difficult to stain than the growing bacillus and are oval in form, and one would, therefore, expect the spores of the bacillus of tuberculosis to show a similar resistance to stains. Another observation which seemed to support this view, that spores were formed by the tubercle bacillus, was the difficulty of demonstrating them in lesions undoubtedly of a tuberculous nature; it being argued, that since the material from such lesions would produce tuberculosis in animals, whilst microscopic examination failed to show the organisms, these must be present in some form which resisted staining, and so presumably as spores.

The spore of a micro-organism is a form in which it is able to resist unfavorable conditions better than in the vegetative state and this resistance is typically shown in the greater resistance to heat of the anthrax spore. The tubercle bacillus is probably more resistant than many of the ordinary forms of micro-organisms, but as far as we know, it never in any form shows that resistance to heat and other bactericidal agents which is characteristic of the spores of anthrax or tetanus. We consequently have no evidence that spores exist.

The tinctorial characters of the tubercle bacillus have been found to be due to the impregnation of the cell membrane with fatty acids, probably also with a wax-like substance, and perhaps also with a material

allied to chitin. The presence of similar substances accounts for the staining characters of the related forms of the group of *Mycobacteria* and may possibly have an important bearing on the peculiar type of inflammatory reaction which is characteristic of the whole group.

The bacillus, although somewhat more resistant to adverse conditions than some of the more delicate organisms, is, at the same time, comparatively easily destroyed by bactericidal agents. Direct sunlight for about twenty-four hours will kill it almost certainly and Theobald Smith has shown that a temperature of 60° C for fifteen minutes is fatal to it, when suspended in bouillon or milk, whilst an exposure to 70° C is only necessary for ten minutes to achieve the same result. Drying slowly kills the bacilli in sputum, first apparently lowering the virulence.

The problem of the isolation of the toxins of the bacillus and their chemical nature presents the most difficult problem with which we have to deal in attempting to explain the pathogenic phenomena associated with the disease. One of the results of the first attempts was the production of Koch's original tuberculin. Although this extract of the bacilli must be considered a specific product on account of the characteristic temperature reaction which results from its injection into tuberculous animals, yet it is exceedingly doubtful if it presents the true toxin of the organism. The method of manufacture is altogether too gross, the prolonged boiling necessary, too certainly destructive to any substances which we now recognize as toxins, to expect that such a product could be the original poison present within and about the bacilli.

A much more probable representative is the newer tuberculin R of Koch, which was obtained by mechanical trituration of the bacilli and a similar substance has been obtained by Hahn, who triturated the bacilli with quartz sand and then subjected them to enormous pressure, obtaining a clear extract which he called tuberculoplasmin.

The tendency of tuberculous lesions to assume a local character—I mean local in regard to the distribution of the bacillus, and the fact that Prudden and Hodenpyl and following them many others observers succeeding in producing histologically typical tubercles by the injection of dead bacilli (although in the majority of experiments without caseation) points to the fact that the specific poison of the organism is so intimately associated with its protoplasm that it is not liberated until the bacillus begins to disintegrate and renders it probable that it is of the nature of a nucleoprotein.

At the same time it is not necessary to conclude that this toxic substance is in itself specially resistant, since Hahn's tuberculoplasmin is destroyed by a temperature of 60° C., but the disintegration of the organism and the consequent liberation of the toxin is hindered by the

peculiarly resistant nature of the cell membrane, thus giving rise to a more chronic type of inflammation with, as a result, a proliferation of the fixed connective tissue cells. This same explanation holds for the related organisms of the group which give rise to the so-called pseudotubercloses.

The bacillus of tuberculosis as found in human tissues presents considerable variation in virulence when isolated and tried on laboratory animals, but the variations in virulence does not always correspond to the degree of acuteness of the lesion from which the organism has been isolated, for instance from two very similar types of lymphadenitis bacilli of quite different virulence have been isolated. The subject of the virulence of the bovine variety for man is a question which is not yet settled, but there is quite as much evidence in favor of this variety being more virulent than the human form as for the contrary opinion expressed by Koch at the London Congress of Tuberculosis. In tuberculous lesions in man it is a remarkable fact that the bacilli are often met with most sparingly. In a tuberculous lymph gland, it sometimes requires a very careful search to find an occasional bacillus in a giant cell or in one of the epithelioid cells. The number of bacilli which we find in sputum are evidently due to multiplication in cavities and similar situations and it is very rare to find in man the enormous numbers of organisms which we commonly see in the tissues of experimentally infected animals. Recently in some experiments upon the production of inhalation tuberculosis in guinea pigs, one of Flügge's pupils met with a few caseating bronchial glands with very few bacilli, in certain of his animals. As he points out, these lesions probably more closely approach the ordinary conditions of inhalation infection in man, than the usual animal experiments show. This difficulty of demonstrating the bacilli in certain human lesions was used as an argument in favor of the formation of spores. But as pointed out above there is absolutely no evidence for the formation of spores and in every tuberculous lesion, careful search will reveal the bacilli even if few in numbers. It may be that the methods of fixation of the tissues may have some influence upon the staining of the bacilli *in situ* but all our knowledge of the organism seems to point to the ability of comparatively few individuals setting relatively severe pathological changes

In the etiology of the different forms of tuberculosis, the presence of other bacteria plays an exceedingly important part. Clinicians have long been convinced that except where large numbers of virulent bacilli invade the tissues, as in miliary tuberculosis, tuberculous meningitis or caseous pneumonia, the pure tuberculous process is one which tends towards recovery and consequently is readily treated. But where other organisms

are added on, as is probably almost always the case in phthisis, the problem is entirely altered. This is specially well shown in the tuberculous disease of bones and joints where the pure infection is so often treated so successfully by surgeons, yet when pyogenic organisms gain entrance to the tissues adequate treatment presents the greatest difficulties.

The bacteria which play the most important role in these mixed infections are the staphylococci, the streptococci, pneumococci and probably also the pneumobacillus of Friedlander and its allied forms. In phthisis these organisms are frequently found in the cavity wall influencing the pathological changes set up there and always about the tuberculous focus in the pneumonic areas, according to Sata in a recent paper in Ziegler's *Beiträge* the important factors in the characteristic catarrhal pneumonia; here they are often present alone or mixed with the tubercle bacilli. Indeed as Sata points out the disease phthisis is usually only at its inception a pure tuberculosis, and the pure tuberculosis of the lungs which is occasionally met with at autopsy is neither clinically nor in its pathological histology to be classed as phthisis.

The significance of these mixed infections in pulmonary tuberculosis, although recognized for a number of years, is only now beginning to bear fruit in the modern methods of handling the disease. Sprengler in one of the early papers on mixed infections in phthisis showed how valuable was the climatic treatment as carried out in Davos Platz, for these secondary infections. The first evidence of improvement was the disappearance of these secondary organisms from the sputum. The exposure of consumptive patients to the air of small, badly ventilated hospital wards, exposed not only to other patients of the same class but to all the varied infections of such a place, with coughing, spitting, talking patients all about them must mean the continued re-infection of lung cavities and pneumonic foci with repeated doses of virulent organisms, which must have a most serious influence on the course of the disease. And although an open air treatment of consumptives in verandahs, balconies and temporary shelters, in towns and cities may be a distinct advance on the handling of these cases in hospital wards, yet here also, the dust laden atmosphere of cities is a menace. One often sees practical evidence of this in the difficulty which many so-called cured consumptives have in returning to the cities after successful treatment in sanatoria.

A discussion of the bacteriology of tuberculosis would hardly be complete without a reference to the ways by which the bacilli gain entrance into the body.

For many years the hereditary transmission of the disease was accepted by the profession to the exclusion of all other methods of in-

fection; with, however, an increased knowledge of the infecting agent and especially as a result of experimental investigation, it was demonstrated that transmission from male parent to offspring, *i.e.*, by infection of the sperm cell does not occur. From female parent to offspring infection may be transmitted through the placental circulation especially at the time of birth but not by direct infection of the ovum. This form of transmission can hardly be called congenital but rather an intrauterine infection.

Traumatic infection is an occasional source of the disease but such introductions of the bacilli are rarely of a serious character.

Infection through the alimentary tract undoubtedly sometimes occurs and has been demonstrated by experimental evidence, but as the great source of primary intestinal tuberculosis is probably infected milk, the whole question is still in a state of uncertainty on account of the contention of Koch that the bovine bacillus has slight virulence for man. This question which has aroused considerable discussion during the past summer, owing to the stand taken by Koch at the Congress of Tuberculosis, depends upon the difference in virulence for different animals of the human and bovine organisms. This was first clearly shown by the work of Theobald Smith, of Boston, and his work has been confirmed by others including Koch, but the conclusions which the latter drew are hardly justified by the facts at our disposal.

The bovine variety of the bacillus is more virulent for cattle and the ordinary experiment animals of the laboratory than the human form. But this is hardly good evidence that the bovine bacillus is consequently not virulent for man. The contrary opinion might be held from the evidence with perhaps better right, but before a definite opinion can be formed we must have more facts; especially we require more accurate clinical observations and fuller studies of the virulence of cultures from cases of alimentary and other forms of tuberculosis in young children and perhaps also evidence as to the virulence of the two varieties for such animals as the anthropoid apes.

By far the most important result of modern investigation, however, is the clear demonstration of the commonest method of human infection, *viz.*, by the respiratory tract. To Cornet, in his studies upon tuberculosis among the nursing classes of Germany, belongs, perhaps, the greatest credit for placing the whole question upon a thoroughly scientific foundation. Yet Cornet, as will be shown, did not properly appreciate the factors in respiratory infection in giving too much weight to the danger from dried sputum. His investigations, and those which followed had, however, this result, that the public were made fully aware of the danger

from the sputum and the practical outcome has been a decided improvement in the habits, not only of consumptives, but of people generally in the disposal of sputum. Our belief in the danger of dried sputum rests on the following observations : first, on the frequency of tuberculosis of the lungs among nurses and in prisons and other public institutions ; second, upon the presence of living virulent bacilli in the dust of rooms frequented or inhabited by consumptives ; and third, upon the actual experimental infection of the respiratory tracts of animals. But when the evidence is examined more closely it is seen that there is a certain insecurity in the foundations. As to the tuberculosis in institutions it is apparently only the prolonged exposure to the infection which is dangerous, Cornet found his best evidence among the nursing sisterhoods and brotherhoods where the whole life was given to the work and not among ordinary nurses. The evidence as to the presence of virulent bacilli in dust depended upon the intra peritoneal inoculation of guinea pigs with a considerable quantity of the dust. Finally, in the production of respiratory infections in animals, these were exposed to a spray of fluid sputum or of liquid suspensions of pure cultures.

All these facts have been pointed by Flugge of Breslau in a very careful critique of the older experiments. It remained for him and his pupils, to point out what is probably the most common method of respiratory infection viz., by the spraying of bacilli-holding droplets into the air by coughing and talking consumptives.

These researches, which, are perhaps, the most important contributions upon the subjects which we have had in recent years, have a bearing, not only on the etiology of consumption, but also on infection in a great many other disease.

It was shown that a talking or coughing individual sprayed into the air, droplets so small that they might be carried by the lightest currents of air which we find in a room and even by the respiratory current a few inches from the mouth. These droplets always contain bacteria from the saliva and in the case of coughing consumptives can be shown to contain tubercle bacilli. The number of tubercle bacilli which may be present in these droplets varies much with the patient and the character of the cough ; some patients seem seldom to spray tubercle bacilli holding droplets, others produced them plentifully. The number of organisms in the sputum, the character of the cough and other factors played an important role in determining this. For instance the sharp, powerful cough, with open mouth and arched palate most frequently produced the fine bacilli-holding droplets which could be caught upon slides suspended within three feet of the mouth of the patient and stained in the ordin-

ary way. As Flügge points out, the fairly healthy ambulatory patient may be a greater source of danger, than the bed-ridden consumptive, whose sputum may contain many more bacilli, but whose cough is so weak as to be an insufficient force to produce the fine spray of droplets.

Finally, the Breslau investigators succeeded in producing tuberculosis of the respiratory tract of guinea pigs by exposing them for several hours daily to coughing consumptives, at a distance of not more than three feet from the mouth of the patient, excluding, of course, the danger of dust infection.

They also demonstrated quite clearly that the danger from dust was not nearly so great as supposed. Sputum is very hygroscopic, it dries to form a tenacious mass which long retains a little moisture and is not readily converted into dust; when dried only the most vigorous methods of trituration will convert it into a dust which is still so coarse as to require fairly strong air currents to carry it.

Flügge sums up the whole question of respiratory infection as follows: It may occur from dried sputum where large quantities of it lodge on floor or furniture and it is disturbed by vigorous dry sweeping, or by the vibration of railway trains or heavy machinery; it may occur from coughing patients where the sprayed sputum contains the bacilli and persons expose themselves, as in the case of nurses and relatives, by hanging over the patients close to the mouth, or where coughing consumptives are living or working in crowded, ill-ventilated rooms, workshops or offices. But it is pointed out also that the danger from coughing patients diminishes rapidly, with distance from the mouth of the patient, more than a metre from the mouth it was difficult to find the bacilli-holding droplets and of course the simple expedient of holding a handkerchief or a hand before the mouth whilst coughing entirely removed the danger.

It will be seen from these researches that there has been a decided tendency of hygienists to overestimate the danger of infection. The incidence of the disease, the way in which it attacks successive members of a family, or the nurses who are long exposed to it in a hospital, or the fellow workmen in a crowded workshop, points to the nearness of approach to the patient necessary before danger arises; and the Breslau work, from the completeness of the exposition should go far towards removing the danger of infection.

Medical men are certainly to blame for the condition of panic in which the public are, in regard to tuberculosis, and which is converting the unfortunate consumptive into a social outcast; which reaches such an

absurd pitch that people write indignant letters to the daily papers when it is proposed to place a hospital for consumptives a half a mile from them.

Perhaps it was necessary to thoroughly frighten the public first in order that proper care should be taken to prevent the spread of the disease but it is now the duty of the medical profession to exactly point out where the danger lies and what precautions are necessary to avoid it. By so doing more will be done not only to limit the spread of the disease but also to effect a cure of the infected than by any other means.

#### THE HOME TREATMENT OF PULMONARY TUBERCULOSIS.

**L** EONARD WEBER, M.D., in the Post Graduate for November, discusses this phase of the subject. After reiterating the universal belief in the infectious nature of the disease, he points out the importance of careful and repeated physical examinations of the patient.

This is necessary to detect the first signs of bi-lateral affection, and also to judge of the severity of the disease for the purpose of prognosis, in order to know whether home treatment will be of any avail. Besides careful physical examinations for the early diagnosis, the writer believes the radiograph to be of some value, but he places most reliance on the tuberculin test, which he has never found harmful to his patients. Of the serum-reaction agglutination test he has no experience.

When a diagnosis is made, a cheerful prognosis should be given the patient; this is of greatest value in the early stage of the disease since in the later stages the patients are usually optimistic.

The first essential in treatment is rest in bed in the acute stage or until the temperature becomes normal. For high temperature and sweats the writer advises the use of the cold sponge, not the cold bath. As an antipyretic, phenacetine grs. 3, acetanalde gr. 1, antipyrine gr. 1, has been used successfully. The diet might be called forced feeding, the fat-producing materials being of special value. Cough is discouraged, and if the patient cannot control it, then codeia phosphate or  $\frac{1}{4}$  is useful.

So soon as the acute stages are past, and in cases in which acute symptoms are absent, creasote is used. The writer does not favor mixtures of creasote and oils in capsules, but gives the following mixture: - R. beechwood creasote, alcohol, aa. f. oz. I., M. Sig. 10 drops in half a tumblerful of milk or water, three times daily 1 hour after food. Double the dose every week until 60 drops per dose is given. When the stomach is very irritable or the heart weak, strychnia, digitalis and quinine may be given. When the patient does not respond to rest, sponge-baths, and creasote, and resource must be had to Sanatoria and climatic change.

A. C. H.

## SIGNS AND SYMPTOMS OF TUBERCULOSIS OF THE LUNGS.

By ROBERT DAWSON RUDOLF, M.D., M.R.C.P., F.R.G.S.

**T**UBERCULOSIS occurs in the lungs in various forms, as follows:—

1. Acute miliary tuberculosis; 2. caseous tuberculosis; 3. fibroid tuberculosis; 4. fibro-caseous tuberculosis. This classification is the one suggested by Dr. Kingston Fowler and for the sake of description it will be the one adopted here, but it must never be forgotten that, while many typical cases exist, many occupy transitional positions between the classes, and that in most patients at one period or another more than one form of the disease exist. Thus, cases of acute miliary tuberculosis usually show a pre-existing form of chronic disease, and in the same lung one usually finds areas of caseation and areas of fibrosis, the former predominating in acute cases and the latter in the more chronic.

### I. ACUTE MILIARY TUBERCULOSIS OF THE LUNGS.

As this subject is dealt with by Dr. Third in another paper, no further reference will be made to it here.

### II. CASEOUS TUBERCULOSIS OF THE LUNGS.

This condition is also termed Pneumonic Phthisis and it occurs in two forms, corresponding morphologically with the two types of pneumonia. Hence we have, (a) Tuberculous lobular pneumonia. (b) Tuberculous lobar pneumonia.

The former is the more common form and usually occurs in children, while the latter is seen for the most part in adults, and is extremely rare.

Both varieties are frequently complicated by miliary tuberculosis dotted through the rest of the lungs. Caseous tuberculosis usually arises as a primary disease, although it may follow an old infection. This is an acute disease and hence its synonym of "galloping consumption", but it may show periods of arrest, and, from the formation of fibrous tissue, may drift into a condition of chronic tuberculosis. Such chronicity is rare however, and the disease is usually progressive and fatal in a few weeks.

*Symptoms.*—(a) In the broncho-pneumonic type the onset is usually insidious, but may be as sudden as in pneumonia. Occasionally hæmoptysis is the first symptom noticed. If the onset be sudden, repeated rigors may appear; if gradual then indefinite pains in the limbs, cough, progressive asthenia and some fever usually are noted.

Soon the fever is well marked and is of a high remittent type, the remissions being usually more marked than in the miliary form. Later on the curve may show an intermittent character, falling to below normal

in the mornings, and then profuse sweats are the rule. The expectoration is mucoid and then muco-purulent, and contains as a rule numerous tubercle bacilli. Frequently it is blood-stained. Emaciation is marked and as a rule the patient rapidly sinks.

(b) In the lobar variety the onset is usually sudden, although the patient may give a history of previously impaired health. The symptoms are so similar to those of true lobar pneumonia that few cases will be diagnosed at first. After a few days however, the delay in the crisis will excite suspicion and gradually the true nature of the infection becomes clear, and the examination of the rusty, or later purulent, expectoration will probably reveal the presence of the bacilli and perhaps of elastic tissue. The more rapid emaciation of the patient, a greater tendency to sweating and more or less urgent dyspnoea may cause the tuberculous infection to be suspected earlier; the temperature curve is more apt to be irregular, but very little reliance can be placed on such distinctions and the condition may not be suspected until the post-mortem reveals its true nature. The longer the consolidation remains unresolved, the more does the suspicion of tuberculosis press, and then, the profuse sweating, zig-zagging of the temperature, rapid emaciation and dyspnoea make the suspicion more strong. In every case where the crisis does not come as expected the sputum should be examined for tubercle bacilli and elastic tissue. The disease is nearly always fatal; sometimes in two weeks, more often after several. Occasionally a case may take on a less acute course and change into the condition of chronic tuberculosis.

The *Physical Signs* are at first just those of the corresponding forms of pneumonia. In the lobular variety signs of bronchitis plus patches of consolidation and collapse occur. The accompaniments are at first scanty, but later are numerous from the breaking down of small caseous areas and the formation of cavities. A pleuritic rub is often heard and then signs of effusion may follow.

In the lobar variety the physical signs are at first those of lobar pneumonia. Later on, instead of resolution, signs of cavity formation will likely occur, and by this time the continuance of the fever, the profuse sweating, and probably the presence of elastic tissue and tubercle bacilli in the purulent sputum, will have cleared the diagnosis.

### III.—FIBROID TUBERCULOSIS OF THE LUNG.

This form of the disease is the very antithesis of the types that have so far been considered. It is characterized by chronicity and by the presence of signs rather than of symptoms. This is only one form of fibrosis of the lung. It may succeed upon chronic ulcerative tubercul-

osis, where the reparative process has overshadowed the destructive, while in other cases it follows tuberculous pleurisy. Again it appears to be primary, the tubercles proceeding at once to fibrosis without cessation. The condition may be so marked as to produce great deformity of the chest by shrinkage, or very limited and so physically compensated for by surrounding emphysema as not to produce any such signs. The condition usually exists in one apex, although sometimes it is very wide-spread. The shrinking fibroid area frequently is the site of dilatations of the bronchi—bronchiectasis, and usually one or more pulmonary cavities exist.

*Symptoms.*—The patient complains very little perhaps, and the condition may only be discovered by routine examination of the chest. The writer recently saw a case in which very marked shrinking of the right lung existed with great distortion of the chest, and yet the patient did not complain of any pulmonary symptoms beyond a slight cough. He was over 60 years of age and never remembered having suffered from any chest trouble. In another case seen a few years ago, the patient, a man aged 65, had been delicate since the age of 20, when he was prevented from pursuing his studies by the fact that he was consumptive. Although very spare, he was fairly vigorous and took his cold bath every morning, both in Summer and Winter. His chest was most markedly distorted and he had signs of extensive fibrosis of the lungs and his fingers showed a fair degree of clubbing.

There is generally a chronic cough with some expectoration, which may be chiefly bronchial and which may occasionally contain a few tubercle bacilli, but these are frequently not detected except after repeated examinations. There is usually some degree of emaciation and the temperature may show occasional evening rises, although it usually runs subnormal. Attacks of asthma are common and Dr. Fowler writes that "in delicate-looking individuals, the subjects of emphysema and liable to attacks of bronchial asthma, the existence of an arrested or slowly extending fibroid tuberculosis of the lung should always be suspected." A history of haemoptysis is common.

*Physical Signs.*—On inspection there is usually some and it may be great flattening over the affected area, usually an apex, and the movement will be limited here in proportion to the extent of the disease. The clavicle stands out with unusual prominence because, as the chest wall sinks, this bone, being part of the shoulder-girdle, does not participate in the deformity to any extent. Prominence of the superficial veins over the apex may be noted, owing to obstruction to the deeper venous return. The intercostal spaces are hollowed out. If the shrinkage be

great, then displacements of adjacent organs may be found, the heart being drawn over or abnormally exposed, the liver drawn up, etc.

On *palpation* there may be marked increase of vocal fremitus, or the reverse, all depending upon the amount of thickening of the pleura and the degree of surrounding emphysema, both of which factors will decrease the exaggerated vibration which would otherwise be conducted by the fibrosed lung.

On *percussion*, where there is deformity, a dull note will be elicited with usually a considerable degree of resistance. In cases where the fibrosis is limited and emphysema predominates, there may be little want of resonance or even hyper-resonance. Whatever be the extent of the local fibrosis, there is usually a considerable amount of general emphysema, produced by the prolonged coughing, as well as by compensation for the diminished space occupied by the diseased area; hence we get a hyper-resonant note over the rest of the chest and other signs of emphysema.

On *auscultation* over the fibrosed area, the type of breathing is usually more or less bronchial and may be loud or somewhat suppressed according to the condition of the pleura and the amount of emphysema. The vocal resonance, varying as the vocal fremitus, may be increased or decreased. There are very few accompaniments as a rule, none often even on coughing or deep breathing, but occasionally there may be coarse crepitations due to fluid in a bronchiectatic or true pulmonary cavity.

