THE TREATMENT

OF ADVANCED PHTHISIS

- by -

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A T H E S I S

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I N T R O D U C T I O N.

The marvellous change which has come over our conception of the treatment of Tuberculosis of the Lungs, makes one of the most interesting and absorbing chapters in the history of recent medical progress. Now the radical changes in the treatment of this disease have, in great part, developed within the memory of the elder part of the present generation of medical men, and they have gone on so steadily and completely that now in its essential details the present treatment of Tuberculosis of the Lungs is almost diametrically opposed to those of comparatively recent times.

The introduction of Sanatoria indicated a marked advance in the medical appreciation of the true principles of treatment. Before this, a kind of enervating fatalistic view as regards Tuberculosis generally, and Phthisis especially, almost universally possessed medical opinion. So much so, that the discovery of a tuberculous focus in the body was held as sufficient to justify the opinion that from it alone death would, of necessity, sooner or later follow. And if by chance the presence of Phthisis was diagnosed and the case unexpectedly recovered, then the general view that was held was that a mistake in diagnosis had been made. This being the state of medical knowledge

concerning the disease the treatment of which is under discussion, it is not to be wondered at, that treatment was generally wholly wrong in principle and consequently futile or worse than futile. Symptoms were treated solely by drugs aided by various more or less inefficient dietaries. Fresh air and ventilation were altogether neglected because of the dread of giving cold. Stuffy rooms and wholly mistaken coddling were the order of the day. Leeching, blistering and antiphlogistics added to the patient's misery, and he generally rapidly sank from the consuming power of the poisons circulating in his blood, the existence, nature and origin of which were as yet a hidden secret.

But the advance of modern abdominal surgery, whereby the surgeon came to see and handle tubercles of the peritoneum of patients who subsequently quite recovered, did much to demonstrate the curability of Tuberculosis, as also did the accumulating evidences of healed tubercle in the lungs at autopsies performed on patients dying from causes quite unconnected with the respiratory system,- one of the common incidents of the post mortem room as is well known.

Obviously, the accumulating evidences of the curability of Phthisis by the unaided efforts of Nature, could not but lead to a gradual change in the attitude of medical men towards the disease. But the change came slowly and unequally,

and the errors and prejudices of the past blinded the vision of the bulk of the medical profession to the glimmerings of truth that were beginning to show themselves. In the early fifties of last century, we find Brehmer who practised in the little hamlet of Görbersdorf, proclaiming with no uncertain voice the curability of Phthisis, and the intrinsic value of open-air treatment combined with regulated exercise. But truth, as is often initially the case in such circumstances, was weak and prejudice was strong in the minds of men. However, Brehmer bravely held to his ground, helped latterly in great measure by his pupil Dettweiller until in time, their improved results from their treatment of Phthisis, and their cures in the disease, forced a tardy acknowledgment of the soundness of their methods of treatment. But as yet open air treatment was on a more or less empirical basis; for although the infectious nature of the disease had long been recognised, the nature of the infection was of course unknown, and thus, as yet, it could not receive other than empirical treatment. But still a great advance had been made in the treatment of a fell disease. The empiricism of this advance was for some time indicated in the exploiting of climatic treatment which naturally received a considerable impetus from the development of the fresh air vogue. All kinds of climate were advocated as almost specific in the treatment of Phthisis.

But to treat the disease rationally, it was necessary that the essential cause, and the methods of working of this cause should be accurately known. To this necessity of all rational treatment knowledge was steadily advancing; for Koch, the greatest bacteriologist of all time, stimulated by the wonderful work of Pasteur on the causes of Fermentation and Putrefaction, was steadily working to elucidate in a scientific manner, the essential cause of Tuberculosis. And this we know he finally did by his epoch making discovery of the tubercle bacillus in the year 1882.

And now the cause of Tuberculosis in each and every part of the body affected, having been ~~formed~~ found, the ground was cleared for the building up of a rational treatment of Tuberculosis of the Lungs, and indeed of Tuberculosis in general. With the aid of Metchnikoff's theory of Phagocytosis the reasons for the marked success of open-air treatment now became obvious, and consequently there soon developed the modern boom of the all-prevailing efficacy of Sanatorium treatment. The gradual reaction to this boom we are now witnessing; for Sanatoria we now know are being regarded more in their true proportion as one of the means only, in the modern co-ordinated attack on Tuberculosis of the Lungs.

But Koch meanwhile with the prescience of the master

mind was out for greater conquests. It became a fixed object with him to develop a specific which would either kill the bacillus 'in situ' or reduce its virulence to such an extent that the natural defensive forces of the body would successfully cope with it. It is a matter of history how, after nine years of unwearied effort and innumerable experiments, he finally prepared his terribly potent drug Tuberculin, and proved conclusively its specific action on tuberculous foci. Unfortunately with undue haste and with insufficient knowledge of its dose and potency, Tuberculin was launched into general medical therapeutics. Such being the nature of its introduction it was fore-doomed to initial and calamitous failure, and it rapidly sank into general disrepute as a method of treatment, by all but a comparatively few enthusiasts who continuously persevered experimentally with the drug. But it required the brilliant work of Wright and his pupils, in the demonstration of his Opsonic index method, to show how and wherein Tuberculin had failed; and moreover by his method Wright gave the first means by which initially safe dosage of the drug, in each case, could be arrived at. This was an important advance, and from it the modern recrudescence and vast improvement in the recent administration of Tuberculin has followed.