It is usually an easy matter to diagnose fibrosis of the lung, although slight cases may be masked by emphysema. It is much more difficult to find the nature of the fibrosis when tubercle bacilli cannot be obtained. The history of the case will help however.

#### IV.—FIBRO-CASEOUS TUBERCULOSIS OF THE LUNGS.

This is perhaps the best name for the common and more or less chronic form of pulmonary tuberculosis. Many synonyms exist however, *e.g.*, Chronic Ulcerative Tuberculosis of the Lungs, Chronic Pulmonary Tuberculosis, etc. The term "Phthisis Pulmonis" practically means the same thing nowadays, but as it has often been made to include non-tuberculous forms of pulmonary disease it is better avoided.

The disease is by far the commonest form of tuberculosis of the lungs; it is in fact the most widely spread and terrible scourge of the human race and is well termed the "white plague". "In the United States Census Report for 1890, 102,188 deaths were reported to be due to consumption" (Osler).

The disease being so universal, and moreover somewhat contagious, it behoves us to recognize the condition as soon as it occurs both for the

sake of the public health, and also for that of the individuals affected, as the earlier systematic treatment is commenced the better chance have they of recovery.

The *modes of onset* are various, as follows :

I. Perhaps the most common form of onset is the *bronchial* one, in which the patient gives a history of "taking cold easily" and getting rid of it with difficulty. Or he has "caught a cold and neglected it" and it has continued for weeks or longer, with cough and muco-purulent expectoration perhaps. Then, either the long continuance of the condition, or some superadded symptom, such as hæmoptysis or loss of weight, brings him to the physician. Cases of this type are not so likely nowadays to advance very far without detection, as the public are becoming more alive every day to the dread of tuberculosis and are only too apt to suspect its existence in the case of every bronchial catarrh which is not very quickly got rid of. Should an employe dare to cough for a week almost, he finds the suspicious eye of his employer fixed upon him, or his landlady hints at requiring his room for some friend who cannot be denied. Taking care that a few simple precautions are enforced regarding the destruction of the sputum, cases of tuberculosis are scarcely a source of danger to others, and if a panic be created, as is at present threatening, the public are in their turn apt on the one hand to take altogether unnecessary precautions, to the great hardship of the unfortunate individuals infected, and on the other to neglect the few simple precautions that are necessary. If tuberculous patients find that they are treated like pariahs, they will tend to neglect these simple precautions, because the carrying out of such would "give them away". They will tend to adopt a policy of concealment, which is quite possible often and yet fraught with danger to others.

II. Perhaps the next most common form of onset is the *insidious* one. The patient has not been feeling up to the mark lately, gets very easily tired and is losing weight. Probably he is dyspeptic, and may attribute his condition to this alone. Anæmia is often present, and, in the case of women, amenorrhœa is frequent, though an excessive menstrual flow may occasionally exist. He probably has some cough and a little muco-purulent expectoration in the morning, and this may occasionally be streaked with blood. Such an occurrence would at once raise suspicion, and if the temperature be taken in the evenings it probably will be found to be raised. Such patients usually feel better while they have the fever, and it is in the mornings, when this is absent, that they feel most lassitude.

III. In some cases the onset is *pleuritic*. It is fully admitted by all observers that a large proportion of acute pleurisies are of tuberculous

origin, either primary or secondary to disease of the lung beneath. The percentage varies according to different writers from 30 to 80 per cent., or even higher. It is not uncommon to have patients date their pulmonary trouble from such a condition, they saying that they were quite well until the pleurisy occurred. Sometimes such a history may be a correct one, but probably often they have been insidiously ill for some little time, but had not noticed their failing health until the pleurisy occurred. All cases of pulmonary tuberculosis eventually develop pleurisy, but occasionally this complication is the first symptom noted.

IV. Other cases seem to date from an attack of *hæmoptysis*, and this symptom is specially suspicious when it has not been preceded by violent exertion. When it occurs, and subsequently tuberculosis is evident, then probably the disease had already been present when the hæmorrhage took place. Hæmorrhage may be due to many causes, but when it appears in a young person without apparent cause, the chances are that he is tuberculous however well he may seem. There are notable exceptions to this rule, but they *are* exceptions.

V. Again, a few cases seem to start with *laryngeal* symptoms, and it is possible that this may be the case, although most probably in any given case the lungs were first affected and subsequently the larynx.

VI. Some cases date from an acute illness of some sort, and it is specially common lately to have a history of the disease dating from an attack of influenza. Such may be the case, the influenza predisposing to the tuberculous infection, but it must ever be remembered that patients are apt to fix on some marked deviation from their normal condition as the starting point of their trouble, when really it had been going on before, or did not begin until after the intercurrent trouble had ended. Thus one finds cases of cancer, for example, dating also from influenza.

VII. A few cases of chronic tuberculosis begin as the acute pneumonic type and eventually drift into the condition under consideration.

*Symptoms.*—The early symptoms of chronic pulmonary tuberculosis have been already partially considered under the heading of modes of onset.

As the disease becomes established there are three symptoms which usually stand out with more or less prominence and which, when all present, almost render the diagnosis a certainty. These are emaciation, sweating at night, and hæmoptysis. While these symptoms are present to a marked extent when the disease is fully developed, they may often also be found very early in the disease, as already mentioned above, and thus help towards its recognition when this is most important.

*Emaciation* is a very constant feature and the rapidity with which it

occurs is one of the very best tests of the acuteness of the morbid process. Hence a good weighing-machine should be in every physician's consulting room. The weight of the patient, taken in conjunction with his temperature will furnish more valuable information of how he is doing than any physical examination can do. Occasionally, however, the patient gains weight although the disease is progressing and in such cases it will be found that he has been recently put in better hygienic and dietetic surroundings. For example, an over-worked, badly-fed individual, who has been steadily emaciating, is sent to a sanitarium or into the country where he has nothing to do but rest, live in the fresh air and satisfy the better appetite thus engendered. Under such circumstances he may for a time steal a march, so to speak, upon the disease, and the gain in his general condition will be out of proportion to the improvement in the local process. One sees even cases of malignant disease improve temporarily, and put on flesh, when put amidst better surroundings. Only then it is a mere "flash in the pan," whilst in tuberculosis it is certainly a step upwards, although not such a great one as if a similar gain in weight had occurred without any alteration in the environment.

Towards the end of the case the emaciation may be so extreme that the sufferer becomes a mere living skeleton and is apt to develop bed sores.

As already mentioned, *haemoptysis* is a very frequent early symptom. At that stage it is usually slight, although quite a severe bleeding may occur as the first symptom noted. There frequently exists a great unwillingness on the part of patients to admit the existence of this symptom. To the question "Do you spit blood?" a negative answer is often forthcoming, and yet when the question be urged "Not even a streak occasionally?" an unwilling admission is made. For diagnostic purposes such streaks are perhaps just as important as more profuse hemorrhages and hence in suspicious cases it is well not to be satisfied with a simple negative. If profuse, the blood is red and more or less frothy at first, and for several days afterwards a little dark blood may be coughed up. The blood may be swallowed and later on vomited or passed as "tarry stools." In a case where doubt exists as to whether the vomited blood be due to true haematemesis or has been swallowed, the fact that for some time afterwards the patient coughs up a little blood will settle the diagnosis in favor of a pulmonary origin.

*Hemorrhages* from the lungs are usually self-limiting and only about three per cent. of deaths from pulmonary tuberculosis occur from this cause. Occasionally they may be very quickly fatal, as in one where the writer saw the patient simply drown in his own blood in a few seconds.

After every hemorrhage of any size the temperature rises for a few days.

*Night Sweats* are a very constant symptom in chronic pulmonary tuberculosis. They are especially severe late in the disease, but often occur quite early. When profuse, they weaken the patient and hence do harm, although, no doubt, their object is the elimination of toxins. The patient is feverish in the evening and on going to bed. A few hours later he wakes up drenched, and usually feeling chilly and depressed and his temperature will be found to have fallen several degrees and may even be very sub-normal.

Sweating at night is met with in many other diseases besides tuberculosis, *e.g.* in typhoid fever and in suppuration of any kind, and it is only when it is associated with other symptoms of tuberculosis that it is at all diagnostic. Some authorities hold that when it occurs in pulmonary tuberculosis to any extent it is a sign of a mixed infection, but others differ, and Dr. Kingston Fowler points out that in miliary tuberculosis and tuberculous peritonitis, where there is every reason for thinking that the infection is a pure one, night sweats are a marked symptom. The condition is an evidence of certain toxins in the blood, which the system is endeavoring to get rid of, and there is no theoretical reason why the toxins of pure tubercle should not be thus dealt with.

Such sweating is apt to set up skin troubles, especially *miliaria rubra* and *alba*, and it favors the occurrence of the parasitic condition, *pityriasis versicolor*.

*Cough* is usually present from first to last and frequently is, for long, the most urgent symptom complained of. In very rare cases it may be absent, even when the disease has made considerable strides, and a case of this kind recently came under the notice of the writer, where, along with marked involvement of the lungs, no cough existed during the several weeks that the patient was in the hospital, and she insisted that it had never been present. It is at first dry and hacking, and often specially troublesome during the night. As soon as the expectoration becomes profuse the cough is especially bad, and almost limited sometimes, to the early morning hours. The patient will cough and cough until he succeeds in bring up a quantity of sputum, and when he has done so, sometimes with the aid of vomiting, then he is comparatively comfortable for hours. This morning cough is also frequent in chronic bronchitis with emphysema. The cough undoubtedly serves a useful purpose in removing expectoration and hence should not be too freely checked by treatment. Very often, however, it is useless, being due to irritation which cannot be got rid of, and then it does no good, in fact is harmful in

that it fatigues and strains the patient, much as does tenesmus in rectal ulceration or strangury in vesical catarrh.

*Expectoration.*—At first there is none, or at any rate it is scanty and chiefly confined to the early morning. Frequently as already mentioned, it contains blood. Later on it becomes profuse, muco-purulent, and often nurmular. When very profuse the patient may think that he vomits it, which may actually be the case when he has been swallowing it during sleep, but usually it is merely helped up during vomiting by the simultaneous contraction of the bronchi. Young children swallow their sputum and hence it cannot be obtained by examination.

The presence of tubercle bacilli in the sputum is an absolute proof that tuberculous disease exists somewhere in the respiratory tract. It cannot be too strongly emphasized however that, while a positive finding is conclusive, a negative one is of little value in proving the non-existence of the disease. In a doubtful case many examinations should be made on several occasions. The best parts of the sputum to examine are the centres of the purulent masses and the little dark clots of blood that succeed a hemorrhage.

We are not concerned here with the technique of the examination.

The presence of elastic tissue in the sputum shows that destruction of lung structure is taking place and such destruction is usually tuberculous. "If some of the thick purulent material is placed upon a glass plate about four inches square and compressed into a thin layer by a second glass plate about three inches square, the elastic tissue on a black background appears to the naked eye as greyish-yellow spots. The fragment may then be removed, placed upon a microscopic slide and further examined (Andrew Clarke)."

The number of bacilli found bears little relation to the severity of the disease, except in a most general way.

There is usually more *shortness of breath*, which may become a marked feature of the disease later on. When urgent dyspnoea exists and the physical signs do not seem sufficient to account for it, then a secondary invasion of the lungs by acute miliary tuberculosis may be suspected, and this is specially the case if at the same time the fever become high and continuous.

A certain degree of *fever* is usually present during most of the course of the disease and it is a good gauge, especially when taken in conjunction with the weight of the patient, of the rapidity of the local process. Some authorities believe that a persistently subnormal temperature is suggestive of tuberculosis in an early stage, but the question naturally

arises whether or not such a depression of the bodily heat be not merely a sign of lowered vitality, which would predispose to tuberculosis as to any other infection. In the writer's experience, subnormal temperatures are much more common in healthy people (especially men) than is generally supposed.

When tuberculosis has really set in, the temperature is usually somewhat raised in the evening. In chronic tuberculosis it will usually be normal or subnormal in the morning, and if taken after a profuse sweat it may be as low as 95.0° Fahr. Cases are sometimes reported where no fever is said to have existed during any time up to death, but if the temperature be taken regularly every four hours these apparently fever-free cases will be found to be very rare indeed. When the night sweats are marked the fever assumes the hectic type—high at night and low in the morning—and this is the form of pyrexia which some associate with a mixed infection. If the temperature of a case of chronic tuberculosis begin to run high and cease to intermit, then probably an acute miliary infection has become superadded. The inverse type of fever is occasionally met with, in which the rise is in the morning and the fall at night and it is almost pathognomonic of tubercle.

As regards the *circulatory symptoms*: the pulse is hastened usually out of proportion to the fever, and in some cases of grave general depression from tuberculosis a fast pulse is found associated with an absence of fever. There is nearly always some poverty of blood, which is of the nature of a chlor-anaemia. The leucocytes are increased in number, especially late in the disease. Functional bruits are often present in the heart and blood vessels, the two most common being a systolic pulmonary murmur and the bruit de diable in the great veins of the neck. In many cases, however, where the weakness is considerable, and we would theoretically expect to find such murmurs well developed, they are conspicuous by their absence.

Oedema of the ankles occurs sometimes and is a symptom of grave import in tuberculosis.

The appetite is frequently capricious and the digestion poor, and, as the hope of keeping up and improving the patient's condition depends almost entirely on the amount of nourishment which he can eat and digest, the integrity of these should be preserved with the greatest care. Hence, remedies, which are likely to disturb the digestion, should be as far as possible avoided.

As regards the bowels, constipation is perhaps the rule, but an obstinate diarrhoea is not uncommon, and means, probably, tuberculous involvement of the bowels, or else waxing disease of the same from the

prolonged suppuration in the lungs. *Fistula in ano* is a not uncommon complication of the disease; in fact, where this local condition is found, it is well to carefully examine the lungs.

The mental states of the chronic tuberculous are various. At first the patient is often depressed, but later on a remarkable hopefulness remains with him, when it has long departed from his friends. Occasionally insanity and tuberculosis are closely associated, but the percentage of tuberculous people who become insane does not appear to be above the average.

The patient is often a great sufferer from pain. This may be merely neuralgic or he may develop neuritis with paralysis of various muscles. He usually has pains from time to time in the chest, generally due to pleurisy.

Various symptoms may arise during the course of chronic pulmonary tuberculosis, which are due to complications rather than to the disease itself and hence they are not here considered. But we may mention loss of voice from laryngeal invasion; severe diarrhoea, often with blood in the stools, due to tuberculous ulceration of the intestines; headache, squint, cervical rigidity, etc., from meningeal involvement; and sudden pain in the chest and profound dyspnoea when pneumothorax has occurred.

#### PHYSICAL SIGNS OF CHRONIC PULMONARY TUBERCULOSIS.

A careful examination of the chest should be made in every case where the least suspicion of local disease exists. In the later stages of the disease the most cursory examination will probably reveal evidence of the local condition, but by this time the patient's general symptoms are probably so marked that the local examination only proves what is already known.

It is *early* in the disease that careful examination is so necessary and then we only expect to find very slight deviations from the normal; hence it is that the examination should be conducted in the most advantageous surroundings possible. The hurried and very partial examination so often made in a noisy out-patient room is not likely to yield results of great value. Such incomplete investigation is often all that can be achieved, but whenever possible it should be done in a perfectly quiet room with the chest completely exposed and in a good light. A Talmudic law made several hundred years before Christ laid down that "a Levite practicing as a physician must not pursue his investigations at early dawn, nor in the evening twilight, nor even in a chamber on a

cloudy day" (Baas' "History of Medicine") and it teaches a lesson in the value of inspection which is of equal importance to-day.

For the better describing of the physical signs of chronic pulmonary tuberculosis, the disease may be divided, as is done by Professor John Wyllie of Edinburgh, into four stages, as follows:—

*First stage.*—Where there are a few scattered tubercles in the lung.

*Second stage.*—Where the lung has become more or less consolidated by the growth and increase in the number of the tuberculous deposits and the consolidation of the lung tissue between them from pneumonia.

*Third stage.*—Where the tubercles are breaking down.

*Fourth stage.*—Where cavities of recognisable size have become formed.

When one bears in mind the morbid anatomy of the disease, he will realize that none but the first stage will be likely to exist alone in the chest, as later on there will be found a combination of cavities, consolidation and probably isolated tubercles at different parts of the lungs at the same time. Thus the second stage, roughly speaking, gives the signs of the first *plus* those of itself; the third gives its own plus those of the two preceding ones, etc. Further, it must be borne in mind that a patient is not necessarily in a more hopeless state because he is at a later stage of the disease, and as a matter of fact many people with large cavities are better "lives" than those who show only signs of scattered tubercles. The disease may become arrested at any stage.

Although tuberculosis may occur in the most perfectly formed chest, it is more likely to attack those of certain abnormal shapes. Hence such abnormalities may be said to predispose to the disease. A long chest, in which the ribs are further apart than usual and the costal angle is small, is frequently attacked. In such chests the scapulae usually project and hence the name "alar chest." The chest may be of the flat type, where the antero-posterior diameter is small. Chests deformed by previous disease, especially rachitis and less often whooping cough, are prone to this disease. Such are the "pigeon breast" chest and the one showing a transverse grooving in its lower part.

*First stage.*—At this period of the disease, when only a few shot-like tubercles are scattered through the affected part of the lung with more or less normal tissue between them, the chief and perhaps only physical signs elicited will be got by auscultation.

There is nothing as yet to prevent normal movement of the chest, nothing to alter the chest resonance (unless indeed, as is often the case, an early pleurisy has left some chickening over the lung). On auscultation the breathing is probably harsh vesicular over the affected apex and

the expiration will be prolonged. This is the most common type, but occasionally, owing to the thickening of the pleura or plugging of bronchi, the respiration may be quieter than normal. Occasionally it is interrupted ("cog-wheel breathing"), but such is of very common occurrence in nervous people and is only of significance when localized. It should ever be remembered that the respiration is normally somewhat louder and the expiration more prolonged over the right apex than elsewhere; also that over the roots of the lungs it is louder and broncho-vesicular. (The bronchi in the roots of the lungs lie opposite the juncture of the manubrium sterni with the body of the sternum in front and opposite the fourth dorsal spine behind.) The vocal resonance will not be altered. As regards accompaniments, a few dry râles may be heard usually, often only brought out by the inspiration following the full expiration produced by coughing or laughing. Various pitched rhonchi are frequent. The apices, above and especially below the clavicles and above the scapulæ, should be systematically searched with the stethoscope, as also the axilla as high as possible. A spot, which may show signs of early infection, although generally secondary to that of the apex, is the upper part of the lower lobe. The patient should be caused to place his hand on the opposite shoulder and then this part of the lung lies between the vertebral border of the scapula and the spinal column.

The upper parts of the lungs are nearly always the parts first affected with tuberculosis and one should be very chary of diagnosing primary basal disease. Such does occur however in rare cases, usually in the aged or feeble, or as a sequence to pneumonia.

Thus, the signs elicited by examination of the chest in the first stage of the disease, are practically those of mild bronchitis; but the great point to note is that the bronchitis is *localized* to the apex, while in simple bronchial catarrh the signs are generalised over the whole chest, but especially at the bases of the lungs.

Very frequently the disease becomes arrested in the first stage. This is specially likely to occur under appropriate treatment and hence the enormous importance of the early recognition of the condition.

*2nd Stage.*—As the process of consolidation proceeds in the lung, the signs of the second stage gradually appear. Just how much consolidation of the lung is necessary, in order to make itself evident by physical signs, it is impossible to say; but it is quite certain that the more delicate and thorough our examination be, the sooner will the condition be discovered.

On *inspection* some want of movement may be made out over the affected apex and there may be a little flattening here, although such is not common at so early a stage. The physician will best detect either of

these abnormalities by standing behind the patient, (who is seated facing the light) and, placing his thumbs on the vertebral column, spread his fingers over the upper part of the chest, anteriorly. Thus the sense of touch as well as that of sight comes to his aid. The two sides should move equally and synchronously and when there is an abnormality it is always in the direction of lessening and delay of movement.

*Palpation* may reveal some increase in vocal fremitus, due to the fact that the consolidated lung conducts the vibrations of the voice more easily than does the normal organ. It must be remembered, however, that the fremitus is normally greater over the right apex than elsewhere and it is necessary to make allowance for this, which the trained hand soon learns to do.

On *percussion*, more or less want of re-onance will be present over the affected area, but this seldom or never amounts to the degree of dullness given by a lobar pneumonia. There is very little sense of resistance to the finger. It has been stated ("Text Book of Medicine," G. A. Gibson, Vol. I, p. 415) that often, normally, there is less resonance over the right apex than over the left, but the writer is unable to agree with this and believes that in health the two should give the same note, and this is the more generally held belief. Each point of the chest should be systematically compared with the same one on the opposite side; and it helps the ear to always percuss the apparently normal side first. Above, on, and below the clavicle in front and above the scapula behind are the chief spots to examine.

Frequently, more want of resonance exists than might have been expected and this, when combined with lessened breathing and perhaps deficient movement, points to the very common condition of thickened pleura, or, if very marked, to localised effusion, which is fairly common in children.

On *auscultation* over the diseased apex, the breathing is loud, with prolonged expiration and has taken on more or less of a bronchial element. It seldom or never becomes purely bronchial as in pneumonia. The vocal resonance is increased and here again it must be noted that this is normally greater at the right than at the other apex. Frequently some degree of bronchophony exists. The accompaniments of the first stage, *i. e.*, rhonchi from associated local bronchitis and fine crepitations may still be present. The heart sounds are usually heard over the consolidated lung with greater ease than over the normal one.

Roughly speaking, then, the signs of the second stage of the disease are those of an ill-developed and very localised apical pneumonia.

*3rd Stage.*—Here we have breaking down of the tuberculous deposits. This stage may follow upon the second one, or may directly arise out of

the first ; in other words, signs of breaking down may not appear until those of consolidation have become evident, or else they may make themselves apparent before these occur.

This breaking down of tubercles produces the one sign, which, when added to those of the first or second stage, is characteristic of the third. This sign is the occurrence of crepitations of medium fineness. These occur over the affected area chiefly in inspiration and the fluid which produces them is *pus*. They may be numerous or only present as occasional "clicks." These crepitations are similar in sound to those heard over a resolving pneumonia, but are very seldom so numerous as under such circumstances. They are also heard in bronchitis, but are then generalised and chiefly audible at the bases. Moreover, in bronchitis the crepitations are rather of a bubbling than of a crackling nature, being less sharp in quality than in softening tubercles.

When a hemorrhage has occurred, the blood, lying free in the bronchi and vesicles of the lobe, produces crepitations of a bubbling nature, which usually persist for several days.

*4th Stage.*—Here the softening and ulceration of the tuberculous consolidation have produced cavities sufficient in size to be detected by physical examination.

While the diagnosis of the existence of a cavity is often an easy matter, this is not always the case, even when the cavity be of considerable size.

On *inspection* probably some flattening will be noticed over the affected apex. The clavicle, being part of the shoulder girdle, does not share in the sinking of the thoracic wall, and hence stands out with greater prominence than usual as the chest recedes. There is want of movement over this part of the chest, the wall being tied down by the fibrous lung. Frequently the superficial veins over the upper part of the side stand out with unusual distinctness. If the left side be the affected one, although indeed both lungs have usually been attacked by this time, then the shrinkage of the lung may expose the heart and pulmonary artery, and hence abnormal pulsation will be seen in the 2nd and 3rd left interspaces.

*Palpation* confirms the results of inspection and usually yields marked increase in vocal fremitus.

On *percussion*, there will be detected some degree of want of resonance, which will vary with the size of the cavity and its nearness to the surface, the amount of thickening of the walls, and the presence or absence of emphysema in the surrounding lung tissue. As a rule the note is "boxy" and gives the impression of striking a cavity with thick

walls. If the cavity be large and have thin walls, then the cracked-pot sound (*bruit de pot fêlé*) may be present and is obtained when firm percussion is used whilst the patient keeps his mouth open. A similar sound may often be got in healthy children, but then it may be obtained all over the chest, and there are no other signs of disease. Usually at a little distance from the diseased area the note is hyper-resonant from emphysema.

On *auscultation* the breathing is usually louder than normal and of bronchial type, the pitch varying with the size of the cavity; the smaller the cavity the higher the pitch. When there exists a large cavity, with probably a large bronchus opening into it, the bronchial breathing may be so low-pitched as to deserve the name of "cavernous," or it may become amphoric which is suggestive of a very large cavity and is best heard in pneumothorax, when there is a considerable opening through the lung into a bronchus.

The vocal resonance will be increased and often altered, giving the condition of bronchophony, where the voice sounds near to the stethoscope; or of pectoriloquy, where it sounds as if spoken right into the ear and the articulation of the voice is audible.

The accompaniments depend upon the contents of the cavity. They may hence be scarce or even absent, or on the other hand numerous. They consist of bubbling, splashing or gurgling and often have a tinkling character, suggestive of their production in a resonating chamber. Coughing brings them out well.

Over the rest of the chest signs of emphysema are very common. As already mentioned, usually by the time that the disease has reached the stage of cavity formation at its primary site, it has also attacked other parts of the lungs and in these parts the signs of the earlier stages will probably be evident.

In concluding these remarks on physical examination, the writer would endorse two rules laid down by Dr. John Cockle in 1854 in his translator's note of the work of Weber, as follows: (1) Never to infer the non-existence of disease from inability to detect its physical signs, (2) Where it is possible, always test the physical by the vital signs.

# BOVINE TUBERCULOSIS AND PROTECTION OF MILK SUPPLIES.

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**T**HE importance of any phase of investigation regarding the subject of Tuberculosis and its relation to milk is unquestioned in these latter days when the general public is beginning to appreciate, for the first time, the magnitude of the problem that confronts them in attempting to lessen the ravages of the "great white scourge" of the human race.

In considering this subject, it may be approached from two points of view :

1. From the standpoint of animal industry.
2. From that of public health.

## BOVINE TUBERCULOSIS AND ANIMAL INDUSTRY.

The rapid extension of the disease among cattle within the last few decades has forced upon breeders and dairymen the necessity of considering this subject whether they desire it or not. It is customary in many quarters, even yet to decry all consideration of this matter as unnecessary, inexpedient, and harmful to the dairy interests. But, as is too frequently the case, the motive for such action rests upon a financial foundation, and many breeders are averse to a calm, judicious discussion of the matter, simply because it may mean financial loss to them.

Since the introduction of the tuberculin test as an aid in the diagnosis of the disease in cattle, it has been positively determined that the malady, at least in its incipient form, is very much wider spread than was formerly supposed, but it by no means follows that all animals that react to the tuberculin test are actually in a condition in which they or their products are dangerous to man and beast.

The slow, insidious nature of the disease that characterizes it in the human is also to be found in cattle, and not infrequently an animal may be infected with the seeds of disease for a considerable time—even a year or so—without showing in any degree physical symptoms that are manifest to even the animal expert. Such animals are not diseased, in the ordinary meaning of the term, *i. e.*, they are not capable of transmitting the disease, either directly or indirectly, through their milk supply or meat. The affection in such cases is latent, generally confined to various lymphatic glands, but animals so affected are, however, potentially dangerous, for the latency of the disease may be overcome through the operation of various factors, and the chronic type may be awakened into

an acute phase. It is in this way that the disease spreads slowly and unperceived through a herd. Before it has made such inroads as to cause actual death of any considerable number of animals, many more have acquired the trouble, at least in its earlier phases. Necessity of controlling its spread and eradicating it is evident for the sake of the herd itself, if from no other point of view. Successful animal industry, especially with cattle, requires that herds shall be kept free from all taint of this disease.

#### BOVINE TUBERCULOSIS AND PUBLIC HEALTH.

But the other phase of the question, viz., the relation of bovine tuberculosis to public health, is undoubtedly of more interest to an audience of medical men than a consideration of the question from the view point of the breeder and stock-raiser.

The fact that both the human and bovine types of this disease have been shown to be causally related to the tubercle bacillus might, on the face of the matter, be taken to indicate that they were produced by the same identical organism, and yet every bacteriologist recognizes that while the causative organisms found in this disease in man and animals show many common characteristics, there are also to be noted differential characters that serve to indicate that the respective organisms belong at least to different types or varieties rather than the same identical form, as in the case of anthrax in man and animals.

Interest in the particular phase of the very practical question as to the transmissibility of the bovine type of the tubercle bacillus to the human, and *vice versa*, has been very recently awakened. Certainly, the practical importance of this problem is such as to demand most careful scrutiny. If there is any danger of transmissibility, it is needless to emphasize its importance to public health interests. On the other hand, if no such danger does exist, it certainly works a hardship on animal industry to expend so much time and energy on precautionary measures that have for their aim the elimination, or at least the diminution, of the reputed danger to the narrowest possible limits.

But, if the question of bovine tuberculosis is considered merely from the view point of animal husbandry, restrictive regulations are still necessary; and if these must be maintained, it would seem the part of a sound public health policy to also continue the enforcement of such restrictive measures as are designed to safeguard human life, until it can be shown beyond all doubt that such measures are needlessly severe.

One fact should be borne in mind and that is, that the virulence of the bovine type is much greater than the human variety of the organism.

The conclusive researches of Theobald Smith and others in this country as well as a number of European investigators indicate that the susceptibility of cattle to inoculation with tuberculous human sputum is relatively slight in comparison with similar inoculations with material of bovine origin. This in itself would indicate that the danger of cattle acquiring the disease from human sources would be so slight as to be practically negligible. Furthermore, comparative experiments made on various animals in which both types of bacilli were employed show uniformly that the bovine type is much more virulent than the human.

Pending the accumulation of sufficient observations relating to accidental infection to prove conclusively what could be quickly demonstrated beyond cavil if it were possible to study this subject experimentally, it seems fair to consider that the danger of infection from the bovine to the human would be greater than it would be from the human to the bovine. It will take some years at the best to collect the data that from the very nature of the case must be derived largely from observations, before we will be in a condition to consider the evidence as conclusive either one way or the other.

In the meantime, it is desirable that restrictive measures should be maintained with sufficient rigor to ensure freedom from all possible danger, even though such measures may be found in the future to be too onerous. One might with equal propriety decry periods of quarantine that were enforced with rigidity during the middle ages but which are now known to have been unnecessarily severe. At the present time, when our knowledge relating to the ways in which contagia are disseminated is much more complete, it is true that such rigid, lengthy quarantine and complete isolation measures are not necessary; but in cases, even yet where exact data are lacking, it is a correct principle for public health officials to insist upon such measures as are known to safeguard public health interests, even though it may become necessary to modify them subsequently as the actual conditions become more completely known.

These restrictive measures relating to the prevention of the possible transmission of tuberculosis from the bovine to human should, however, not be unnecessarily severe, and must, of necessity, be revised frequently as knowledge becomes more accurate

#### POSSIBLE DANGER FROM TUBERCULOUS CATTLE.

The main sources that may serve directly in the dissemination of tubercle bacilli from animal to man are the meat and milk. It is true that indirectly the possibility exists of inhaling tubercle organisms of bovine origin as these are thrown out from the respiratory passages of animals. Not only may they be ejected forcibly as in the act of cough-

ing, but in a dried form they exist in the barn on surfaces with which the animal has come in contact. Not infrequently does this indirect method of transmission serve to introduce the disease into a perfectly healthy herd, if the same is brought into infected quarters, in a manner entirely comparable to that which exists in the tenement districts of the cities, where certain houses become so saturated with the virus of the disease that it is practically endemic.

#### INFECTION FROM MEAT.

The first direct source of infection referred to, viz., the use of tuberculous meat is fraught with much less danger than that which arises from the use of milk. In the first place, the fact that meat is almost always consumed in a cooked condition diminishes the danger in great measure as ordinary cooking destroys the vitality of the organism. Again, it is also to be noted that by far the larger proportion of animals are adjudged tubercular, on the basis of the tuberculin test, are affected to such a slight extent that the muscular parts used as food do not contain the seeds of the disease. Generally speaking, tuberculosis is a disease of the visceral organs and serous surfaces. Normally it is not disseminated in the body by means of the vascular circulation, and consequently, in the earlier phases in any event, the muscular parts are not invaded. With generalized and advanced stages this condition may differ, so that it becomes possible to transmit the disease by ingestion of meat.

To condemn and destroy all such flesh simply because of a positive tuberculin reaction is to follow a course needlessly severe and expensive. Much of such meat is just as good as any that could be purchased.

In actinomycosis it is no longer considered necessary to sacrifice the entire animal, if the disease affects the jaw or some portion of the head. Such should be the case with animals in good condition that react to the tuberculin test where post mortem examination reveals a localized state of disease. It naturally follows that such a course ought only to be permitted under strict veterinary inspection. This method of disposal is practiced in various European countries, and if as large a percent of our stock was affected as is found in some of these countries, some such measures would of necessity be adopted.

#### INFECTION FROM MILK

With reference to the danger from milk the conditions are far different. This food is so generally consumed in a raw state that if tubercle bacilli are present, the opportunity for intestinal infection is much greater.

The relative susceptibility of the intestinal tract, especially with children is a question of magnitude in this connection, but here hospital

statistics afford the only answer that can be given, and unfortunately there is considerable difference of opinion in interpreting these. I shall therefore leave this question open and consider next the question as to how frequently the tubercle bacilli are to be found in market milk. It is unfortunate that American data are so meagre on this point. The work of Ernst, Rabinowitsch, and others has shown that the organism is to be found under our conditions, but it is impossible for us to apply the data gathered abroad, especially in Germany, for the reason that bovine tuberculosis is a very much wider spread disease in these countries than in our own. It would therefore be manifestly unfair to compare conditions in Denmark or portions of Germany, where from 25 to 40 percent of calves are found to react to the test, with regions here that do not contain at most more than a few percent (2 to 4).

It must be borne in mind that although an animal may react to the tuberculin test, yet she may deliver milk, even for a long time to come, that contains absolutely no trace of tubercle bacilli. The important question as to just when the milk of a reacting animal becomes infectious is not susceptible of exact answer. Unquestionably, if the udder itself is affected, the milk is almost sure to contain tubercle organisms, but this condition does not occur so that the organ becomes visibly affected except in a relatively small percent of cases. It more frequently happens, however, that less marked lesions may exist in the udder that would even escape close examination, and in such cases the tubercle bacillus is not infrequently found.

On the other hand, of the animals that react to the tuberculin test but show no physical symptoms of the disease, either generalized through the system or localized in the udder, the larger part of these do not contain the seeds of this disease. This fact has been determined as a result of experimental inoculation on laboratory animals, and has also been abundantly confirmed by tests upon young cattle and hogs.

There is ample evidence though that milk may possess infectious properties for animals and still be derived from cows that show no apparent symptoms of disease, but when one recalls that very frequently an animal may be in good flesh and apparently healthy and yet the disease have made extensive progress in the internal organs, becoming well generalized, it is not surprising that tubercle bacilli are to be found in the milk supply. We need, however, much additional data as to the prevalence of the tubercle organism in milk before the relative distribution of the germ can be at all accurately determined. In this work for accuracy animal experiments should take precedence over microscopic examination, for it is frequently possible to produce positive infections in guinea

pigs by intraperitoneal injections where the microscope fails to reveal the specific organism.

#### TUBERCLE BACILLI IN MILK PRODUCTS.

If tubercle bacilli are at all numerous in milk it follows of necessity that milk converted into cheese and butter must contain them. It seems quite improbable though that the danger from these products can approximate that of infected milk, for the reasons that a considerable number of the organisms must be eliminated in the process of manufacture and also that these food products are consumed in less quantities than milk, and therefore the amount of simultaneous infection must be reduced. The conclusions derived from earlier experimental evidence on the subject of tubercle bacilli in butter have been rendered less satisfactory of late years by the discovery of organisms in this food that simulate the morphology of the tubercle germ and to a less degree in some cases even the pathogenic properties of the organism. Just how much the data previously accepted are vitiated by these findings can only be known by a thorough retest of the question.

#### CONTROL OF TUBERCULOUS MILK.

But what shall be done with the products of animals reacting to the tuberculin test? While it can be readily demonstrated that a large proportion of animals responding to the test actually deliver tubercle-free milk, still the impossibility of telling just when an animal may pass from the harmless into the dangerous stage necessitates the proper treatment of all milk.

#### EXCLUSION OF TUBERCLE BACILLI BY MEANS OF TUBERCULIN TEST.

This question has been solved in two ways, either of which accomplish the desired end in a perfectly practical manner. These methods are exclusion and destruction. By applying the tuberculin test to a dairy herd—especially one that is concerned in the production of milk for direct consumption—and excluding all animals that react to the test, it is easily possible to avoid all semblance of danger. This course has much to recommend it, especially in milk supply herds, for not only does it insure a tubercle-free milk but it eliminates one of the greatest dangers to the continued well being of the herd, for experience shows that bovine tuberculosis is a more serious menace to dairy herds than beef herds, because usually they are more closely housed thereby increasing the danger of infection.

This method is very frequently followed in herds that produce extra fine milk where the enhanced keeping quality is secured in exercising

great care as to the milking conditions and to the manner in which the milk is subsequently handled. The bacteria associated with the ordinary fermentations of milk, such as souring, can be practically eliminated by keeping out all dust and dirt, invisible as well as the visible filth, but these methods of cleanliness have no effect on the bacteria derived directly from the cow. It therefore becomes necessary to rely on veterinary inspection to eliminate the animals unfit for milk production, and with reference to tuberculosis, the tuberculin test enables this to be done much more accurately than physical examination.

#### DESTRUCTION OF TUBERCLE BACILLI BY HEAT.

The remaining method of treatment is to destroy any possible tubercle organisms (as well as any other pathogenic forms) by heat. The two methods of applying heat that have been the most successful are known respectively, as pasteurization and sterilization, the essential difference in these two processes, as doubtless all of you know, being that the pasteurizing treatment aims to kill only the vegetative, growing bacteria, while the sterilizing process approximately and some time exceeds the boiling point, thus destroying most of the spore-bearing forms. As a rule, over 99 per cent. of the organisms contained in milk are in a growing vegetative condition. Therefore, so far as keeping quality is concerned, the pasteurizing method is almost as good as the more stringent treatment.

I need not enter into the relative merits of these two processes, for the preparation of milk for infants or invalids. The standpoint that we are considering is that of the general consumer and from this point of view, the first method is more applicable. It is cheaper, more easily performed, changes the normal characteristics of the milk to a less degree, and so far as destroying pathogenic bacteria, is fully as satisfactory when properly done. It is true pasteurized milk will not keep as long as sterilized, but this is of little consequence to the general user, for if the milk keeps perfectly sweet for even 24 hours longer than is usually the case with raw milk, it is sufficient to meet his needs.

With reference to the conditions in pasteurizing that are necessary to destroy the tubercle bacillus, our knowledge is much more exact at the present time than it was two years ago. Until very recently it has generally been considered that the tubercle bacillus ought to be taken as the standard test organism in pasteurizing, because this organism was considered the most resistant of any pathogenic germ that was likely to be found in milk.

#### THERMAL DEATH POINT OF TUBERCLE BACILLUS.

De Man working in Forster's laboratory formulated a scale as to the

time required to destroy this organism at varying temperatures. His standard was as follows:

55 degrees C.	.....	4 hours.
60	"	.....1 "
65	"	.....15 minutes.
70	"	.....10 "
80	"	.....5 "
90	"	.....2 "
95	"	.....1 "

Inasmuch as in pasteurized milk it is desirable to avoid the cooked flavor which appears when milk is heated to 70 degrees C. or above, the standard gradually adopted for pasteurizing was the requisite time to kill the tubercle bacillus at temperatures slightly below this point.

The more thorough work of Smith within the last two years has shown that the tubercle bacillus is not endowed with greater powers of resistance than that possessed by many other organisms. His experiments carried out under laboratory conditions at 60 degrees C. (140 degrees F.) showed that this species was totally destroyed in 15 minutes at this temperature. The great majority of the bacteria were killed in 5 or 10 minutes. This result was obtained whether he exposed the culture of tubercle in distilled water, dilute salt solution (o. 6%), bouillon, and under certain conditions in milk. Where the exposure was made in sealed tubes in milk, the thermal death point was no higher than with other media: where the medium was exposed to the air, the organisms were not killed, the protection in this case being associated, as he thought, with the scalded layer that forms on the surface of milk when this liquid is heated.

The practical significance of these investigations led us to retest these experiments, under commercial rather than laboratory conditions. This was done by pasteurizing milk infected with tubercle cultures in a closed rotating commercial pasteurizer. Guinea pigs were used to test the vitality of the heated bacteria, intraperitoneal injections being made in each case. The quantity of tubercle organisms thus inoculated was much greater than would ordinarily be found in even a badly infected, naturally tuberculous milk. The results of these tests confirmed the data presented by Smith, and showed that a ten minute exposure at 60 degrees C. was sufficient to destroy the vitality of the tubercle organism so thoroughly that no trace of disease developed in any case. Where the milk was heated for five minutes disease was produced, although even in these cases the course of the same was much less rapid than in the control pigs

which were inoculated with unheated milk and which died invariably within 13 to 19 days.

#### RELATION OF THERMAL DEATH POINT TO "SCALDED LAYER" ON MILK.

These experiments were still further continued in order to test the thermal death point in milk pasteurized in an open vessel in a quiescent state with that treated in a commercial pasteurizer. In domestic pasteurization, milk is frequently heated in vessels where its surface is exposed to the air. Under these conditions the surface pellicle forms readily. When such milk was infected with tubercle bacilli and pasteurized at 60 degrees C., the contained bacteria in the milk exposed in the closed commercial pasteurizer were always killed in a ten minute exposure, while that exposed in a quiescent condition in open bottles was not destroyed in a considerably longer period of time. The exact limit was not determined in these cases, but in an exposure for fifteen minutes the vitality of the contained organisms was not impaired. In Smith's experiments the organism retained its vitality heated in cotton stoppered tubes in one case for an hour.

To determine with certainty whether this increased resistance in open vessels was due to the surface pellicle or not, further experiments have been made this season. These have not yet been reported in full but the results obtained are briefly as follows.

Samples of milk were inoculated with a peculiarly resistant coccus form that we have found in milk that has a normal thermal death point at 75 degrees C. (practically 15 to 18 degrees C. higher than possessed by ordinary bacteria). Under these temperature conditions, the surface film forms very quickly. After an exposure of the milk for ten minutes at various temperatures varying from 70 to 85 degrees C., the surface pellicle was removed, and planted in an agar culture, care being taken to spread out the membrane as much as possible. Even where the temperature was raised to 82 degrees C., colonies of the inoculated organisms developed quite abundantly in the membrane while the milk exposed in sealed tubes became sterile when a temperature of 76 degrees C. was reached.

To show that this increased resistance was not due to a lower temperature at the surface, the experiment was made by removing the membrane a few minutes after it had formed and immersing the same in a bath of sterile water. In this medium the membrane sank quickly to the bottom and even under these conditions the organism tested lived longer in the submerged membrane than it did where the milk was heated in a closed vessel. This throws the explanation of the phenomenon

back on to the nature of the membrane itself. This surface pellicle is made up largely of dried casein due to the fact that evaporation takes place at the surface faster than convection currents can occur in so viscous a liquid as milk, and the result is that the surface of the liquid dries out to some extent. Any bacteria, tubercle or otherwise, that are caught in this layer are thus artificially protected by being encapsuled in the more or less dried casein.

It is evident from these investigations that the conditions necessary for the destruction of the tubercle organism in milk are not simply to heat the milk to a certain temperature, but it is necessary to so protect the liquid as to prevent the formation of this surface film.

#### ADVANTAGES OF LOW TEMPERATURE PASTEURIZATION.

One great advantage arising from the pasteurization of milk at this relatively low temperature (60 degrees C.) is that the consistency of the liquid is not changed. The chief objection that has hitherto been urged against the more common use of pasteurized products in general milk supplies is that the action of the heat destroys the creaming power of the milk and so renders it apparently thinner in "body," due to the fact that the cream line does not form on the surface. It has been previously shown at the Wisconsin Experiment Station by Babcock and the writer that this diminished viscosity is due to the separation of the characteristic fat globule clusters found in normal milk, into the constituent isolated globules. This physical change occurs at about 60 degrees C., and therefore, if milk is heated at this temperature or below, even though the exposure be continued for a long period of time, the milk does not lose its creaming power. If then, it is possible to destroy the tubercle bacillus with certainty at this temperature where the physical condition of the milk is not changed, one may be assured that such milk is perfectly safe so far as pathogenic bacteria are concerned, and at the same time the only valid objection that has ever been urged against the use of pasteurized products is thereby removed. This method has now been in practical operation at the University of Wisconsin for two years and has been thoroughly tested under commercial conditions. The keeping quality of such milk is satisfactory, retaining its sweetness for several days where the product is kept with any ordinary degree of care. The introduction of this process into general milk supplies has been quite rapid during the past year, and there are now quite a number of plants in the larger cities in the States that pasteurize a very considerable proportion of their output under these conditions.

## THE HOME TREATMENT OF PULMONARY TUBERCULOSIS.

By ALEXANDER McPHERDAN, M.B.,

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**P**ROBABLY less than 5 per cent. of the persons affected with tuberculosis are able to seek the advantages of the climates most suitable for their conditions. The question of treatment in this climate becomes, then, one of the utmost practical importance. The feeling is very prevalent, not to say universal, that the only hope of recovery from tuberculosis lies in the affected persons seeking a mild climate, and this view is general even among physicians. The laity, with few exceptions, regard the air of such a climate as possessing a special curative quality by which the disease is arrested, and in due time, cured. They associate with this far away climate much the same mystic power that they do with medicines and medical resources in general—a kind of occult influence that will act as a specific on their special cases and restore them to health. It is difficult to convince most people that the air of Colorado or California is no better than the air of Ontario, and that the only advantage these climates have over our own is in their dryness and warmth, especially the former, by which an out-of-door life is rendered more comfortable. Both in the case of those who are able to seek the milder climate, as well as of those whose ties or means prevent them leaving home, it seems most desirable to disabuse their minds of such erroneous ideas, and give them as clear as possible an understanding of the conditions that render one climate more favorable than another. Such a knowledge will prevent those who go to these climates from anticipating magic effects from them, and in many cases save them much disappointment, while those who remain at home will be more easily led to make the best of the home climate, which, after all, does not fall very far behind the best. It should be made quite clear that the chief benefit to be derived from a mild climate is in the facility it affords for living a comfortable out-of-door life, because the more clear people are of what constitutes a good climate, and how it exercises its beneficent influence, the more intelligently will they endeavor to make the most of this less favorable climate. There is now abundant evidence that tuberculosis can be successfully treated in any temperate climate. The rapid lowering of mortality in all the countries of northern Europe, as well as in America, offers the most convincing proof of the truth of this statement, as does also our own experience.

It is also important to note that in recent years experience has shown that practical and permanent success in the treatment of tuber-

culosis is best attained in the climate in which the patient must afterwards carry on his daily work. This is of special importance to that great body of sufferers who are unable even temporarily to resort to other climates.

Tuberculosis is avoidable and curable. To the knowledge that the disease is contagious is primarily due the diminution of tuberculosis in all civilized countries, because it has led to greater care not only of the sick but also of the well.

That the disease is contagious has been recognized only within the last two decades, but that it is curable was known to the ancients. Hippocrates wrote that "phthisis if treated early enough gets well." His wisdom seems to have been equalled only by his modesty, because he appears to mean by the expression that the patient would get well if given a proper chance, not that he could cure it. It is the most curable of chronic diseases. This is a statement of great importance. In the first place the fact that tuberculosis is curable robs it of the hopelessness with which even to recent times it has been wont to be regarded, and affords encouragement to the patient in the persevering use of the means for its arrest and cure. In the second place it emphasizes the importance of an early recognition of the disease by the patient as well as by the physician, so that the means of cure may be adopted promptly. It has been too often the custom to keep the patient in ignorance of the true nature of his malady until it is far advanced and practically incurable. Too often he has been informed that his lungs are a little weak, or that he has a little local bronchitis or a little trouble in his lung, consequently he has not seen the necessity for persevering with treatment intelligently. Before it becomes the rule to give patients a clear, explicit statement of their condition, there will have to be a general appreciation of the hopefulness of the outlook if treatment is begun in the early stage. With early diagnosis and suitable treatment probably 80 per cent. of the cases will recover. The crux of the question is the early recognition of the disease; then in the light of this knowledge it should be treated seriously from the first. Suspected cases in whom a positive diagnosis can not be made should be treated as established cases until they can be proved well.

In determining the means to be adopted in combating this disease in this climate we should realize that an appreciation on the part of the physicians of the importance of an early diagnosis and a knowledge on the part of the public of the hopefulness of early treatment will do more than any other agencies towards the provision of the proper means for the care of tuberculous patients. Of these means properly equipped sanatoria afford of course the best provision for treatment under skilled

sup rvision. Unfortunately only a small percentage affected can be provided for in sanatoria, but their usefulness does not end with the patients actually received into them. In every patient received they remove a focus of contagion from the community—a matter of great importance, especially if the patient is removed from a crowded house with small rooms and poor sanitary condition. A further important function of the sanatorium is to furnish an example to the community of the provision that should be made for tuberculous persons in their own homes. This influence will be of much more importance than the caring for the few sufferers within its own walls. It is a matter worthy of those charged with the administration of such institutions whether means can be adopted to extend this beneficent influence. While they furnish the best general plan for caring for tuberculous persons they are nevertheless not ideal, or suited, as at present administered, to all persons in the early stages. Many such persons are, though infected, yet vigorous and able for active employment. To send such to a sanatorium to pass their time in idleness seems injudicious, as with the proper restrictions they would be the better of having occupation for mind and body. This suggests a question worthy of consideration by all concerned, including the promoters of sanatoria, whether these institutions should not have attached to them some facilities for profitable work, such as vegetable and fruit gardens, etc., in which sufficient might be produced to meet their own needs. Various handicrafts, as carpentering, brick-laying, or any open air occupation, might also be carried on; new buildings could thus be added to the institution. Such patients would in this way be afforded opportunity for earning at least part of the means necessary for their own maintenance. There are certainly many young men who need sanatorium care but are yet quite able to do such out-of-door work and are the better of such mental and physical employment. Such cases usually do well on ranches on the western plains. A still further benefit arising from occupation would be the tendency of patients to remain longer under care, and this is most desirable. Sanatoria might thus be made largely self-sustaining, especially those for the poorer classes. It would of course need increased capital to establish such sanatoria, but they would be maintained at less cost.

Next, the question of the utilization of general hospitals for the care of tuberculous patients is an important one. At present such patients are generally refused admission into these institutions as no provision is made to accommodate them properly. This is not as it should be because, at least for many years to come, there cannot be adequate sanatoria accommodation, and in the meantime many of these unfortunate

ones have no place in which to be cared for. With few, if any exceptions, the hospitals in this country should have one or more pavilions in which to receive tuberculous patients at least temporarily. In Germany these additions to hospitals are becoming general even where greatly increased sanatorium accommodation is being also provided. It would greatly benefit many cases to have treatment in a hospital for a time to improve their general health and fit them for the more vigorous out-of-door life of a sanatorium. Many such pavilions would be placed as favorably as any sanatorium in this country can be, and in all of them the conditions would be much more favorable than they are in homes from which persons in need of admittance come. Furthermore, these pavilions would bring before the public in almost every county of this province examples of the provision that should be made in the homes in which tuberculous patients are cared for. They should be built as plainly and inexpensively as is compatible with efficiency. They would also furnish the most economical provision for the care of these patients as they would be managed without extra administration expense. In them also cases could be received that are unsuitable for sanatorium treatment, cases that must be removed from the home if we would save the children of the household. Let the sanatorium accommodation be never so ample there will still be the most urgent need for hospital provision for tuberculous patients, and it is the unmistakable duty of our general hospitals to make that provision. Many cases could be received into such pavilions that could only remain away from home and work for a few weeks. It is true that little can be accomplished in the way of cure in that time, yet much would be accomplished in the way of education. Patients would be instructed in the proper methods of living as to fresh air, food, rest and as to care of sputum, to disinfection of rooms, etc. These methods they could apply to their own houses with infinite advantage to their families and to the community. The great decrease of tuberculosis in England—and it is greater than in any other country—is largely attributable to the large number of special hospitals.

But even with the fullest sanatorium and hospital accommodation possible the great majority of tuberculous patients will still have to be cared for in their homes. In the better class of homes fully as effective provision can usually be made as in any sanatorium. In recent years the addition of verandahs and balconies to houses has become much in vogue; a most laudable addition it is and should be widely encouraged as it tends to greatly increase the time spent by the family out of doors and this increases the desire for fresh air in the house. There are few houses to which a simple balcony or verandah cannot be easily built on which a

tuberculous inmate may spend much time. I have advised it under such circumstances for several years past. Another feature that should be encouraged in future house building is the provision of a hospital room for the time of need that is certain, sooner or later, to come to all households. In the plans special care should be taken that this room at least has ample ventilation and sunlight, with a balcony attached if possible. Such a room would have much influence on the rest of the house and be a silent monitor inculcating the need for fresh air.

Where there is suitable ground available simple temporary or permanent shelters should be constructed in which patients can sit or recline for some portion of the day sheltered from the wind or rain. A simple summer house will serve the purpose, or a shelter made of duck such as is used for awnings will afford ample protection in all but the most inclement weather. Such shelters are portable and can be shifted to the most desirable positions.

The Provincial Board of Health has a large and important duty to fulfill in the prophylaxis and home treatment of tuberculosis. On it devolves the responsibility of educating the people in the dangers of contagion, in the means necessary to prevent it and the sanitary precautions required to prevent the spread of the disease, as well as in its treatment when acquired. Much may be done for the general health of the people by providing illustrated pamphlets dealing with the questions of fresh air, ventilation, furnishing, the use of tents and shelters, the importance of constructing verandahs to all houses and the kind of soil and location to be preferred for a house. Then special pamphlets should be provided describing the liability of infection, the danger of all sputum, the best means of destroying it and the importance of frequent cleansing and disinfecting of rooms occupied by tuberculous patients. Such pamphlets would instruct in prophylaxis as well as in the care of tuberculosis, and could be distributed through physicians especially such as dealt with the care of tuberculous patients. In England much is being done in this way by the anti-consumption league. Illustrations could be given of simple inexpensive balconies, of shelters, tents and summer houses. All this should be done with care so as to not produce an unreasonable fear of the disease as has been done in regard to the acute infectious diseases. Such work on the part of the Board would naturally lead to notification of the disease in order that the work might be more thoroughly done, especially in the disinfection of rooms of tuberculous persons. The increased care that would follow the improved education of the public would lessen the danger of infection of hotel rooms, sleeping-car berths and public places generally. The public would also learn

the importance, before occupying a house, of enquiring into its history and of the necessity of its disinfection especially if it had been previously occupied by tuberculous persons. Of course if the health authorities performed their part well, the public would be duly protected from such dangers.

There are three conclusions that should be specially emphasized, first, that the disease, in the early stages, if properly treated, is very curable, the great mortality from it being due to its great prevalence.

Second, that our climate is not detrimental to tuberculous patients especially in the early stages as it is fairly dry and its moderate coldness is no barrier to their being out-of-doors. In fact they should do better in the stimulating cold of winter than in the depressing heat of summer provided there is as free an out-of-door life.

Third, in order not only to lessen the prevalence of tuberculosis and in time "stamp it out", but to successfully treat those affected it is necessary to largely increase the Sanatorium accommodation; to make proper provision in all general hospitals for the care of cases that cannot be otherwise cared for; and to so improve the home of the people as to render them suitable for the care of the well no less than the treatment of the sick.

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## THE MEDICINAL TREATMENT OF TUBERCULOSIS.

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**T**O even name the various medicines which have been vaunted for the treatment or cure of tuberculosis, would occupy more space than is at my disposal; and while much interest could be excited, from an historical point of view, by the consideration of such drugs used from the earliest times; and while such a review would be extremely interesting also, as enabling us to institute a comparison between the scientific attainments of the medical mind of to-day, and the more empirical state of that of the profession within even our own time, the purposes of this short article will be best served by a necessarily brief consideration of some of the most important drugs used in this fell disease; as many of those exhibited even within the last two decades have entirely fallen into disuse and well merited oblivion. The purpose of this paper also, does not lead me to consider the action or use of such drugs as may be used symptomatically in the treatment of tuberculosis, as, say, the bit-

ter tonics for the anorexia which is common to tuberculosis, and many other morbid states of the system. Rather, I shall confine myself to the medicines used especially in the treatment of pulmonary phthisis, premising that the work cannot be in any sense exhaustive, but rather suggestive.

If any substance in the whole realm of materia medica were to be left for the use of the patient suffering from tuberculosis and all the others taken away, the great mass of the profession would choose *oleum morrhuar* as the one which could least be spared. To enter upon a discussion of its merits would not interest the readers of this Journal. One word I would like to say, and that is, that the whole product, usually in the form of an emulsion, seems more beneficial than any of the extracts of cod liver oil which are put on the market for the sake of their palatability, but which it is to be feared are at best, emasculated products.

Emulsions are usually better borne than the pure oil, and enable the physician to combine in one dose other medicines valuable in the treatment of the disease, as, iron, hypophosphites, etc. The writer would say that good will come from the exhibition of this remedy in some form, irrespective of other methods of treatment which may be carried on at the same time. The instances and times when it cannot be used with some benefit will be found to be very few, if due care and thought be given to its exhibition by the attending physician. This is especially true in the earlier stages of the disease. If there be one form of the disease in which it seems more beneficial than another, it is in the glandular involvement of young persons and children—though it is valuable at all times and in all forms when it can be given in such form so as to agree with the patient.

*Creosote and its derivatives.*—It is now some 15 years since this remedy was first exploited, and among the scores of drugs that have had their day since then, it still holds its place. Not so high a place indeed, as it did during the first year or two of its use, but it is still considered eminently valuable in the treatment of the disease, and especially in pulmonary phthisis. The purest form of the drug is essential to success, and unfortunately even this sometimes disagrees with the stomach. Patients differ greatly in the amount they can tolerate, but in many cases to say the least, by commencing with two or three minims, disguised as best possible, and increasing to the limit of the stomach's toleration, large doses, up to 30 minims and more even, may be given three times a day.

Its good effects seem to be directly proportional to the amount used. Here, as in so many other cases of treatment, a good stomach is above

price. Thus, one young man who came under the writer's care in what seemed an absolutely hopeless condition, with emaciation, high fever, night sweats, two small cavities, *et al*, rapidly increased the dose to 30 minims three times a day; taking at the same time (on persuasion) large quantities of nourishment and 4 oz., of pure oil per day, and rapidly improved in all respects. He was practically cured in about 10 months, all because he had a stomach "above rubies".

It may be given combined with cod liver oil, in an emulsion, or by inhalation. It is not believed that creasote has any specific action upon the bacillus, but doubtless it is the most efficient drug, pure and simple, that we have, cod liver oil being a food as well as a medicine. Under its persistent and skilful exhibition, the night sweats are lessened, the cough becomes less troublesome, assimilation is increased, and the condition is improved generally.

Many derivatives have been put on the market which are said to be less irritating to the stomach. Creasotal, or creasote carbonate, a liquid compound representing the carbonates of the various substance found in creasote, was tested in Von Leyden's clinic. The results as shown were highly satisfactory. The patient begins with 5 drops three times a day, increasing the dose three drops per day till 25 drops are taken at a dose. After being kept at this maximum dose for some weeks or even months, it is gradually diminished till 10 drops are taken at a dose. No interference with appetite, etc, is noted in these tests, and the inference one would draw from this report is that the action of the drug is specific rather than symptomatic. In Europe it seems more popular than pure creasote at the present time, and its trial is certainly advised in cases where the original creasote has become hateful to the patient.

*Guaiacol*.—Like many other remedies guaiacol had numerous advocates. The consensus of opinion seems to be that it possesses no advantages over creasote. It may be used for a change, as patients frequently tire of the use of one drug for months together and the effects of a change is sometimes beneficial, *per se*. Administered in pearls of one or two minims three times a day; hypodermically, one minim in olive oil, or thus combined with iodoform, it has been found useful, though, as stated above, either creasote or creasotal is preferable.

The use of guaiacol for the lowering of temperature from which so much was expected a few years ago, has been practically abandoned. Fifteen or twenty minims rubbed on the skin will produce a rapid but transient reduction of the temperature.

*Arsenic*.—A few words should be said about this drug, which was one of the sheet anchors in the treatment of pulmonary phthisis in the

days of our fathers and grandfathers, but which is now, it is to be feared not so often used; which omission is to the detriment of the patient.

Its mode of action is the production of fatty degeneration of the abnormal products of inflammation, thus rendering them more easy of absorption or expectoration, with a resulting lessening of the nidus for the bacillus. The hypophosphites probably act in the same way, and as both arsenic and hypophosphites are excellent general tonics, their double rôle in the treatment of such a disease as pulmonary phthisis is easily understood. They are very valuable.

*Iron.*—This drug also has fallen more or less into disuse in the treatment of the disease since the host of synthetic remedies, serums, antitoxins and tuberculins have been coming to the front. Circumspection is necessary in its exhibition, for when the alimentary tract, and especially the stomach, is not in good condition, and also when there is considerable rise in temperature, iron does no good, but rather harm. In the anæmic condition found in the early stages, some easily assimilable form of iron is not only indicated—it is a necessity.

*Alcohol.*—The routine exhibition of alcohol has fallen into disuse. The old saying that a man can use 2 oz. of alcohol per day as a food is, perhaps in the light of modern physiological chemistry, none too trustworthy. Much depends upon lung capacity, exercise, climate, nerve force, etc. The central idea in its use in phthisis seems to have been that of controlling nitrogen-loss. Rosemann concludes that "the use of alcohol to control tissue destruction in acute diseases is illusory, and is likely to lead to grave errors, since it causes fat retention, but the nitrogen loss goes on and the patient is really in a worse condition than his appearance indicates."

The old idea that its continuous use promotes fibroid changes in the lungs is now exploded.

Given with milk, or as a hot drink at bed-time, or with honey or glycerine, and in small quantities, it is often of service. If it promotes a sensation of well-being, does not flush the face, does not impair the appetite, and is not followed by a sense of depression when its effects wear off, it may be considered beneficial. Much care is needed on the part of the physician in prescribing this drug and its routine use is by no means to be recommended.

The number of new remedies with long names, and bizarre chemical formulæ are legion and while few persons in private practice pay much attention to them, perhaps a note of warning is necessary, especially to the younger members of the profession, that they may not be led away by any *ignis futurus*, of the scores of such lights which flare for a few

months through the pages of serial literature, only to go out into everlasting night. Only a few of them upon which favorable reports have been made, seem worthy of being mentioned in this place.

*Cinnamic acid and Cinnamate of Sodium.*—These have been favorably reported upon by Landerer and Lovtsky. The acid, in addition to being an antiseptic, produces in tubercular subjects a hyperleucocytosis. The cinnamate of sodium is used by intra-venous injection, about one-tenth of a grain, increased, in normal saline solution every 48 hours, this to be persevered with for from four to six months and then suspended for one month.

*Thiocol-Roche.*—This contains 52 per cent. of guaiacol. The dose is from 15 to 30 grains daily. Different writers have reported favorably on its action.

*Nitrate of silver*, though not a new drug, is new in this connection, and is said to have produced good results (Mays) when injected in the neck.

*Inhalations.*—The method of treatment by inhalation appeals to the patient, but, like so many others, has not been so successful as its advocates hoped it would be. Mention may be made of a few drugs which in certain cases seem to have proved beneficial.

*Formalin* in the combination of one dram of this substance with 4½ drams of glycerine in 5 oz. of water. If the mucous membranes are sensitive 10 minims of spts. ammon. aromat. are added to the mixture.

*Chloroform* is reported to have proved efficacious in checking the growth of the bacilli.

*Hot air inhalations* are highly recommended by many writers.

The various balsamic preparations, terebene, tolu, creasote, eucalyptus, and benzoin, while having no specific action, are found useful for special symptoms.

*Counter irritants*, as croton oil, tincture of iodine, and especially of the red iodide of mercury ointment of the B. P., are often found useful in relieving the pleuritic and myalgic pains. It is believed also that they tend to lessen the congestion in the parts beneath, and thus lessen cough, and put the patient in a condition of greater comfort.

A word or two may be added regarding a few remedies for the treatment of some of the symptoms specially troublesome in pulmonary phthisis.

*For the cough.*—Heroin has been lauded, and Daly states that it also checks the night sweats. If this be true, it is a valuable adjunct. When first exploited it was thought to have less unpleasant after-effects than other derivatives of opium but the most recent reports would lead us to

suppose that this, however desirable, is not true; so that codeia, when that drug will answer, or morphia otherwise, are holding their old place. Inhalation of tincture of benzoin, creasote, oil of eucalyptus or turpentine in some simple manner, as by pouring the drug on hot water and inhaling the volatilized particles, will often lessen the catarrh and give relief from irritating cough. Warm drinks, a small amount of hot whiskey with honey or glycerine, are sometimes beneficial, as are alkaline drinks, and especially in the later stages with cavities, when expectoration is absolutely essential. The above and similar means render it less exhaustive.

*For night sweats.*—Nothing has been brought forward equal in efficacy to the old atropine, in doses of  $\frac{1}{16}$ th to  $\frac{1}{32}$ th of a grain. The resulting dryness of the mouth and throat, and still more, the increased cough next day from the stimulating effects of the drug on the respiratory centre, makes it a not ideal remedy, but the best one we as yet possess. When the cough and restlessness increase sweating, the addition of say  $\frac{1}{4}$ th gr. of morphia is indicated. Among the dozens of other remedies which have been recommended for this troublesome symptom, we may mention aromatic sulphuric acid, muscarin, gallic acid, picrotoxin, sodium tellurate, 4 or 5 grains a day), and tincture of nux vomica.

*For the fever.*—The drug treatment of pyrexia is most unsatisfactory. As has been stated, the application of 15 to 25 minims of guaiacol gives a transient respite. Digitalis, quinine, antipyrine, antifebrine, *et al.*, are all weighed in the balance and found wanting, though any one of them may aid in suitable cases; the depressing effect of the coal tar compounds and the evil effect of quinine upon the stomach when given in adequate doses, being the principal objections to their use.

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## GOVERNMENT ACTION *re* TUBERCULOSIS.

By P. H. BRYCE, M.A., M.D.

Secretary of Provincial Board of Health of Ontario.

THE attitude of the medical profession and sanitary authorities towards tuberculosis, during the past fifteen years, has gradually become so well-defined that there seems to be no longer any necessity for discussion as to, What ought to be done? but rather, How it is to be done? The authorities in so conservative a country as England, have adopted as a sanitary measure in many local health districts notification of cases of tuberculosis, on the same basis as notification of other communicable diseases; while in other states and countries, compulsory notification has been put in force. While this primarily depends upon the State powers

granted to municipalities, yet it must be distinguished from the more formal legislation and executive acts, which Governments may themselves undertake for dealing with the problem of State aid to consumptives or, for suppressing the disease. It would be of no special value to refer to the old sumptuary laws of Italy during the 18th century for dealing with consumption, since the nature of the disease had not then of course been elucidated; but we shall confine these references to the work of recent years.

While the Hospital Service of Great Britain has greatly developed during the past century, whether as associated with its Poor Law system, or its municipal charities and medical schools, and though it is well known that "Chest Hospitals" or hospital for consumptives have existed in London and elsewhere for many years, yet it is nevertheless true that there, as elsewhere, consumption has until quite recent years been treated simply as one of the many diseases ordinarily dealt with in General hospitals and even in public wards. The situation as it was in London in 1882, is illustrated by the fact that although in that city there were 30,000 beds in public hospitals, yet there were but 482 beds in the four existing hospitals for "Diseases of the chest and consumption." The mortality for that year from consumption in London, was 8000, of whom probably 75 per cent would be amongst the poor. Such then was the situation in Britain at the period when Prof. Koch made his memorable discovery.

That the idea, which is so rapidly finding public favor to-day, is not of yesterday, on this continent, may be found in a series of resolutions unanimously adopted in the Public Health Section of the Pan-American Congress in Washington, in 1893, urging the system of County Sanatoria, as the solution of the problem for dealing with consumptives.

Undoubtedly however, it is to Germany, that we have to turn for the earliest practical schemes for dealing with consumptives in any fairly systematic way, although consumptive hospitals had existed at Ventnor, Bournemouth, and Torquay in England, as also at a number of seaside places in France. The progress of the work in Germany had been made possible by Imperial legislation passed in 1883, providing for the compulsory insurance of all classes whose daily wage did not exceed \$1.50 per diem, or for some 12,000,000 of the population. The residents of a district were required to insure in guilds, free associations, friendly societies, or with municipal or state insurance societies in their several districts, and the cost of such insurance was deducted by employers from the wages. The annual cost varied from 2 to 4 per cent of the wages. In 1891, the cost of sickness in the different associations was, \$21,312,610

for as many as 21,498 associations. The enormous extent of the operations of this Act is thus seen, and when in 1894, Weicker arranged with the Hanseatic Assurance Co., to receive a number of their tuberculous insured, while in the early stage of the disease, as patients at the Krankenhaus, or Sanatorium at Gorbersdorf, it may be said that the practical advent of the new idea had taken place. The cost was partly paid by the Insurance Company, and partly by the patient. When it was found, after 13 weeks' stay, that 80 per cent of the first patients went away so far cured as to be able to resume work, the commercial importance of the scheme became so apparent to the Assurance Companies that its rapid development was assured. Since then there have been established some 45 Sanatoria, owned either by states, by municipalities, by assurance companies, or by charitable associations, in which in 1900, some 4500 beds existed, and where 25,000 patients received treatment.

It is now some three years since the National Association for the Prevention of Tuberculosis was formed in Great Britain, and through congresses and special meetings in the different large centres, it has rapidly developed the idea of the open air treatment of consumption, which had proved so successful in Germany.

The problem of dealing with consumption in England, has been admirably presented in a recent address by Dr. Burdon Sanderson, who enquires how the work of suppressing tuberculosis is to be carried out: whether by Imperial authority, by County Councils and sanitary authority, by Poor-law Boards, by compulsory insurance societies as in Germany, or by levying a special county Poor Rate? He recalls the fact that that great sanitary administrator Sir John Simon, urged owing to the peculiarly chronic character of the disease, its special incidence upon the industrial population, and its wide-spread prevalence, that to be adequately dealt with, it should be dealt with as a special work by a special poor-rate.

A review of the work done within the last two years, since the organization of the National Association for the Prevention of Tuberculosis, shows that in keeping with the peculiar national characteristics of the English people,—defined by M. Boutmy, as “uncontemplative, impatient of abstractions, of the niceties of thought, and of the rigour of logic, the Englishman presses on to results, and is careless of anomalies”—the practical development of measures for dealing with consumption, is travelling along the several lines suggested by Dr. Burdon Sanderson. There does not seem to exist any published report of the full operations of the Branch Societies of the National Association for the Prevention of Consumption, but a reference to the weekly medical liter-

ature of the past few months, readily illustrates the situation. We have first the several Branch Societies holding meetings and having addresses and reports presented giving general and local statistics of the prevalence of the disease, as seen in mortality tables, and through the social prominence of those present, cultivating an interest in the higher classes whose influence and substantial aid are thus secured. There is next the active work done by the Local Government Board Sanitary Department, which prepares circulars, suggesting lines of municipal action to the local authorities in matters of foods and factory inspection, and likewise grants orders for loans, where local sanitary authorities undertake municipal sanatoria or hospitals. Following, and as a part of the sanitary administration, is the action taken by the County Councils, either separately or several combined for promoting county action in dealing with the subject.

The following are illustrative of county activity ;—The Westmoreland Association has interested the County Council, and already a number of the Municipalities have subscribed grants, amounting in June last to £731 and special grants for the annual support of 20 free beds, varying from £50 to £60 per bed, the County Council endowing one free bed at £60. The Durham Association reports the distribution of much literature ; Sunderland Town has decided upon voluntary notification of cases, giving 2s. 6d. per notification, and has already Horn Hall Sanatorium, with 18 beds—shortly to be increased to 40—in which were treated last year 36 patients, of which 14 of 16 primary cases returned to work, and 11 others were greatly improved and returned to work. A committee for Gloucester, Somersetshire and Wilts, has been formed to establish a sanatorium at Winsley for poor consumptives. The County of Perth has established a sanatorium at the Hillside Home, Perth, started through the gift of Sir Robert and Lady Pullan, of £8000, with a capacity of 20 beds, and bazaars are being carried on in different towns to raise £10,000 more for endowment and extension, the town of Perth having in this way already raised £3,000. As we would expect the larger urban centres have undertaken work independently, Leamington Town Council has instructed the medical officer of Health to arrange for the notification of cases, that it may take action in all those not properly cared for at home, and which may become dangerous to others. Kendal Town Council has ordered a prosecution in all cases where the bacilli of tuberculosis are found in public milk, and has called on all municipalities in Westmoreland to do the same. Halifax has made an order requiring that all cases of consumption with expectoration be notified. Manchester had similarly already put in force the recom-

mendations recently adopted by the Congress on Tuberculosis. Morpeth, Sheffield, Hull and Ayr have also taken action.

The London Association, under the auspices of the National Association has reported a year's results of the National Sanatorium at Bournemouth and discharged 226 patients, of whom 191 received the full open air treatment, with an average of 12 weeks stay; 63 per cent. of early cases showed arrest: 40 per cent. of those in intermediate stages showed good improvement, but 11 per cent. only of advanced cases improved. Plans are being prepared for an extension of the institution.

The North London Hospital for Consumptives, at Hamstead has, through an anonymous contributor, received a gift of £100,000 for the erection and partial endowment of a sanatorium of 100 beds, to be located on 60 acres in Hertfordshire. The Brampton Hospital is establishing a county branch and Convalescent Home, with 100 beds at Heatherside, near Bagshot, for open-air treatment.

Liverpool has two sanatoria erected at the expense of their Boards of Guardians and has just had opened, by Hon. Mr. Long, President of the Local Government Board, one in Delamere Forest on 30 acres of land, for 32 patients, lady Willox and Mr. W. P. Horley each giving £7,500 towards the fund.

Dundee Infirmary has 4 open shelters in connection with the Infirmary where 80 patients were very satisfactorily treated last year.

The London Sanatorium Association has begun operations with a loan of £30,000, at 2½ per cent. through the kindness of Wertmer, Beit & Co. who are to receive interest only after expenses have been defrayed.

Edinburgh is preparing a scheme for a hospital of 100 beds for advanced cases, in the present fever hospital, it to be transferred to a new building in the suburbs.

In addition to these there are several private sanatoria at different points, illustrating the value of open-air treatment. From these illustrations it becomes amply apparent that apart from any general law, the highly developed, though complicated, and cumbrous municipal machinery of Great Britain is, through a rapidly developing public interest, dealing with this as she has with so many other social problems, in a manner which reflects that spirit of practical wisdom, which in the social developments of the past century, has made her *facile princeps* among the nations.

We have already noticed what has been done in Germany, and has been well begun in France. The work has however extended greatly beyond the confines of these two countries on the Continent. In Switzerland the Canton of Zurich has established a sanatorium at Wald of 88 beds.

Belgium, Holland and Spain are establishing sanatoria, and the Swedish parliament has recently voted 850,000 crowns for a sanatorium, which amount has been supplemented by the gift of 2,000,000, crowns recently given to King Oscar, who has devoted it to sanatoria in Northern and Central Sweden.

We may now turn to the progress of the sanatorium idea in America. The last United States census shows a mortality from consumption at least equal to that of England, and it might be expected that the importance of this subject would before now have taken a strong hold of the people where such strides in material progress have been made; but an enquiry recently made, elicits the following facts. For the 100,000 merchant sailors, amongst whom, 1000 cases of tuberculosis are treated annually, the Marine Hospital service has an hospital or sanatorium at Fort Stanton, New Mexico. Replies from State Hospital officers indicate that no legislative action towards establishing sanatoria for consumptives has been taken in thirty states. Of these, Illinois, Maine, Michigan, Minnesota, Nebraska, New Hampshire, New Jersey, Pennsylvania, Rhode Island, have introduced bills before the State Legislatures for a State sanatorium, which have, however, not yet become law. New York state, however, passed an act in 1900 for establishing a State Hospital in the Adirondacks for treating incipient pulmonary tuberculosis. Powers are given the trustees for admitting free patients. The amount of the grant for the same was \$50,000 and an additional \$100,000 has been given in 1901. Massachusetts has also made provision by a grant of \$150,000 and has established at Rutland a state sanatorium for incipient cases.

It would appear further that in the United States the genius of the State constitution makes but little provision for the adoption of general State laws, looking to aiding municipalities to establish such institutions. It may be either the State or it may be the municipality, but State assistance with State oversight is but seldom adopted. That there is a rapidly developing municipal sentiment looking to the care of, at any rate, the consumptive poor in advanced stages, is apparent from the existence of several institutions such as the Cook County, Hospital for the Poor, Chicago, of 300 beds, a New York city hospital a few miles up the Hudson and the Sharon Sanatorium near Boston with however a philanthropic basis. Such would seem to be so far the principal legislative developments in the United States, of special institutions for the treatment of consumptives.

Turning to Canada it may be said that a grant has been made towards a sanatorium near Halifax, by the Nova Scotia Legislature, but apart from that the only legislation bearing upon the subject is that

passed by the Legislature of Ontario, in 1900. The bill, so far as the writer is aware, is the first on the Statute book of any country, which provides for the systematic establishment of sanatoria, as a part of the sanitary machinery of the country, whereby the State assists, and inspects the sanatoria, which may be established by any county or municipality or groups of municipalities, along lines clearly set forth by the Statute. It is essentially in keeping with the evolution of the other public charities of the Province, wherein governmental, municipal and philanthropic financial aid are combined, and which would seem likely, when developed by the aid of an educated public sense both as to the need for such institutions and the incalculable benefits to be derived from them to prove the nearest to a practical solution of the problem, at any rate in such communities as exist in America.

What is specially urgent at present is the formation of a strong National organization with its associated Provincial Societies for educating through literature, public lectures and the example of liberal-hearted men of means in our several counties, the people and municipal authorities up to a point where they will take such positive action, as has been done in the matter of General Hospitals and County Houses of Industry as well cause by-laws to be submitted for the establishment in counties, or groups of counties of Sanatoria, with separate hospitals for advanced cases. Such will enable Local Health Authorities to press forward the work of notification of cases, and the household investigation of those cases, which through poverty, become a danger to their families and thus indirectly to the public.

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#### PREDISPOSITION OF SPECIAL ORGANS TO TUBERCULAR INFECTION.

**D**IE Deutsche Medicinische Wochenschrift for October 10th discusses the predisposition of organs for infection with the B. tuberculosis, pointing that the larynx and trachea enjoy a comparative immunity. That the intestinal mucosa is not one of the more susceptible tissues is shown by the fact that it is often found intact when the mesenteric glands are involved and when pulmonary lesions exist. Nevertheless were the tubercle bacilli found in milk and butter really virulent for the human organism, we should expect to find primary enteric lesions of some frequency, whereas they are very rare.

A. J. M.

## THE SELECTION OF CASES OF PULMONARY TUBERCULOSIS SUITABLE FOR SANATORIUM TREATMENT.

DR. N. A. POWELL, Toronto.

**A**N experience extending over nearly five years, and taking in the physical examination, the charting, and the estimation of many hundreds of applicants for admission to a sanatorium is the basis for what it is proposed here to present. In the working out of this experience, views once strongly held, have undergone material change, and the possibility of helpfulness to cases neither recent in time nor limited in respect to lung involvement has been a most pleasing surprise. Though suggestions made to the family physician who have referred cases to me, patients have been distributed to health resorts in various parts of America, but in the main the attempt has been to determinè what particular classes of tuberculous patients would receive the greatest benefit from a residence in the Muskoka Cottage Sanatorium, situated near Gravenhurst. This institution was built and is being maintained to demonstrate that consumption recognized early and subjected without delay to what is embraced under the term "Sanatorium Treatment" is a curable disease. Its annual reports state fully and frankly what has been accomplished. An initial expenditure of some \$80,000 dollars has made it possible to treat sixty resident patients at a time. At present this accommodation is not nearly sufficient to care for the suitable patients desiring admission, but the pressure now felt will be relieved in a few weeks when the new buildings for public ward patients are ready. Built in our Laurentian region at a moderate rather than an extreme elevation, with air made dry by blowing over sun warmed granite hog backs and balsamic from its passage through forests of pine its situation is ideal and its success in coping with lung disease, in the class of patients for which it is designed was from the start assured.

One, not a physician has written :

" There's iron in our northern winds  
Our pines are trees of healing ".

And his words are words of wisdom.

The difficulty has been to secure patients in a sufficiently early stage, and the distressing part of my work has been having to refuse admission to patients unsuitable by reason of the nature of the invasion or the stage of disease reached

A physician's own health is known to influence largely his view regarding the outcome of the disease in others. Chronic indigestion, for example, may cause him to look with gloomy foreboding upon a simple

metastasis of mumps, seeing in it the probability of greatly impaired future usefulness or possibly the extinction of an ancient line.

*Per-contru*, if his own health is flawless, he may see for his patients possibilities of improvement which others less optimistic cannot discern. I can only explain in this way and on the theory of robust health in my *confreres* the cases in the cavity stage, the cases with bilateral deposit and laryngeal ulceration, the cases of phthisis florida, the cases with large and frequent hemorrhage, the cases with dilated heart or with ruined digestion or with massive fibroid change, as well as others equally hopeless which come to me as being "incipient and most suitable for sanatorium treatment."

Provision requires to be made in the near future for all such cases but the Sanatoria at Gravenhurst, must be kept for patients who can receive more than brief temporary benefit.

Without attempting to follow a strictly scientific classification it may be useful to consider certain clinical groups more or less suitable for regulated open air treatment in the Muskoka region as well as for the hyper-alimentation which is the element of next greatest importance in securing arrest of the disease and ultimate cure.

Unresolved pneumonias and cases of pneumonic (c) phthisis of limited extent and with the acute stage well over are, I am led to think better cared for in sanatoria than elsewhere. Cases of acute bronchopneumonic phthisis have nothing to expect from the open air treatment, and it is only from the fact that I have been importuned to admit such cases, because they were of recent development, that they are here mentioned.

In chronic ulcerative phthisis everything depends upon the early recognition of the disease.

It is greatly to be feared that until the fact is recognized that a thermometer and a set of platform scales may point the way to an earlier diagnosis than is possible by means of the stethoscope and the microscope, valuable time will continue to be lost and chances for recovery needlessly sacrificed.

If we wait for localized rules and for an expectoration containing tubercle bacilli we wait too long. Elsewhere in this number of THE LANCET the elements of an early diagnosis are discussed, and in consequence they will not be here taken up.

Our general hospitals will not now admit cases of phthisis and our students have imperfect means of obtaining that training in the physical diagnosis of this disease which is all essential.

If the carrying out of plans now fully matured is not again blocked,

we shall shortly have in the immediate vicinity of Toronto an opportunity for the almost constant teaching of small classes with abundant material for illustration. When this time comes—and it may come soon—I trust that many physicians now in practice will visit Toronto for purposes of post-graduate study, and that the facilities provided will aid in the removal of such stagnation as is inevitable when one's work is isolated, and cannot be checked and compared with the work of others who are expert.

If my own experience is a guide, such a review will prove of more real benefit than any number of the courses on operative surgery or gynecology, now so popular in many cities.

Returning to our clinical groups, we next consider the hemorrhagic cases. Early hemorrhage, mixed with mucous, limited in extent, due to congested areas, and not to the ulceration of vessels or the giving way of small aneurisms, is in itself often a fortunate occurrence. It compels attention, and may lead to treatment which, without this warning, might have been disastrously postponed.

The other forms of hemorrhage mean, of course, advanced lesions, with softening, and their occurrence clouds the prognosis. As to the pleuritic groups, we must distinguish the primary from the secondary forms. French pathologists tell us that with them 80 per cent. of all pleuritis are tuberculous, and Bowditch had phthisis developed in thirty out of ninety cases treated by aspiration. In next month's number my assistant, Dr. Lusk, will point out the great relative frequency of pleurisy in a series of cases tabulated by Dr. J. H. Elliott.

It was the writer's fortune to practice for ten years in the County of Simcoe, and to treat there a great many cases of acute pleurisy, with or without effusion. In not a single instance did phthisis follow these attacks, but in cases seen since my removal to Toronto the sequence has become a common one. Does not this justify the belief that in northern Ontario pleurisy tends toward complete recovery, while along the great lakes its after treatment involves graver responsibility? Up to the present time twenty-five operations for empyema have been done by myself, and, so far as traced, in but a single one of these has there been an ending in phthisis. Laryngeal cases in the state of infiltration only, and with limited lung deposit, have often with us shown signal improvement. They are still being admitted, but when accommodation is provided elsewhere the line must be drawn more closely. Cases with open laryngeal ulcers are always unsuitable for sanatorium treatment.

Turning now to fibroid condition of the lungs becoming in an early or later stage tuberculous, it may be stated that during the summer

months a Muskoka residence is likely to prove distinctly helpful. In spring and fall the risks of catching cold are not to be ignored, while in the settled, dry cold of winter I have known a number of cases, not too advanced, to be signally benefited.

Reference has been made in this communication to the painful duty of refusing admittance to patients greatly needing and desiring treatment. All such must soon be provided for, and it is our duty to point out to men of means the great field for usefulness now open to them, and their privilege in this respect. In conclusion, may I be pardoned for mentioning that amongst the most delightful experiences of present years may be counted the meeting with a large and ever-growing number of persons restored to health and to all life's activities through agencies which are the subject of this paper.

#### SERUM DIAGNOSIS OF TUBERCULOSIS.

**E.** ROMBERG, (*Deutsche Med. Woch.*, May 2nd, and 9th, 1901) describes the work of Arloing and Courtmont. The *modus operandi* of this test is briefly: an emulsion is made with a  $\frac{1}{2}$  per cent solution of caustic soda from dried divided tubercle bacilli (in his belief this is as effectual and more reliable and convenient than the cultures as used by Courtmont). Blood is taken from the loin by cupping, it is left standing for three to six hours the serum is removed and mixed with the emulsion diluted three times, while a control tube of blood from a non-tuberculous patient is also used. The tubes must not be shaken and about 5 c. cm. of each is used. Agglutination is marked by the falling of a precipitate and the perfect clearing of the upper part of the mixture, and this requires from twenty to forty hours. The reaction is positive in mild or early cases and negative in those which terminate rapidly or are far advanced, thus it is not only of diagnostic but prognostic value.

An interesting coincidence is noted by comparison of the result of this test with Nageli's table of the frequency of tuberculosis, the statistics from the two showing marked agreement. Romberg's results justify the conclusion that positive agglutination is a certain proof of the presence of a progressive or at least not inactive tuberculosis, while a negative result means that there is no tuberculosis or that the deposit is quite healed or that the case is far advanced and has a bad prognosis.

A. J. M.

## INTRAPERITONEAL TUBERCULOSIS.

By JAMES F. W. ROSS, M.D.

### TUBERCULOUS PERITONITIS.

CLASSIFICATION. After a considerable experience with tubercular peritonitis I have come to the conclusion that many of the classifications given are artificial and confusing. I consider that the disease occurs in two forms:

1. With fluid, (the ascitic form).
  - (a) Serous;
  - (b) Purulent.
2. Without fluid, (the dry adhesive form).

In either variety we may have tubercular disease in other organs or such disease may be entirely absent. When fluid is present it may be either serum or pus.

DEFINITION. Tubercular peritonitis is a disease of the peritoneum consisting of the deposit of tubercle in isolated patches, producing nodules causing inflammatory adhesions and, in some cases, the effusion of fluid, and affecting many of the organs covered by peritoneum, such as the ovaries, Fallopian tubes, uterus, bladder and kidneys, stomach, intestines and mesenteric glands, omentum, liver and spleen.

GENERAL CONSIDERATIONS. Of all the forms of chronic diffuse peritonitis the tuberculous is the most common and of the greatest clinical importance. In acute miliary tuberculosis the peritoneum, especially the omentum and the peritoneal covering of the liver and spleen, is studded with small grey miliary tubercles. This condition is oftentimes accompanied by serous effusion and is not attended by any symptoms that can be definitely ascribed to it. Under such circumstances it is part of the general tubercular infection. When it occurs apart from acute miliary tuberculosis it becomes a distinct disease with definite clinical signs. Small nodules are present and these nodules are similar in appearance to the nodules in miliary tuberculosis found elsewhere and require no special description.

There is a great tendency to the formation of a new tissue, and this tissue produces firm adhesions to one another of the parts affected, except when fluid is poured out separating the surfaces.

The omentum is often shortened and thickened until it can be felt through the abdominal wall as a hard mass that may easily simulate a malignant tumour. The mesentery and mesenteric glands are often found thickened. The bowel wall is very much thickened, injected with

blood, and velvety in appearance. The parietal peritoneum may be one-half an inch thick and the tissues of the abdominal wall, external to it, may appear cedematous as if filled with a turbid fluid, giving it a greyish appearance and looking just as the abdominal wall does external to an appendiceal abscess, or some intra peritoneal septic condition.

The quantity of fluid poured out varies very greatly. In some cases it is pocketed, in others encysted, and in others free in the peritoneal cavity. The fluid is blood stained serum. Sometimes there is no blood staining and the fluid is then straw colored. The fluid may become purulent but this is a rare occurrence, except as a consequence of operative interference or intestinal perforation from within. Coils of intestine ulcerate, occasionally, into one another or into the bladder or through the abdominal wall. In some cases there is a complete absence of any chest affection; in others there may be tubercular pleurisy, while in another class of cases the lung tissue itself may be affected. Primary tubercular of the genito-urinary organs is often followed by general tubercular peritonitis.

It has been stated by some that there are two separate and distinct conditions in which the deposit of fibroid nodules takes place in the peritoneum. One of these is of tuberculous origin and the other of inflammatory origin. If this is so, it is strange that we do not meet with these fibroid nodules in all cases of subacute inflammation of the peritoneum. It is not difficult to explain the co-existence of tuberculous disease and tumor of the ovary or uterus. If a tuberculous diathesis exists in the patient, tuberculous deposits are liable to take place in parts in which irritation is present. If a growth is present, irritation is present, and it is but natural to suppose that tuberculous deposit is all the more liable to occur in cases in which there is a growth than in cases in which there is no growth. The fibroid of the uterus or the cyst of the ovary acts as the exciting cause of the deposit just as the inhalation of dust acts as the exciting cause of the deposit of tubercle in the lungs.

The age at which the disease may occur varies. In my cases I found it most frequent between the ages of 15 and 25; the youngest patient being 14 and the oldest 49.

**SYMPTOMS OF TUBERCULAR PERITONITIS.** In the female there is frequently some disturbance of menstruation. At first the menstrual flow appears to be increased in quantity. There may be irregular floodings; later on, amenorrhœa often sets in and a leucorrhœal discharge is frequently met with.

In many of the cases there has been a history of a previous illness that has, perhaps, been but ill understood. The patient has at the time suffered from abdominal pains and low fever, from which a partial re-

covery has taken place. Then emaciation sets in, together with enlargement of the abdomen. The patient feels an unaccountable weakness and, though the appetite may remain fairly good, the health becomes seriously impaired. The patient becomes anæmic. In some there is an irregular diarrhœa, perhaps with a discharge of blood-stained mucus. Nausea and vomiting are sometimes present. The temperature and pulse become elevated and a hectic flush appears upon the cheeks. The teeth become dry and covered with sordes. The tongue is glazed and red. Sometimes a cough sets in and râles may be noticed over some portion of the lungs, or fluid may be found in the right or left pleural cavity. These patients may remain ill for many months; they then look as if in the last stages of septicæmia. In some cases chest trouble may be noted before there are any abdominal symptoms.

The symptoms may run over a great many years. One of my cases was tapped six years prior to the date of my operation on her. In some cases the onset of the symptoms is quite sudden. This appears to point to the sudden entrance of the tubercle bacilli into the parts.

The character of the pain varies from a steady, dull, aching pain to very acute pain similar to that found in acute peritonitis.

**PHYSICAL EXAMINATION.** On physical examination, bowel resonance is found in front and dullness in the flank, if fluid is free in the peritoneal cavity, but, as a rule, bowel resonance is irregularly distributed. If the fluid is encysted, the area of dullness will be limited to one portion of the abdomen. Irregularly hard nodules may frequently be felt on palpation. A peculiar far-away feeling to the parts is to be observed if the peritoneum is thickened, or, in other words, there is an obscure, indefinite feeling not to be met with in other intra abdominal diseases.

*Pelvic Examination in Women.*—The bi-manual examination may indicate the presence of masses on either side of or behind the uterus. The pelvic cavity may be filled with such masses. Pelvic examination, under such circumstances, is as a rule indefinite.

**DIAGNOSIS.** The diagnosis lies between tubercular peritonitis; chronic peritonitis, accompanying pus tubes or abscess of the ovary; malignant disease of the peritoneum or cancerous peritonitis; papilloma of the ovary; ectopic gestation subsequent to rupture of the sac; ovarian cyst; and chronic appendicitis.

*Pyosalpinx or abscess of Ovary, not tubercular.* In a case of double pyosalpinx, or abscess of the ovary, due to direct infection subsequent to labor or abortion or from gonorrhœal virus, the history will give us some clue as to the real nature of the condition present. For instance, if the hymen is intact the chances are that the disease must be

tubercular. If the illness began subsequent to miscarriage the chances are that the disease is not tubercular, but it is only by a careful attention to details that a correct diagnosis can be made. Tubercular appendicitis will be rarely met with.

*Malignant Disease of the Peritoneum.* In malignant disease of the peritoneum the temperature is not, as a rule, elevated to such an extent as it is in tubercular peritonitis. Though the tongue is red and glazed the teeth are not covered with sordes. The skin usually has the faded leaf appearance and a crepitation can frequently be made out as a consequence of the attrition of the little pendulous grape-like bodies that hang free in the serous fluid filling the cavity of the peritoneum. I consider this crepitation as a valuable diagnostic sign of cancerous disease of the peritoneum.

*Papilloma of the Ovary.* In papillomatous disease of the ovary there is, as a rule, no elevation of temperature. A tumour can be made out and can readily be diagnosed as tumour of the ovary. Free fluid will be found present in the abdominal cavity. Operation is therefore undertaken for ovarian cyst. It will sometimes be impossible to differentiate between papilloma of the ovary and chronic tubercular peritonitis of the ascitic form.

*Ectopic Gestation Subsequent to Rupture of the Sac.* In one case I found symptoms closely simulating an ectopic gestation. Uterine hemorrhages after having missed a period, pains in the breasts, sudden pain in the abdomen, boggy, indefinite mass in the pelvis and free fluid in the peritoneal cavity. When peritonitis sets in, as a consequence of the rupture of a tubal pregnancy, it may be impossible to make a differential diagnosis between this condition and tubercular peritonitis.

*Ovarian Cyst.* In many of the cases an ovarian cyst may be mistaken for encysted tubercular peritonitis and *vice versa*. Amenorrhoea, enlargement of the abdomen, absence of fever, and evidences that the fluid has become encysted, will make it impossible for anyone to say whether the case is one of ovarian cyst or encysted tubercular peritonitis.

*Chronic Appendicitis.* Appendicitis may closely simulate chronic tubercular peritonitis and it is only after the abdomen has been opened that a correct diagnosis can be made.

ORGANS FOUND AFFECTED. In the cases tabulated below the conditions found at the operation are given. The reader can easily scan them over for himself. It will be found that there is a great deal of repetition and nothing is found there that is not included in the original definition of the disease.

**SUBSEQUENT HISTORY.** The number in good health after operation is 14; in fair health, 4; in poor health, 1; number without subsequent history, 9; making in all 28. There were 13 deaths: 6 died of phthisis pulmonalis; 1 of tubercular laryngitis; 1 of acute pneumonia; 1 of cerebral tuberculosis; 4 shortly after operation.

**SUMMARY.** One is bound to confess that but little more is known of this disease than was known years ago. No advance has been made. Many theories have been advanced as to the effect of operation, the surgeons have puzzled their brains to determine the exact manner in which surgical operation benefits the patient. Some have stated that it is the entrance of air; others that it is the increased congestion of the peritoneum produced (but it seems as if increase of congestion is almost impossible as the intestines are already so loaded with blood); others claim that it is the mixed infection that is introduced. The physicians state that we are "barking up the wrong tree," that surgical operation has no effect whatever, that patients do just as well without surgical interference and make as rapid and as complete recoveries. They state further that these recoveries are not influenced by the administration of drugs.

After everything is taken into consideration, we are forced to the conclusion that there is an inherent tendency in the tuberculous patient to cure himself. Something seems to act on him like the breezes on the surface of the water purifying the depths below. But our research does not appear to have brought us any nearer to a solution of the "mystery," to a knowledge of what that "something" is.

All the cases that have come under my care are not included in the table. I have treated others "without" surgical interference and am free to admit that the results have been satisfactory. As a surgeon, however, I prefer to operate on such cases as I still have a lingering belief that convalescence is somewhat hastened thereby. This belief may be an erroneous one.

#### TUBERCULAR DISEASE AFFECTING THE INTESTINAL WALL.

We have now to speak of tubercular disease affecting the intestinal wall. In the table three cases of this kind have been noted. The portion of the intestinal wall affected in two of the cases was the omega flexure of the colon; in one case the small intestine was the site of the disease. In two other cases seen on which no operation was performed, the omega flexure was also the site of the disease, so that it seems as if tubercular disease is particularly prone to affect this part of the bowel. One of my patients had been fighting against tuberculosis for years.

*Symptoms.*—The symptoms produced by the deposit of tubercle

No.	Book No.	Name.	Age.	Doctor.	Family History.	Symptoms.
1	10	Mrs. K	36	J. Ross, Sr.		Rapid enlargement of abdomen. Facies ovariana; shooting pains.
2	11	Mrs. C.	35	—Wilson		Sudden pain on left side of abdomen; swelling of abdomen; sickness at stomach; bowels move every other day.
3	18	Miss B.	16	L. G. McKibbin.	Mother died of tubercular laryngitis.	Thin, emaciated; temperature and pulse elevated; gradual enlargement of abdomen; free purgation reduced it; increased again; pain at times; no oedema.
4	23	Miss P.	32	M. Stalker		Menstruation more profuse, lasting two weeks; emaciation and anæmia; pain at neck of bladder; frequent micturition; chills, night sweats, pain in pelvic region; no vomiting; bowels regular.
5	35	Mrs. I.	36	—Shaw		Emaciation; red tongue, coated in centre; sordes on teeth, teeth dry; abdomen began to enlarge Feb., '91; fullness and bloating; loss of appetite; derangement of digestion; general weakness; periodical fever, worse at night.
6	61	Miss D	23		Mother and father died of phthisis.	Menstruation became profuse; intra-abdominal pains and pelvic pains; bloated feeling; emaciation; diarrhoea; vomited in attack of cramps; went to bed, pain severe; constant on right side, slight on left, worse at times.
7	82	Mrs. L.	28	G. H. Carveth.		Suffering some time; after intra-uterine application a chill; for many years had stiff knee joint, and from old scar evidences of bone disease; temperature and pulse elevated.
8	90	Mrs. M.	23			

Physical Examination.	Diagnosis.	Date of Operation.	Organs Found Affected.	Result of Operation.	Subsequent History.
Bowel resonance in front and flank. Uterus small. Free fluid in peritoneal cavity.	Between tubercular peritonitis and malignant disease of peritoneum.	Mar. 28, 1890.	Intestines, peritoneum. Bowels glued together. Ovaries and tubes normal. Large quantity fluid present.	R	Died shortly after from phthisis pulmonalis.
.....	.....	Mar. 28, 1890.	Intestines distended with flatus. Peritoneum and intestines studded with tubercle. Large quantity of fluid. Abscess of right ovary. Haematocele of broad ligament, tarry fluid and pus on puncture. R't tube tubercular.	D	Was in a very bad condition before operation.
.....	Tubercular peritonitis.	June 18, 1890.	Intestines matted together. Fluid. Tubercle of intestines and peritoneum. Washed out. Drained.	R	A sinus for a time; in 1900 patient been married and in good health.
Lungs healthy. Pus in urine. Acid reaction.	Double pyosalpinx.	Aug. 16, 1890.	Omentum, intestines, peritoneum studded. Fallopian tubes filled with pus; not removed. Bowels matted. No fluid. Dry adhesive form.	R	Better for a few weeks; gradually became weaker; bladder symptoms increased; tubercular cystitis; lungs affected; death one year after operation.
Hardness irregularly distributed over abdomen; irregular tympanites; ascites; enlarged veins on abdominal walls.	Between malignant disease and tubercular peritonitis.	Feb. 26, 1891.	Peritoneum, omentum, intestines studded; pelvis could not be reached owing to adhesions; encysted fluid; washed out, did not drain.	R	Died one month after; temperature remained elevated; patient gradually weakened.
Hymen intact. Rectal examination, masses to be felt in neighborhood ovaries.	Tubercular.	Sept. 29, 1891.	Ovaries cystic, omentum thickened and dark; recent peritonitis; serum in peritoneal cavity; tubes and ovaries removed; tubercles on walls, fallopian tubes and pelvic peritoneum; tubes not enlarged.	R	Improved in health; married about two years after; no further history.
General peritonitis chronic; large masses in pelvis to be felt.	Pus tubes	Mar. 18, 1892.	Peritoneum, intestines studded; tubes thickened to 6 or 8 times natural size and filled with pus; bladder implicated; attempted to remove tube; hemorrhage severe; tissue would not hold ligature; portion of intestine tore during enucleation.	D	Operation very difficult; died two days after operation.
.....	Tubercular peritonitis.	May 17, 1892.	Peritoneum thickened and studded with tubercle; parietal peritoneum about $\frac{1}{4}$ inch thick; intestines vascular rough and granular and matted together; no fluid; dry adhesive form.	R	Went home June 2, '92, and have no further history.

No.	Book No.	Name.	Age.	Doctor.	Family History.	Symptoms.
9	165	Mrs. S. ....	35			Ascitic fluid in peritoneal cavity.
10	219	Mr. D. ....	14	M. Wallace .....		Been ill six weeks; pains in abdomen, diarrhoea; temperature elevated every night; night sweats; commencing cough.
11	222	Mrs. H. ....	48	H. H. Moorehouse .....		Been tapped six years previously and again recently.
12	270	Mrs. M. F. ....	31	J. R. Stone .....	Husband died of phthisis.	Menstruation always regular until nine months ago, when attack of indigestion she thought; five weeks bloated twice her natural size; missed one period; following month unwell and flowed steadily 2½ months; then unwell every two weeks until six weeks previous; since then seen nothing; leucorrhoeal discharge; steady, dull, aching pain region right ovary; sharp pain both limbs.
13	275	Mrs. R. ....	26			Misplacement of womb had been diagnosed; elevation of temperature, 105½ for few days, and then dropped to normal; supposed to have had typhoid fever with night sweats and chills.
14	279	Mrs. H. ....	33	A. R. Gordon .....		
15	292	Miss R. ....	32	J. Thorburn .....	Father and mother died of phthisis.	Menstruation irregular; flooding; constant pain on right side; feverishness and sickness at stomach; pulse elevated; ill some weeks; several attacks of hæmoptysis; scars of two or three tubercular abscesses over ribs; one sinus re-opens at intervals.
16	299	Mrs. L. ....	32	G. S. Cleland .....		Pain in abdomen; temperature elevated for some time; someone diagnosed as ectopic gestation.

Physical Examination.	Diagnosis.	Date of Operation.	Organs Found Affected.	Result of Operation.	Subsequent History.
		Apr. 20, 1893.	Operation performed without anaesthetic; pains for a moment, but after peritoneum reached this ceased; large quantity of fluid evacuated; peritoneum and intestines studded.	R	Left hospital May 20, '93, and have no further history.
	First thought it was a grippe; then tubercular peritonitis.	Feb. 23, 1894.	Peritoneum fully one inch thick; intestines adherent; impossible to wash out.	R	Is perfectly well.
Mass felt on right side, thickened and tympanic; on left side dullness on percussion; evidently fluid encysted.	Encysted tubercular peritonitis.	Mar. 2, 1894.	Incision median line and found peritoneum very much thickened; impossible to enter abdomen through front owing to intestinal adhesions; another incision to left and fluid drained off.	R	Wound never healed, and patient died six weeks after operation.
Uterus retroflexed, enlarged and low down.	Pus tube, or abscess of ovary, right side.	Sept. 20, 1894.	Omentum glued down in front; peritoneum studded with tubercle; intestines adherent to intestine; removed nothing.	R	Good recovery; has since married but had no children; is quite well.
	Probably tubercular peritonitis.	Oct. 12, 1894.	Omentum firmly adherent to parietal peritoneum; no fluid; of the dry adhesive form.	R	Have been unable to trace subsequent history, but when patient left hospital the temperature had reached normal limit.
		Jan. 7, 1895.	Stomach adherent over upper surface; stomach wall covered by tubercle; enlarged lymphatic glands behind stomach; other portions of peritoneum studded.	R	Subsequently suffered considerably from gas; in November, 1901, is stout and quite well; has never been sick since operation.
Tender to touch over abdomen.		Feb. 21, 1895.	Old cheesy cyst of hydatid of Morgagni size of walnut; both tubes club-ended and filled with cheesy material; ovary healthy; evidences old tubercular disease in pelvis.	R	
Free fluid in peritoneal cavity; abdominal wall thickened, and peculiar "far-away" feeling to peritoneum.	Tubercular peritonitis.	Mar. 30, 1895.	Omentum firmly adherent beneath surface, pressed to one side; hole broken through and fluid removed; peritoneum studded. Washed out and drained.	R	Had pneumonia in lower lobe of right lung; two or three years afterwards she looked the picture of health; in interval husband died of phthisis.

No.	Book No.	Name.	Age.	Doctor.	Family History.	Symptoms.
17	319	Mrs. B . . . . .	38	T. S. Wiley . . . . .		
18	320	Miss E. . . . .	22	R. A. Corlett . . . . .		Ill for 12 months; looked like patient in last stages of septicaemia or one suffering from tuberculosis.
19	402	Miss M. . . . .	22	M. Wallace . . . . .		Temperature elevated; good deal of pain.
20	444	Mrs. B. . . . .	40	. . . . .		First diagnosed by someone as fibroid tumour, and electricity used.
21	485	Mrs. P. . . . . (an Italian)	30	W. J. Fletcher . . . . .		No accurate history of menstruation; pain for some time.
22	535	Miss B . . . . .	22	. . . . .		Menstruation always regular and normal; never ill until twelve weeks previos; soreness upper part of abdomen, and dull, heavy pain; pain more intense, sharp, and lower down; had to walk in a stooped position; pain worse in left than right side; confined to bed; abdomen swollen; weight of bed clothes painful.
23	597	Miss C. . . . .	20	A. E. McColl . . . . .	Lived in same house with sister-in-law who died of phthisis.	For some time trouble in chest; localized pneumonia; abdomen then swollen and swelling painless; fluctuation; hectic flush in cheek.

Physical Examination.	Diagnosis.	Date of Operation.	Organs Found Affected.	Result of Operation.	Subsequent History.
.....	Either abscess of right tube or ovary, or localized tubercular peritonitis.	June 27, 1895.	Both coils of intestine adherent to one another; tubercular nodules through parts, also cul-de-sac of Douglas studded; reddish colored fluid in peritoneal cavity.	R.	After operation was up and around and doing nicely, but one year and a-half after operation died from pulmonary phthisis.
.....	Tubercular peritonitis.	July 12, 1895.	Intestines, pelvic and parietal peritoneum studded; washed out, drained.	R.	In spring of '99 got a wetting and had attack inflammation of lungs; died March, 1899; up to this time had improved; was fleshy and quite regular menstruation.
Mass towards left side of uterus; some indefinite thickening right side.	Pus tubes or tubercular disease in pelvis.	May 27, 1896.	Peritoneum, intestines and omentum; tubercular mass in pelvis.	R.	Never been well since although working; an abscess developed in side afterwards; this was opened and has almost closed again.
.....	Tubercular peritonitis.	Aug. 18, 1896.	Peritoneum and intestines; large tubercular mass filling pelvis; large quantity ascitic fluid; washed out, abdomen sponged; not drained.	R.	
Uterus towards right side; large mass in cul-de-sac of Douglas fluctuating extended up to left side of uterus as well as to right and behind.	Obscure.	Jan. 27, 1897.	Omentum attached to uterus in front; mass on left side firmly adherent to rectum; during peeling process perforated; degenerated hydrosalpinx, and ovary with pus removed on left side; on right ovary and cyst firmly imbedded in adhesions; another perforation when removing right tube; all over intestines and peritoneum were tubercles; closed perforations; washed out.	R.	Operation extremely difficult; patient made a good recovery.
.....	Tubercular peritonitis.	June 8, 1897.	Omentum $\frac{3}{4}$ -inch thick; everything matted together; bowel torn through; wall of bowel like a piece of tissue paper, studded with tubercle.	D.	Recovered from operation, but disease seemed to progress; temperature became subnormal on June 25th, remained so until 30th, when elevated to normal, then subnormal and she died July 2, 1897; no record of condition of lungs.
.....	Tubercular peritonitis.	Dec. 9, 1897.	Large quantity fluid; washed out, sterilized water; allowed air to enter, and placed drainage tube.	R.	In Jan. 3, 1898, doctor states patient sits up most of time; sinus is closed except small opening about $\frac{1}{4}$ inch deep; Nov. 19, 1901, patient in perfect health.

No.	Book No.	Name.	Age.	Doctor.	Family History.	Symptoms.
24	619	Miss A . . . . .	22	F. Oakley . . . . .	Mother had been fighting against tuberculosis for years. Had several hemorrhages from lungs.	Always well until pain in abdomen and feeling of bloating; enlargement of abdomen.
25	622	Miss W . . . . .	19	W. J. Fletcher . . . . .		Menstruation regular until a few months previously, when amenorrhoea came on; loss of appetite, emaciation, enlarged abdomen.
26	640	Mrs. W. J. . . . .	37	F. E. Godfrey . . . . .		
27	658	Miss J . . . . .	22	J. C. Smith . . . . .		Ill nearly three years; diminution of menstruation, pains in abdomen, fever.
28	666	Mrs. W. C. C . . . . .	34			Menstruation profuse for some months; a year previously severely ill for several months; illness unexplained.
29	679	Mrs. P . . . . .	22			
30	694	Miss S. . . . .	32	Jennie Gray . . . . .		Menstruation ceased; abdomen enlarged; weakness and intra abdominal pains; no perceptible elevation of temperature.
31	735	Miss F . . . . .	25			Menstruation recently excessive; pelvic pains; anaemia.

Physical Examination.	Diagnosis.	Date of Operation.	Organs Found Affected.	Result of Operation.	Subsequent History.
Free fluid in peritoneal cavity; temperature somewhat elevated.	Tubercular peritonitis.	Jan. 28, 1898.	Peritoneum, intestines, ovaries, tubes, uterus, all studded; large quantity fluid removed; small rubber drainage tube in cul-de-sac of Douglas.	R.	Made a good recovery, and remains in perfect health.
Fluid free in peritoneal cavity; hectic, lips dry, teeth dry; tongue smooth and red.	Tubercular peritonitis.	Feb. 1, 1898.	Intestines and peritoneum studded; quantity of fluid; washed out, allowed air to enter freely, and drained.	R.	Recovered from operation and left hospital improved; lungs became affected with tubercle, and she died of phthisis.
Hard mass in abdomen; a year afterwards increased and abdomen enlarged	Either tubercular or papillomatous.	Mar. 14, 1898.	Hard mass here and there produced by adhesions of intestine to intestine and omentum; quantity of fluid; washed out, but did not drain.	R.	Recovered from operation, but trouble returned, and she died in about five months afterwards.
Abdomen enlarged; mass on left side opening from vagina into abscess sac; this abscess had been opened by a doctor, and drained; another mass above and not communicating.	Tubercular pyosalpinx.	May 10, 1898.	Intestines and peritoneum studded; large pus tubes on left side.	R.	Patient left hospital June 5th feeling fairly well; in December began having cerebral convulsions; died Jan. 1st, 1899.
.....	Double pyosalpinx.	May 26, 1898.	Intestines, peritoneum and fallopian tubes studded; tubes filled with pus: were not removed.	R.	Left hospital and have no further history.
Small tumor on right side of uterus, evidently cystic.	.....	July 2, 1898.	Intestines adherent to one another; peritoneal cavity obliterated; tumour of tube and ovary on right side studded with tubercle; did not remove; tissues friable.	R.	No further history.
Nodules felt and free fluid in abdominal cavity.	Between tubercular disease and papilloma of ovary.	Sept. 2, 1898.	Omentum firmly adherent ant. abd. wall; intestines and peritoneum studded; fluid cyst of right ovary; tubercular nodules on left side.	R.	Uninterrupted recovery; since, has had inflammatory condition, one wrist and knee, probably tubercular; these have subsided and general health very fair; for years has suffered from epileptic convulsions.
Nodule near fundus uteri, supposed to be small fibroid.	.....	Dec. 7, 1898.	Cyst of right tube, tube and ovary glued together; cheesy mass near fimbriated end of tube; appendix running into ovary; tubercular nodules on peritoneum over uterus.	R.	Menstruation ceased; Now, 3 years after operation, patient in good health, although not robust.

No.	Book No.	Name.	Age.	Doctor.	Family History.	Symptoms.
32	777	Mrs. L	29		Father died acute pneumonia	
33	788	Mrs. E	26			
34	905	Miss S	22			Icteric; supposed low fever; abdomen enlarged.
35	907	Mrs. C				Abdominal pain, supposed to be due to tear; trachelorrhaphy and curettage done; no better; elevation of temperature.
36	925	Miss H	16	J. Guinane		Abdominal pain; suffered intensely; vomiting.
37	951	Miss C	19	T. S. Wiley		Indefinite pains in abdomen; abdomen enlarged; emaciated.
38	988	Mrs. J. D. H.	36	W. Lehman		Indefinite pain in abdomen; slight elevation of temperature; sharp attack of inflammation with temperature elevated.
39	994	Miss H	22	A. M. Baines		Bloating, pains on left side, some elevation of temperature, pallor of skin and redness of tongue; no amenorrhœa.
40	997	Mrs. J. W.	42			Indefinite pelvic and abdominal pains; sensation of bloating; no marked elevation of temperature; appetite poor.

Physical Examination.	Diagnosis.	Date of Operation.	Organs Found Affected.	Result of Operation.	Subsequent History
		Mar. 31, 1899.	Fallopian tubes, broad ligaments, peritoneum, and cul-de-sac of Douglas, studded with tubercles; tubes filled with pus and removed.	R	Made an easy recovery from operation and have no further record.
	Tubercular peritonitis.	May 1, 1899.	Peritoneum and intestines studded; large quantity of fluid washed out and sponged dry.	R	After operation temperature dropped to normal and she left hospital June 12th; no further history.
	Impossible before operation.	April 24, 1900.	Intestines studded with tubercle matted closely together; no fluid; dry adhesive form.	R	Dec. 1901. Is married and feels as well as ever.
Tear in cervix masses in pelvis.	Tubo-ovarian disease, either specific or tubercular.	May 4, 1900.	Intestines, peritoneum, ovaries, tubes and uterus studded; dry adhesive form.	R	Hard masses in pelvis disappeared, and, though not robust, able to do her own housework.
Abdomen distended, sordes on teeth, teeth dry, tongue glazed and red; hectic flush on cheek.	Tubercular peritonitis.	July 10, 1900.	Peritoneum and intestines; adhesions broken and allowed air to enter; dry adhesive form.	R	Improved and able to be out, and at present is getting along nicely; no trouble in the lungs.
Evidence of ascitic fluid in peritoneal cavity.		Sept. 25, 1900.	Intestines and peritoneum studded; large quantity of fluid; washed out with normal saline solution.	R	Doing very well; has gained flesh.
Cyst of left ovary; no evidences of ascitic fluid.		April 8, 1901.	Left ovary and tube inflamed and matted together; ovary cystic and ruptured; right tube and left tube and ovary removed; broad ligaments, peritoneum over cul-de-sac, and both tubes studded.	R	Made a good recovery and continues in good health.
Abdomen enlarged.	Ovarian cyst.	May 20, 1901.	Intestines and peritoneum studded; large quantity encysted fluid in abdominal cavity. Washed out, allowed air to enter and placed drainage tube.	R.	Has improved in health and remains in good health to present time.
Nothing definite to be made out; pain continued.		May 30, 1901.	Intestines and peritoneum studded; small quantity of fluid. Sponged out, air allowed to enter freely; no drainage.	R.	Returned home, menstruation ceased; is pretty well.

## TUBERCULAR ULCERATION

No.	Book No.	Name.	Age.	Doctor.	Family History.	Symptoms.
41	539	Mrs. H. . . . .	28			Profuse menstruation ; supposed to have la grippe ; pain, discharge from bowels ; pain in pelvis increased by anything that jarred her.

## TUBERCULAR DISEASE AFFECTING

42	728	Mrs. L. . . . .	32	H. Hunt . . . . .		Bleeding from rectum for three months.
43	767	Mrs. B. . . . .	48	A. W. Nixon . . . . .	Fighting for years against hereditary tendency to tuberculosis ; went south several winters.	Taken ill with symptoms similar to indigestion, belching of gas, indifferece to food ; emaciated.
44	976	Mr. N. . . . .	24	W. J. Fletcher . . . . .		Severe hemorrhage from intestine ; loss of appetite ; feeling of weakness ; skin looked pale.

## TUBERCULAR APPENDICITIS AND

45	871	Mr. S. . . . .	25	T. S. Wiley . . . . .		Supposed attack of appendicitis some months previously ; evidences of peritoneal inflammation.
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## OF THE PERITONEUM.

Physical Examination.	Diagnosis.	Date of Operation.	Organs Found Affected.	Result of Operation.	Subsequent History.
		June 15, 1897.	Roughened nodular surface, about size of silver dollar, over left utero sacral ligament; right meso-salpinx studded with tubercle; tubes patulous; intestinal wall thickened and velvety and reddened from increased injection of blood.	R.	Remained fairly well until 5th week, when another rise of temperature took place; pink flush in each cheek; looked as if disease was going to proceed rapidly; improvement again took place and she returned home. In Aug. 1897, about as bad as ever, soreness and tenderness continuing, also anæmia.

## INTESTINAL WALL.

Mass in wall of rectum and enlarged glands.	Malignant disease.	Nov. 23, 1898.	Tubercle in wall of rectum producing narrowing of the lumen of the gut; glands in meso-rectum enlarged; one removed for microscopic exam.; large caseous gland over abdominal vessels near junction of renal vessels on right side.	R.	Made an uninterrupted recovery, and is now in good health; hemorrhages having ceased.
.....	Nervous dyspepsia, but not quite clear; afterwards intestinal obstruction.	Mar. 7, 1899.	Tubercular stricture high up in rectum, just over promontory of sacrum; tubercular nodules over other parts of intestinal canal; colotomy.	D.	Patient left the table in a very weak condition; bowel opened next morning. She only lived a few days.
Small mass to be felt in left iliac region.	.....	Dec. 12, 1900.	Glands in meso-rectum enlarged throughout the whole of mesentery of omega-flexure up to descending colon; wall of rectum much thickened and studded with tubercle.	R.	Back at work again; in fair health.

## ULCERATION OF ASCENDING COLON.

Mass to be felt on right side, neighbourhood of appendix.	Chronic appendicitis with probable pus formation.	Dec. 20, 1899.	Appendix bound along bowel; bowel mass of tubercle. For about 18 inches along ilium spots showing intra-intestinal ulcers; ilium studded, other intestines not infected.	R.	Recovered from operation but succumbed in a few months from tubercular laryngitis.
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at a given point in the intestine are, intestinal colic accompanied by irregular hemorrhages from the bowel. The patient becomes blanched as a consequence of the loss of blood, weakness is marked; they become somewhat emaciated and display a great indifference to food.

*Physical Examination.*—A small mass can generally be made out by examination under an anaesthetic.

*Diagnosis.*—The diagnosis lies between tubercular stricture, malignant stricture and syphilitic stricture. It is impossible to make a differential diagnosis between a malignant and tubercular stricture until after the abdomen has been opened. Syphilitic stricture, occurring low down, can usually be more readily made out. One of the cases I have recorded was supposed to be suffering from nervous dyspepsia until symptoms of acute intestinal obstruction set in.

*Organs found affected.*—A mass of tubercle was found in the wall of the bowel producing narrowing of its lumen; the glands in the mesentery were enlarged. In one case an old cheesy gland was found high up over the abdominal vessels. In one case tubercular nodules were found in outlying districts surrounding the main tubercular mass. The wall of the bowel near the seat of the tubercular deposit was much thickened.

*Results.*—One patient died as a consequence of acute intestinal obstruction. Colotomy was done but, unfortunately, too late. The other two cases made an uninterrupted recovery. Surgical interference gained the credit but, I believe, had nothing whatever to do with the improvement.

#### TUBERCULAR APPENDICITIS AND ULCERATION OF THE ASCENDING COLON.

One case of tubercular appendicitis and ulceration of the ascending colon is given in the table. This condition is rare. The symptoms were those of an attack of appendicitis, abdominal pain localized in the right iliac fossa, rigidity of the right rectus muscle, tenderness on pressure, elevation of pulse and temperature.

*Physical Examination.*—A mass to be felt in the right side in the neighborhood of the appendix.

*Diagnosis.*—The diagnosis in all such cases must lie between chronic appendicitis, with a probability of pus formation, and tubercular peritonitis. At the operation the situation of the ulcers could be readily made out, the appendix was bound down and appendix, caecum and ascending colon were studded with masses of tubercle. The patient, it may be noted, died within a few months from tubercular laryngitis.

# TUBERCULIN IN THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS.

By H. C. PARSONS, B.A., M.D., L.R.C.P., M.R.C.S.,  
Professor of Pathology in the Woman's Medical College, Toronto.

**H**OWEVER suggestive may be the symptom group presented by an early case of pulmonary tuberculosis, failure to demonstrate the tubercle bacillus in the sputa postpones a positive diagnosis. The presence of the organism in discharges implies a full development, degeneration, and ulceration of the tuberculous focus, so that during this development, that is in the early stage of the disease, our most valuable diagnostic measure fails us; and though the presence of tuberculosis is not proved, it is not disproved.

If this difficulty exist in disease of organs having a natural outlet for their discharges, how much greater the obscurity in those not accessible from without, as bones, joints, serous sacs, glands, etc.

Of this, A. Fränkel,<sup>(1)</sup> says, "it is evident that the practitioner has an urgent need in such cases of some diagnostic resource which will as far as possible take the place of the actual demonstration of the bacillus." "Such a resource"—he adds—"is found in Koch's tuberculin."

The condemnation heaped upon tuberculin after its apparent failure as a curative agent was so sweeping that any other virtue it possessed was for a time overlooked. Its selective power as applied to cattle was later recognized, and the analogy presented by human tuberculosis invited a similar application for diagnostic purposes, and today there is substantial evidence as to its utility in this respect.

Vaughan,<sup>(2)</sup> speaking of tuberculin says "here is a body that has

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(1) Albert Fränkel, *Zeitschrift für Tuberculose und Heilstättenwesen* and *Journal of Tuberculosis*, Vol. iii, No. 1.

(2) Vaughan, *20th Century Medicine*, Vol. xiii, p. 104.

(3) Trudeau, *Medical News*, May 29th, 1897.

(4) Von Jaksch, *Verhand der Congress. and Junere Med.* 1891, (quoted by Trudeau).

(5), (6), (7), (9), quoted by Trudeau.

(8) Heron, *Journal of Tuberculosis*, Vol. iii, No. 4.

(10) Elder, *Montreal Medical Journal*, Vol. xxx, Oct. 1901.

(11) Casselberry, *Medical News*, Oct. 12th, 1901.

(12) Otis, *Medical Record*, June 17th, '99.

(13), (14), (15), (16), quoted by De Renzi and by Trudeau, *Medical News*, May 29, 1897.

(17) Kabler and Wien, *Klin Wochen*, Nov. 30, 1891, (quoted by Trudeau).

(18) Linoir *Progrès Méd.*, Nov. 30, 1893, (quoted by Trudeau).

(19) *Brit. Medical Journal*, Feb'y 21, 1891, (quoted by Trudeau).

(20) *Deutsch Archiv und Klin Med.*, 1894, (quoted by Trudeau).

(21) Quoted by Heron, *Journal of Tuberculosis*, Vol. iii, Nov. 4, 1901.

(22) Moorehouse, *Cleveland Med. Jour.*, Aug., 1900.

(23) Maragliano Berlin, *Klin Wochen* Nov. 19-20, 1896, (quoted by Trudeau).

(24) Goetsch, *Deutsch Med. Wochen*, Nov. 25, 1901, and *Journal of Tuberculosis*, Vol. iii, No. 3.

(25) *Journal of Tuberculosis*, Vol. iii, No. 3.

a specific action, a chemical substance, by the effects of which one can distinguish a tuberculous from a non-tuberculous individual."

Franckel<sup>(1)</sup> draws attention to the striking effects produced by tuberculin in true lupus and the absence of such in erythematous lupus. Trudeau<sup>(2)</sup> speaks of the accuracy of the test in cattle, and in other animals artificially inoculated—as shown by post mortem examination—and thinks it remarkable that the application of its diagnostic use in man should have been so long neglected. Von Jaksch<sup>(4)</sup> attributes to it a higher diagnostic value, and similar experience is reported by Reazi,<sup>(5)</sup> Grasset,<sup>(6)</sup> Vedel,<sup>(7)</sup> Heron,<sup>(8)</sup> Maragliano,<sup>(9)</sup> Moorehouse, Elder,<sup>(10)</sup> Casselberry,<sup>(11)</sup> Otis<sup>(12)</sup> and others.

Peiper,<sup>(13)</sup> Reitzkow,<sup>(14)</sup> Senn<sup>(15)</sup> and Verueuil,<sup>(16)</sup> are reported as having found it unreliable, and it must be admitted that there are instances in which the reaction has failed in undoubted cases of tuberculosis, but the weight of evidence is in favour of the test and its value in diagnosis. Possibly when certain points in technique are settled, as for instance a standard concentration of tuberculin, and a more uniform dosage, an explanation of these errors may be forthcoming.

The element of danger in the use of tuberculin appears to have proved a barrier to its more general acceptance. There are two questions. Is there any immediate danger as a result of the injection? And secondly is there a risk of aggravation or dissemination of the disease?

Both have a certain amount of excuse for their existence. The early cases treated with tuberculin were unselected; the dose was large and frequently repeated, under which the reactions were violent and the strength of the patients severely tried. Such are now carefully avoided. The cases are selected, and in the earliest stage of the disease; in advanced cases the test is unnecessary, as the diagnosis is made clear by other means; the dose is small, just sufficient to produce a reaction, and one reaction is all that is called for. No unfortunate results have been recorded.

Regarding the aggravation and dissemination of the disease. Shortly after the introduction of the tuberculin treatment when large doses and violent reactions were in order, some of the cases died during the course of the treatment. At autopsy Virchow reported the finding of numerous apparently new foci of disease at a distance from those recognized during life, these were interpreted as evidence of the dissemination of the disease. A condition of softening was also described in the tissues about the older tubercular areas, which was construed as having broken down the natural barrier of encapsulation set up by

nature and a resulting liberation of the bacilli to invade the surrounding tissues.

As a more definite knowledge was gained of the local changes produced by tuberculin, these disseminated lesions were, and are now looked upon as local reactions about foci of disease unrecognized during life, and not as any evidence of a new infection. Broden's observations on the use of tuberculin in peritoneal tuberculosis of dogs, (*Archives de Med. Exper.*, Vol. x, No. 1, 1899, quoted by Trudeau), supplies experimental confirmation in favor of this.

Tuberculin is regarded as the specific chemical poison of the bacillus tuberculosis. Certain rules govern the production of tuberculin, virulent tubercle bacilli are used; the tubercle bacillus substance is required; the presence of tubercle bacilli intact results in the formation of abscess and is to be avoided; the centrifuge has superseded the porcelain filter, as it was found that the latter withheld, in addition to the bacilli, certain other substances considered necessary to the filtrate. The object is to obtain an extract of the bacilli. A concise description of the production of tuberculin is given in *20th Century Medicine*, Vol. xiii.

*As to dosage.*—The fact that doses from 25 to .2 milligrammes of tuberculin have been employed for diagnosis, and with equally satisfactory results, would imply that the concentration of the substances in use at the present time varies in a marked degree. Moorehouse, in his series, gave  $7\frac{1}{2}$  mgm., Elder  $2\frac{1}{2}$ , Casselberry 3 to 6. In order to avoid violent reactions in the more susceptible, Trudeau advises that the initial dose be small. 1 mgm. is given, and if no result, 2 mgms. are given after an interval of 2 or 3 days, and a third injection of 3 mgms. if necessary. This is the maximum dose.

The patient is kept under observation for three or four days prior to the administration of tuberculin; the temperature must be running a normal course.

The injection is made with every antiseptic precaution, beneath the skin of the back, and the patient confined to bed, temperature and pulse being recorded every 2 hours for 24 or 36 hours.

The reaction occurs in from 6 to 32 hours. It is characterized by an elevation of temperature, malaise, sensations of chilliness, but rarely a chill, headache, nausea, sometimes vomiting, there is frequently also a moderate amount of pain according to the seat of the lesion.

The pulse rate is proportionate to the rise of temperature. The temperature may range from 100 to 104. The duration of the reaction, as shown by the temperature curve, varies from 20 to 30 hours.

The local reaction, as seen in lesions, on or near the surface, consists of redness, swelling, pain and tenderness and elevation of surface tem-

perature. In pulmonary cases, pain in the chest has been noted in some in others an increase of physical signs, which, however, rapidly disappear.

This reaction is explained by a certain affinity possessed by tuberculin for tuberculous foci (Frænkel). Trudeau describes tuberculin as a partly specific irritant, both to tuberculous foci, and to the susceptible organism in general. The local reaction is an active hyperæmia about the focus of disease such as one sees in the initial stage of inflammation. Baumgarten describes it as an exudative inflammation in the vascular tissue about the tubercles.

In a well marked reaction the changes are so profound that it would seem hardly possible that they result from the toxin contained in the minute dose of tuberculin.

It is shown by Kabler <sup>(17)</sup> and Lenoir <sup>(18)</sup> that the urine secreted during the reaction contains albumose in greater quantity than is represented by the injection material. It is further known that from caseous tuberculous material may be obtained albuminous substance which give the tuberculin reaction. (Crookshank, Herroun, <sup>(19)</sup> Matthes.)<sup>(20)</sup> The deductions from this are, that the tuberculin by its action upon the tuberculous foci sets free toxins stored up within them, which, by their action, either alone or in conjunction with those of the tuberculin, give rise to the general reaction.

In bovine tuberculosis Frænkel shows that in 8,000 tests the error was between two per cent. and three per cent. The proof of the test was the gross appearance of the organs at autopsy. Frænkel thinks that in the absence of gross lesions, nothing short of a microscopic examination, especially of the lymph glands, can be considered absolute proof.

A synopsis of a few series of cases will serve to show the results in man. France <sup>(21)</sup> reports 55 tests; 45 were positive, 10 negative. 34 of the former eventually died, and 29 were submitted to autopsy and all showed active tuberculosis. Five of the negative cases died and post-mortem examination failed to show any trace of the disease, the remaining five are living and well. Moorehouse <sup>(22)</sup> reports a positive result in 13 cases, (12 suspected and one undoubted case) of tuberculosis.

In 14 cases, Trudeau, <sup>(3)</sup> seven gave the reaction, seven were negative. Casselberry reports nine cases, four positive, five negative. The subsequent records of these (23) cases are given and appear to prove the accuracy of the test.

Elder <sup>(10)</sup> gives results of eleven tests, four were positive, seven negative. Three of the four positive were proven tuberculosis by examination of the tissues after operation, the fourth refused operation. Of the seven negative, three were cases of enlargement of the testicle, which later cleared up under antisyphilitic remedies. Two were undoubted cases of

tuberculous peritonitis, as subsequently proved at operation. One case of tuberculosis of the elbow joint and one of tuberculous adenitis did not give the reaction. The writer, however, questioned the value of the tuberculin used in these last two instances.

Maragliano<sup>(23)</sup> and Guttsdat<sup>(3)</sup> report reactions in 9 per cent. and 8 per cent. respectively of apparently healthy persons. In view of the present knowledge of tuberculosis and its behavior, its talency in many cases, and the post-mortem findings in persons dying of various diseases, and in whom tuberculosis was not suspected, it is not surprising that such results are obtained from time to time. Again it is said that cases of carcinoma, sarcoma, syphilis and actinomycosis have reacted to tuberculin, but in these the possibility of associated tuberculous disease was not excluded.

Of this Trudeau says: "Before condemning the test as at fault when reaction occurs in apparently healthy individuals, it should be borne in mind that autopsies made on persons dying of other diseases show some unsuspected tuberculous focus to exist in from thirty to forty per cent."

In summing up the results of his observations Elder says that the reaction does not appear to be constant, even when tuberculosis is undoubtedly present, but contra, in no case did he get any reaction, when tuberculous, so far as could be determined, was not present.

The only unequivocal proof of the correctness or otherwise of the test is a complete autopsy with special reference to the lymph glands (Fränkel). This being true there will necessarily be an element of doubt in some cases of human tuberculosis, in the absence of more searching investigation than clinical methods afford.

Apart from the diagnostic use of tuberculin evidence as to its curative value is on the increase, this is both experimental and clinical, and, though not generally accepted, has made such marked strides of late that it is well worthy of careful study and trial.

The advocates of tuberculin as a curative measure are unanimous in condemnation of the course followed in earlier days, when large doses were given and their violent reactions produced, and these in unselected cases.

These points are established, that the cases should be carefully selected; the temperature should be normal for 24 or 48 hours previous to the administration of a dose; when the injection is followed by a rise of temperature the dose should be diminished rather than increased, as was the former custom; mixed infection is a contraindication. The injections are made beneath the skin of the back. The initial dose is 0.05 mgm. This is rarely followed by a reaction; should there be a reaction the dose is reduced. Koch repeats the injection every second day, gradually increasing the dose, but avoiding elevation of temperature.

If an elevation of temperature should occur, further treatment is delayed till there is a return to normal. He advises a continued increase in dose till 20 mgm. is reached. His experimental work with T. R. following the above course, has proved remarkably successful, he moreover finds that in tuberculous guinea pigs the most striking results are obtained when the treatment is begun shortly after the inoculation, not more than two weeks. He holds that the same results may be looked for in the treatment of early tuberculosis in man.

Heron<sup>(8)</sup> reports 57 cases, 51 of pulmonary tuberculosis, 6 of lupus vulgaris. Old and new tuberculin were used. Of the pulmonary cases, many were lost sight of after leaving the hospital, but 10 cases were well and working 7 years later, 3, 3 years later, 3 for two years, and others were known to be well for a period of a few months to 18 months after treatment.

The cases of lupus did well up to a certain point, but suffered relapse.

Goetsch<sup>(24)</sup> reports his results in the treatment of 224 cases of pulmonary tuberculosis. The diagnosis was made by demonstration of the organisms in 89, by reaction to tuberculin in 135; 12 proved unsuitable and treatment was discontinued. At the time of publication 175 cases had been discharged. Of these 125 were cured, in the remaining 50 the treatment had been interrupted and recovery was only partial.

The average period of treatment in 125 cases was 198 days, the minimum 50 days and the maximum 791 days. Injections were given twice weekly. The first dose was small and gradually increased. Reactions were avoided.

In a note by Prof. Koch who had followed Goetsch's work, mixed infections are insisted upon as barriers to successful treatment. Sprengler, Turbau, Petruschky, Krause, Thorner, Rembold Baudelieer are quoted as asserting that in purely tuberculous, non-felerile cases, not too far advanced, the influence of the remedy is favorable without exception. Von Ruck<sup>(25)</sup> also reports very encouraging results.

These results form but a fraction of the evidence in favor of the use of tuberculin.

Tuberculosis is an important subject, a difficult disease to diagnose and combat, these investigators have opened up a new path, or rather cleared the old path of many of its most formidable barriers, and their results are sufficient to warrant a more general use of tuberculin both for diagnostic curative purposes.

## CURRENT MEDICAL LITERATURE.

Conducted by A. J. MacKenzie B. A., M. B.

### TEMPERATURE EFFECTS

**B**Y a series of experiments reported in *Le Bulletin Medical*, October 16th, it was found that neither a moderate degree of cold nor slight variations in temperature had an influence on the evolution of experimental tuberculosis, but that sudden and considerable changes hastened the course of the infection in a most striking manner.

### ALCOHOLISM AND TUBERCULOSIS.

**P**ROF. P. BROUARDEL, speaking at the recent British Congress on Tuberculosis, said: "Alcoholism is the most potent factor in propagating tuberculosis. The strongest man, who has once taken to drink, is powerless against it. . . . Baudran, of Beauvais, has shown that mortality from tuberculosis and from alcoholism are nearly identical. In this connection he obtained the following results:

Deaths from tuberculosis in 10,000 Inhabitants.	Annual consumption of Litres Alcohol per head.
30 to 40 . . . . .	12.47
40 to 50 . . . . .	15.21
50 to 60 . . . . .	14.72
70 to 80 . . . . .	16.36
80 to 90 . . . . .	17.16
More than 90 . . . . .	50.70

Any measures, state or individual, tending to limit the ravages of alcoholism will be our most precious auxiliaries in the crusade against tuberculosis."

The same prominent physician, speaking on another phase of the subject at the same time, said: "As for my personal experience at the Morgue in Paris, where I frequently make necropsies on accidental deaths, I can state that in half the cases if, the person on whom the necropsy is made has lived in Paris for about ten years, I find healed tuberculous lesions, either in the form of cretaceous transformation or fibrous cicatrizations. I may add that it is quite certain that such cases of old people, and those on whom necropsies are held in almshouses, hospitals and the Morgue, have certainly taken none of the precautions

we consider necessary. In spite of often deplorably dirty habits the system has been strong enough to resist the ravages of the disease.

"These anatomical results have also another meaning. These lesions, in the majority of cases are not phthisis in an early stage manifested by small disseminated foci, they are cicatrices of large foci, sometimes of large cavities completely cicatrised. Phthisis, therefore, is curable, even in its most advanced stages."

#### ON THE GROUPING OF CASES OF PULMONARY TUBERCULOSIS FOR CLIMATIC TREATMENT.

**D**R. I. Burney Yeo, speaking at the recent British Congress on Tuberculosis, is reported in the *British Medical Journal* of July 26th as follows:—

"The question put to us in this discussions is: What influence has climate on the treatment of consumption, and how far can cases be grouped for treatment in certain climates?"

The answer to the first part of the question will, I suggest, be that a suitable climate:

(a) Relieves or removes catarrhal conditions accompanying the disease in a number of cases.

(b) It raises nervous and vascular tone.

(c) It increases muscular energy and the ability as well as the desire for exercise.

(d) By rendering an open-air life possible, it increases the aëration of the lungs and diminishes the activity of bacterial agencies, one of the most essential conditions of arrest and cure of the disease.

(e) It improves the tone and promotes the activity of the digestive functions, and so enables the patient to take the large amount of food which is needed to heighten his state of nutrition.

(f) And, finally, it improves the moral and mental state by surrounding the patient with a bright, cheerful and hopeful environment.

Then, as to the answer to the second part of the question, we may, I think, say:

1. That cases seen at the very commencement of the disease, and who are otherwise in good health may be permitted a certain amount of choice in the selection of a climate, provided it allows of many hours being spent daily in the open air, and that they are placed under admittedly hygienic conditions. A choice may be made from climates of altitude, the desert climate, the inland plateaux of South Africa, the sea voyage for those with a decided liking for the sea, and suitably placed sanatoria.

2. For progressive febrile cases, repose in bed or on a couch at home,

in the best conditions practicable for the free access of air and sunshine to their apartments.

3. For advanced cases, home is best if the conditions of home life are favourable, or the warm marine climates with cheerful surroundings if home life is unfavourable or change is urgently desired.

4. For catarrhal cases warm, soothing climates like Madeira or Teneriffe are best.

5. For rheumatic or gouty cases of the fibroid or pieurogenic type, dry, marine climates or the desert climate are most suitable.

6. For the so-called "scrofulous cases," if free from catarrh, fairly bracing marine climates: if with catarrh, mild marine climates should be prescribed.

7. For most other moderately advanced cases, with the limitations already mentioned, the climate of the high mountains, above the cloud belt, is the most curative.

I have not had a "hæmorrhagic" group because I do not think it would be a natural one; every hæmorrhagic case must be, in my opinion, considered apart, and, if I may be permitted the phrase, dealt with "on its own merits."

#### THE COMMUNICABILITY OF HUMAN TUBERCULOSIS TO CATTLE.

**I**N the *British Medical Journal* for Oct. 26th, Sheridan Delepine, Professor of Pathology, Owens College, Manchester, reports the result of an experiment bearing on this subject, subsequent to Koch's now famous delivery, and with a very different conclusion.

Having learned from previous experiments that cultures of tubercle bacillus vary in virulence to a marked degree, the writer adopted the expedient of mixing several tubercular sputa, representing several types of disease in the human being. These were furnished by the Manchester Consumption Hospital, and consisted of sputa containing bacilli belonging to the following classes: (1) long slender, showing typical metachromatism; (2) thick, staining almost uniformly; (3) short in clumps; (4) short, staining badly.

Four healthy young calves were used. These were not subjected to the tuberculin test, the professor believing that this might affect the value of the results obtained, as the use of this test has probably some immunising effect, decided to rely upon the fact that tuberculosis is a rare condition in young calves, and curiously one of the animals chosen proved an exception to this rule.

The animals were injected then, one directly into the lung, the second subcutaneously, the third was inoculated into the peritoneum, and to

the fourth was given, in two meals, milk containing ten times as much sputum as the others had received by inoculation. Of the four calves experimented upon only two survived long enough to allow definite results to be obtained and these two calves had contracted tuberculosis as the result of the inoculation or ingestion of human tubercular sputa.

The results may be summed up as follows :

First calf, inoculated in the lung with 5 c. cm. of sputum. Death on the sixth day. Generalised tuberculosis not due to the inoculation.

Second calf, inoculated under the skin of the leg with 5 c. cm. of sputa. Death on the sixth day, marked enlargement of a gland at a distance of 5 inches from the seat of inoculation, no other trace of tuberculosis. Living and virulent bacilli found in the affected gland. As these might have been carried from the seat of inoculation and remained alive without actually producing tuberculosis, this experiment is discarded.

Third calf given 50 c. cm. of mixed sputa with its food in one day. Death twenty-six days after the ingestion of this material. No trace of tuberculosis in any organ except the glands connected with the alimentary canal. Virulent tubercle bacilli found in the oesophageal glands.

Fourth calf, 5 c. cm. of mixed sputa injected into the peritoneum. No definite tuberculous reaction sixty-eight days after inoculation. Definite tuberculin reaction sixty-eight days after inoculation. Post-mortem examination two days later showed marked tuberculosis of the peritoneum, extending to the pleura and pericardium. No other organ affected except a few of the lymphatic ganglia connected with the peritoneum.

Inoculation of guinea pigs from the latter two cases verified the virulence of the bacilli present.

In conclusion Professor Owen says: This first set of experiments had only for its object to determine whether human tuberculosis products are infectious to cattle or not; further experiments are being arranged for with a view of determining the conditions which influence the virulence of human bacilli for cattle and the proportion of recoveries after such infection.

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## EDITORIAL.

### OUR TUBERCULOSIS NUMBER.

WHEN we decided to issue a number of THE LANCET specially devoted to the discussion of tuberculosis in its various aspects, we thought one double number would afford ample space for the contributions arranged for. The field, however, proved larger than we had anticipated, so that we have found it necessary to divide it into two parts. The general aspects of the subject are dealt with in the current issue and the papers dealing with the special aspects will appear in the January number. Tuberculosis is at present attracting the interest of both the profession and the public to so great an extent that we feel amply warranted in placing before our readers a series of papers representing the present status of our knowledge regarding it. We would sincerely thank our contributors for the ready assistance they have given us in producing the number.

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### CARE OF THE TUBERCULOUS POOR IN TORONTO.

A DEPUTATION of medical men, clergymen, laymen and ladies recently waited on the Toronto City Council to urge the submission of a by-law to the ratepayers to provide \$50,000 for the erection of a hospital for the poor tuberculous patients of the city. Action in the matter has been deferred on several previous occasions awaiting the fulfilment of the promise of the National Sanatorium Association to make provision for this need by building a hospital near the city in which poor patients will be admitted on a 40 cents *per diem* allowance from the city.

Rev. Dr. Eby, of the Anti-Consumption League, accused the Sanatorium Association of having controlled this work for the past five years, with the result that the death rate from consumption in Canada was steadily going up, while it was decreasing in every other country. He conjured up

the terrible spectacle that according to the plans of the National Sanatorium Association the consumptive poor from all parts of the province would be dumped into the city of Toronto to poison the air as that of Muskoka is now being poisoned by the overflow from the sanatorium in that district.

Not to be outdone in fervency and zeal by his reverend brother, the Rev. J. P. Lewis advocated the adoption of a law to compel, forcibly if necessary, the removal of every consumptive patient to an institution where he should remain until cured or decently buried.

Such indiscreet and unnecessarily alarming statements coming from prominent members of a league, the purpose of which is to disseminate *knowledge* of tuberculosis among the public, cannot be too strongly deprecated. Enthusiasm is often commendable, but it should be tempered with common sense and in accordance with at least a rudimentary knowledge of the subject under discussion.

Much has already been done in this province in creating "a scare" as to the degree of contagiousness in cases of tuberculosis under proper management. It is the opinion of the Medical Health Officer of the city, and with it most physicians will concur, that tuberculous patients could be safely received temporarily into isolation wards in our general hospitals until other provision is made for them. Their exclusion has resulted in unnecessary hardship and suffering to these unfortunates and has added to the dissemination of the disease by their being forced to remain in their own homes. We would respectfully suggest to the medical men in the Anti-Consumption League the advisability of acquainting the lay members with a few elementary scientific facts in reference to the spread of tuberculosis before the latter undertake to educate the public. The real dangers from tuberculosis are great and obvious enough without any exaggeration or the conjuring up of imaginary ones.

#### A DEATH UNDER CHLOROFORM ANAESTHESIA.

**T**HE death, recently, of a patient under chloroform, in the Toronto Western Hospital, was made the subject of an inquiry by a Coroner's jury. The facts brought out at the inquest were, that a private patient, some fifty years of age, had entered the hospital to be operated on for necrosis of the humerus. The anaesthetic was administered by the House Surgeon, under the direction, we are informed, of a member of the hospital staff. From the time the administration began until it ceased, was forty minutes, during which time five drams of chloroform were used. It was administered drop by drop, by the open method. The



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operation had been finished and the anæsthetic discontinued about two minutes, when the patient was noticed to become blanched. All the usual methods of resuscitation were applied, but without avail, death occurring almost at once from cardiac failure. During the administration of the drug no bad symptoms had appeared.

The patient had suffered from an attack of typhoid fever a short time before, and the autopsy showed that Peyer's patches were still swollen. No other gross evidence of disease was found in any of the organs.

An important point in the case was the fact that the House Surgeon was not a registered practitioner, and according to section 53 of the Ontario Medical Act, no unregistered person is eligible to appointment in any public institution or hospital in the province, not supported entirely by voluntary contributions. This regulation, however, has heretofore been more honored in the breach than in the observance, having been commonly interpreted as applying to positions of emolument, and not to unpaid assistants acting under instructions from members of the staff. While not *technically* qualified, the House Surgeon in this case was certainly well fitted by training and experience for his duties. He was an honor graduate of Toronto University, having received the M.B. degree in May last, and had passed the primary and intermediate examinations

of the College of Physicians and Surgeons. He had previously anaesthetized some 100 patients. As a matter of simple justice we feel that these facts might have been placed more clearly before the jury. Moreover, no fault could be attributed to the method of administration, nor to the subsequent treatment. It was apparently one of those unfortunate accidents which occurs from time to time in institutions where large numbers of cases are subjected to anaesthesia, and which no amount of study of anaesthetics, nor their methods of administration, has, so far, succeeded in preventing. The hospital and the House surgeon have been subjected to much adverse criticism in the matter, which the facts and our knowledge of such cases in general, do not warrant. We believe the authorities are right in investigating all such cases to see that no precaution has been overlooked to ensure the safety of the patient, but in the interests of public hospitals and of the profession in general, the greatest care should be taken in getting a verdict that does no injustice to those concerned.

As the Medical Council now require a fifth year to be spent in hospital or laboratory work before a candidate can present himself for the final examination for the Ontario licence, it seems scarcely fair that provision should not be made that will technically qualify such candidates for appointment as hospital interns. We are informed that the matter will be brought up at the next session of the Medical Council, when we trust some such amendment of the Medical Act, as indicated, may be made.

### THE MUSKOKA SANATORIUM FOR TUBERCULOSIS.

**W**E quote the following interesting statements from the annual report of the Medical Superintendent of the Sanatorium, which must be very gratifying to those interested in the institution :

"Of 99 cases treated last year 15 have been discharged apparently cured, and 29 with the disease arrested; that is, in 15 there is a return to perfect health, while in 29 others there is a relative cure—the general health is quite normal, and there are no subjective symptoms other than perhaps an occasional cough or slight expectoration. Of the 29 arrested cases, 14 gave promise of cure had their finances permitted them to remain, which would mean that 29 out of 99, or almost 30 per cent., could have been apparently cured had a longer stay been possible. The fact that in 44 of 99 patients the disease has undergone more or less complete subsidence is highly satisfactory considering the class of cases treated.

"It is gratifying to note that the average gain in weight is 31 lbs.,

and that there is an average gain of 14½ lbs. in those remaining over three months.

"It is difficult to arouse people to the necessity of sending cases early to secure the best results, notwithstanding the fact that we have shown in previous years that of incipient cases 65 per cent. or over are cured, while of the more advanced cases we may look for permanent results in only a very small percentage, and for these results a very prolonged stay is necessary.

"These 99 cases were classified on admission: Incipient, 224; advanced, 43; far advanced, 32. Such a proportion of advanced and far advanced cases is not compatible with the best results. With our past results becoming more known throughout our Province and Dominion, the people are beginning to realize that consumption can be cured, and we are in receipt of a constantly increasing number of applications. We hope during the coming year we may be able to restrict our admissions still more to the class of cases for which the Sanatorium was established.

"An erroneous idea prevails to some extent amongst the physicians of the Province that our rejection of a patient means incurability. This is not the case. It is our endeavor to select from amongst the applicants those who give greatest promise of improvement, more especially to select those for whom the shortest time seems necessary, so that our beds may be occupied by as many patients as possible in succession. With this object in view our standard of admissions must necessarily vary somewhat from time to time, depending upon the number and physical condition of applicants.

"I would urge that in every possible way we make an earnest plea to the medical profession to use the greatest care in the selection of patients sent for examination. In our endeavor to make our Sanatorium a place where people can recover we cannot admit hopeless cases; and it is a constant source of surprise to our examining physicians and to us here that men and women are sent by their physicians as hopeful cases when their symptoms and physical signs show them to be in an advanced condition. The refusal of these cases is one of the most unpleasant parts of our work, and the consequent disappointment, to say nothing of the needless fatigue and expense to patients coming from a distance, is often almost heart breaking.

Of the 99 discharged patients there were:

Apparently cured	15
With disease arrested	29
With marked improvement	26
Unimproved	20
Failed	8
Died	1
	99

75 patients gained in weight; average gain, 13 lbs.  
 12 " lost " " loss, 4½ lbs.  
 12 " neither gained nor lost in weight.

CLASS II.

44 Patients remaining from one to three months.

Condition on Admission.	Condition on Discharge.						Total.
	Apparently Cured.	Disease Arrested.	Much Improved.	Stationary	Failed	Died.	
Incipient . . . . .	4	3	2	0	0	0	9
Advanced. . . . .	1	5	11	1	0	0	18
Far Advanced. . . . .	0	1	4	8	4	0	17
	5	9	17	9	4	0	44

Of these patients 32 gained in weight; average gain, 10½ lbs.  
 " " 6 lost " " loss, 4 lbs.  
 " " 6 neither gained nor lost.

CLASS III.

55 Patients remaining over three months.

Condition on Admission.	Condition of Discharge.						Total.
	Apparently Cured.	Disease Arrested.	Much Improved.	Stationary	Failed	Died.	
Incipient . . . . .	9	4	1	1	0	0	15
Advanced . . . . .	1	14	4	5	1	0	25
Far advanced . . . . .	0	2	4	5	3	1	15
	10	20	9	11	4	1	55

Of these patients 43 gained in weight; average gain, 14½ lbs.  
 " " 6 lost " " loss, 5 lbs.  
 " " 6 neither loss nor gained.

(A maximum gain in weight, 43½ lbs. during a stay of 4 months.)

*Site of Pulmonary Lesion.*

Right lung only affected—	Upper lobe only . . . . .	18
	Lower lobe only . . . . .	1
	Upper and middle lobes . . . . .	7
	Upper and lower lobes . . . . .	8
	Upper, middle and lower lobes . . . . .	6

Left lung only affected—	Upper lobe only.....	5
	Lower lobe only.....	0
	Upper and lower lobes.....	16
		21

Involvement of both lungs.

	Right upper lobe.	Right lower lobe.	Right upper and middle.	Right upper and lower.	Right upper, middle and lower.	Total.
Left upper lobe.....	14	0	2	8	4	28
Left lower lobe.....	3	0	1	1	2	7
Left upper and lower lobes.....	21	2	1	5	0	29
	38	2	4	14	6	64

DEFINITIONS OF TERMS EMPLOYED.

- Incipient*—Cases in which both the physical and rational signs point to but slight local and constitutional involvement.
- Advanced*.—Cases in which the localized disease-process is either extensive or in an advanced stage, or where with a comparatively slight amount of pulmonary involvement the rational signs point to grave constitutional impairment, or to some complication.
- Far Advanced*.—Cases in which both the rational and physical signs warrant the term.
- Apparently Cured*.—Cases in which the rational signs of phthisis and bacilli in the expectoration have been absent for at least 3 months, or who have no expectoration at all; any abnormal physical signs remaining being interpreted as indicative of a healed lesion.
- Disease Arrested*.—Cases in which cough, expectoration and bacilli are still present, but in which all constitutional disturbance has disappeared for some time; the physical signs being interpreted as indicative of a retrogressive or arrested progress.
- Improved*.—Cases in which there has been some marked gain in the condition of the lungs, or in which there has been marked amelioration of the constitutional disturbances. Cases with simply a slight gain in weight are not placed under this term.

## EDITORIAL NOTES.

Sixty-two candidates presented themselves at the recent supplemental primary examinations of the College of Physicians and Surgeons of Ontario and thirty-seven in the final.

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The Board of Endowment of Trinity University has made an appeal for \$500,000, conditional upon not less than \$250,000 being subscribed by December 31st, 1903. Subscriptions are to bear interest at 4 per cent. up to this time, when the capital shall become payable in instalments. A good beginning has already been made, the following subscriptions having been secured: Rev. T. C. S. Macklem, \$5,000; James Henderson, W. R. Brock and E. B. Osler, \$10,000 each, and Lieut.-Col. Pellatt, \$25,000.

Lieut.-Col. Pellatt has recently given \$10,000 for the erection and equipment of an operating theatre in Grace Hospital, Toronto, and the will of the late W. E. H. Massey bequeaths the twentieth part of a thousand shares of stock in the Massey-Harris Co., Limited, to the Hospital for Sick Children. These are healthful signs of an awakening of public sentiment in Toronto to the needs of our medical charities.

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The annual banquet of the Medical Faculty and students of Toronto University was held in the University gymnasium on the evening of Dec. 3rd, and was pronounced an unqualified success. The Dean, Dr. Reeve, announced the intention of the Medical Faculty to erect in the near future a new building on the University grounds for the teaching accommodation of third and fourth year students.

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The Faculty and students of Trinity Medical College held their 24th annual dinner at the Temple Café on the evening of Dec. 5th. It was largely attended and was generally acknowledged the most successful in the history of the College. It was strictly a "dry" dinner—a judicious preparatory training, it is thought, to the possible early adoption of prohibition in the province. Mr. A. H. Anderson acted as president and Mr. W. W. Milburn as secretary of the dinner committee.

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We are pleased to note that the various hospitals in Toronto have consented to again open their doors to tuberculous patients, who will be

received into special isolation wards. The wisdom and humanity of the decision will scarcely be questioned, and will have a good effect in allaying the unreasoning and unwarranted fears that have been engendered in the community as to the dangers of contagion in this disease. The medical profession are not responsible for this "scare," which is due largely to the unwise agitation of certain laymen and lay journals, actuated more by zeal than knowledge.

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In reference to the article by Dr. A. C. Lambert in the last number of *THE CANADA LANCET* containing certain suggestions to as precautions which should be taken against the entrance of Bubonic plague into Canada, we are in receipt of a letter from Dr. Montizambert, Director General of Public Health, in which he states that these preventive measures have been recommended as far back as 1895. Certain difficulties have so far prevented their adoption by the authorities but there is every reason to hope that these will shortly be overcome and then the precautions mentioned will be enforced. With the experience gained from the outbreak of plague at San Francisco, certainly every effort should be put forth to protect our western ports.

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No modern writer has referred to the physician with more grace and with kindlier feeling than Robert Louis Stephenson. Surely he had us all in mind when the little prayer given in the new "Life" by Graham Balfour was penned. It found an echo in the heart of our business man whose death from typhoid fever was recently and most sincerely mourned in this city and is copied from a slip that lay upon his desk when the fatal illness was developing. Medical men, into whose lives there enters of necessity so much of care and of anxiety may find the invocation restful:—

N. A. P.

"The day returns and brings us the petty round of irritating concerns and duties. Help us to play the man; help us to perform them with laughter and kind faces; let cheerfulness abound with industry; give us to go blithely on our business all this day; bring us to our resting beds weary and content and undishonored and grant us in the end the gift of sleep. Amen."

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## PERSONAL.

Dr. T. W. Lambert, of Kamloops has gone to Europe.

Dr. E. Fitzpatrick has removed from Vanleek Hill, to Winnipeg.

Dr. A. F. Wright, (Trinity '01) is now practising at Plainville, New York.

Dr. F. Phinney and Dr. A. P. Crocket, of Fredricton, leave soon for Europe.

Dr. H. E. Paul, of Napanee, has gone to spend a few months in New York.

Dr. Wm. Brace, of Brockville, will spend the winter in Calgary for the benefit of his health.

Dr. K. C. McIlwraith, has recently been elected a Fellow of The Obstetrical Society of Edinburgh

Dr. C. D. Parfitt, has been appointed to a position on the resident staff of the Muskoka Sanatorium for Tuberculosis.

Dr. A. P. Kelly (Trinity '98) formerly a House Surgeon in St. Michael's Hospital, Toronto, has begun practice in Orillia.

Dr. Howard Kelly and Dr. Thomas Cullen, of Baltimore, were in Toronto last week to attend the funeral of Dr. Lesslie M. Sweetman.

Dr. Thos. G. Roddick, has been appointed Dean of the medical Faculty, of McGill University, in succession to Dr. Craik, who recently resigned.

Dr. Wm. Nattress, has taken up his office and residence on Rusholme Road, Toronto, his former residence on Carlton St., being now occupied by Dr. Donald MacGillvray.

Dr. Geo. A. Sutherland, of Embro, formerly a member of the resident medical staff of the Toronto General Hospital, we are glad to learn, is recovering from an attack of Typhoid fever. The doctor had a perforation of the bowel, which was operated on by Dr. H. A. Bruce. This, we believe, is the first successful operation for typhoid perforation in Canada.

The following gentlemen have been elected officers of The Ontario Medical Library Association for the coming year: President, J. F. W. Ross; 1st Vice-President, R. A. Reeve; 2nd Vice-President, A. A. Macdonald; 3rd Vice-President, W. J. Greig; Secretary, H. J. Hamilton; Treasurer, H. A. Bruce; Curator, N. A. Powell; Assistant Curator, W. J. Wilson; Solicitor, W. Mulock, Jr. These gentlemen with H. T. Machell, R. A. Pyne, G. H. Carvith, and H. B. Anderson form the Board of Directors.

## BOOK REVIEWS.

### DORLAND'S MODERN OBSTETRICS.

*Modern Obstetrics: General and Operative.* W. A. Newman Dorland, A.M., M.D., Assistant Demonstrator of Obstetrics. University of Pennsylvania; Associate in Gynecology, Philadelphia Polyclinic. Second Edition, re-written and greatly enlarged. Handsome octavo, 797 pages, with 201 illustrations. Philadelphia and London; W. B. Saunders & Company, 1901. Cloth, \$4.00, net. Canadian Agents: J. A. Carveth & Company, Toronto.

This work has probably not been so widely read in this country as some others. Still, it is worthy of a place with the best works on the subject. Either student or practitioner will find it a work well up to date and reliable. It is written with a clearness which leaves no doubt as to the author's meaning.

In the chapter on Eclampsia, there is a thorough discussion of the role which the liver plays in disease.

A classification of the many causes of puerperal sepsis is given, together with their clinical bearings. No doubt many will differ with the author's statement regarding the frequency of the gonococcus as a cause of puerperal sepsis. He states that twenty-five or thirty per cent. of all women become gonorrhoeic. Let us take it for granted that he means married women. We can hardly endorse this statement, for, if that be true, the germ cannot be very active as a cause of sepsis. For instance, in the reviewer's fairly large practice of obstetrics of twenty odd years, only two cases of sepsis have been met with; and there was no reason to believe that either of those was due to gonorrhoea. Again, in hospital practice, since the use of antiseptic precautions, the number of cases has so largely diminished that one can hardly believe that the gonococcus ever was a leading cause of the disease. However, the author's statement will be a fresh argument for those operating gynaecologists who believe that all "pus tubes" are caused by the gonococcus germ.

One very important point is treated very fully and ably, namely, the protection of the perineum during labor. The student and young practitioner will find a great deal of good advice in this connection.

L. B.

### GRAY'S ANATOMY.

*Anatomy, Descriptive and Surgical.* By Henry Gray, F.R.S. Edited by T. Pickering Pick and Robert Howden. Revised American, from the fifteenth English, Edition. With 780 illustrations, many of which are new and in colors. Lea Brothers & Co., Philadelphia and New York, 1901.

Gray's Anatomy has long since passed the stage where it needs any praise, or fears any criticism. To say that a large Imperial octavo volume of 1,257 pp. on so difficult a subject as descriptive and surgical anatomy is well-nigh perfect, is no small praise. Yet such is the case.

If a few remarks are offered of critical character, they are only intended as suggestions to make the work still more perfect in the future.

In the description of the ligamentum teres of the hip joint, no mention is made of its suspensory action. By means of the two ligamenta, the pelvis is suspended from the heads of the femora; and not carried by them pressing against the upper portion of the acetabula. In the dissection of about 1,000 hip joints it was never found absent, though the text states that it often is, or is unimportant in development.

The illustration at page 654 gives the old classification or numbering of the cranial nerves. This is unfortunate. On page 507 the illustration gives these nerves correctly numbered.

In the illustration of the optic commissure on page 721, the old view of inter-retinal fibres is still retained. No such fibres are described in the text, as indeed none such exist.

The illustration of the foramen of Winslow on page 900 is still faulty. The layers of the peritoneum, forming the gastro-hepatic omentum, do not course along as represented in the diagram. The greater sac should be continuous with the smaller sac. The layers are not perforated to form the foramen of Winslow as the diagram shows. The foramen is formed by the constriction of the peritoneum at this point, and is the passage through this constriction from the greater to the lesser sacs.

The cervix uteri is wrongly portrayed on page 1,026. The posterior lip of the os does not recede behind the anterior lip as shown in the illustration.

On page 1,042 there is a faulty diagram of the intercolumnar fibres. The description of these fibres on page 1,043 is not quite clear. They are not connected to the outer third of Poupart's ligament. These fibres are some of the fibres of Poupart's ligament, and diverge in course from it, crossing inwards and upwards to the linea alba. They are therefore some of the fibres of Poupart's ligament taking an independent course.

The description of the appendix is meagre. As it plays so important a part in modern surgery its relations, peritoneal covering, and vascular supply merits more consideration. The appendix sometimes has no mesentery. It lies behind the peritoneum, in the retro-peritoneal tissue. Its perforation in such a situation would give rise to an abscess outside the peritoneal cavity.

Though the above criticisms are offered, they do not detract appreciably from the real merit of the work. Gray's Anatomy is, taken in all, the most useful and trustworthy work on the subject of anatomy within the reach of the student and practitioner. The publishers deserve high praise for the splendid form in which they have gotten the work up.