And now a rapid introductory sketch of the development

of the treatment of Phthisis having been given, the writer will endeavour to indicate shortly the classes of cases, which for the purposes of this Thesis are included under the term "Advanced Phthisis." To make a satisfactory classification of phthisical cases is difficult. The old classification into "first," "second" and "third" stage cases does not meet the demands of modern knowledge; for we know that the stage of the disease is not correctly measured by the time of disease existence, nor by the extent of physical signs in the chest; but rather by such a factor as the existing balance between the virulence of the infection and the natural resistance of the patient. Now, as initially, this is exceedingly difficult to accurately gauge, it follows that each case as it presents itself must be accepted on its merits, and must for a time be watched in its clinical manifestations, before we can decide whether it can be classed as an advanced case or not. With these provisions, a classification of cases included under the term "Advanced Phthisis" will now be made, and from this classification it will be obvious that the opinion is implied that Advanced Phthisis may be advanced in different senses. The classification is as follows:

Class I. Cases which are necessarily advanced from the length of time existing (chiefly cases where fibrosis preponderates) where natural resistance is great, and the tendency towards

cure is strong, and death from Phthisis is long delayed or occurs from other causes.

Class II. Cases of acute caseous Phthisis with or without cavitation, which from inadequate early treatment added to, or favouring an insufficient natural resistance on the patient's part, have progressed from the early to advanced stages of tuberculous infection, but which still are hopeful under enlightened modern treatment.

Class III. Cases of the nature of those under Class II, but which from continued ngglect or unskilled treatment, added to failure of constitutional resistance are hopeless.

Class IV. Cases in which either from the virulence of the organisms attacking or the lack of resistance (hereditary or otherwise) in the attacked, or in a combination of both, the patients are doomed from the very inception of the disease, and it is impossible correctly to state when the disease was not advanced.

A short consideration of this classification will show that it includes cases which tax all the resources of modern Hygienic, Tuberculin and other drug treatment.

Some of the points in the historical development of the growth and evolution of the present treatment of Tuberculosis of the Lungs, have already been briefly indicated in a short and introductory manner. It is now

proposed in this Thesis to deal more fully with these, and also with the research and experimental work from which this growth and evolution naturally followed. It is also proposed to deal with the applications of modern treatment and as far as possible to assess their value. And in carrying out these propositions the writer intends to give short clinical histories of cases that have occurred in his own experience, in a manner more or less illustrative of the points under discussion. The great necessity for further scientific investigation into the whole subject of this Thesis will also be spoken of.

HISTORICAL OUTLINE.

It is an essential and self obvious fact that the rational treatment of a disease must be based on an accurate knowledge of its etiology. Therefore it will be a matter of interest and profit to consider here, more fully, outstanding facts and work concerned in the growth of knowledge concerning tubercle of the lungs up to the period of the nineteenth century when the infectious nature of tubercle was demonstrated. From this demonstration followed the rise of that modern knowledge of the true cause of Phthisis which has rendered possible the development of the modern conception of its rational treatment.

It is a matter of medical history that advanced Phthisis has been recognised from the days of Hippocrates (460 to 357 B.C.) and in the works of the father of medicine is to be found a classical description of the signs and symptoms of the advanced disease, and of the wasting effects of tuberculosis on the human body generally. From the time of Hippocrates and Galen up to the seventeenth century, little or nothing was added to the almost non-existent knowledge of the etiology and pathology of the disease, indeed the period from Galen to Harvey has been looked upon as one of a degeneration of medical knowledge. Treatment, consequently did not advance in quality. Again turning to the early literature of Phthisis we find that Christopher Bennett

(1617 to 1655) wrote an important work on Consumption, and about 1689 Richard Morton, a contemporary of Sydenham, also wrote on consumption, and his description of its clinical symptoms showed an accurate knowledge of the disease. Autopsies were now being more often performed, and medical men were beginning to test old knowledge and to acquire new facts by direct observation of natural phenomena in the human body, instead of blindly accepting with unquestioning reverence the creeds of ancient medicine.

As a result we learn that by the middle of the seventeenth century, nodules were discovered in the lung and called tubercula. Next we find Lδennec in 1781 stating that every Phthisis develops from tubercle, and also giving expression to the opinion that phthisis was infectious. Out of his work arose the conception of the unity of Phthisis.

In 1865 Villemin, a French army surgeon, injected rabbits with matter from grey and yellow tubercles and thereafter found tubercles in the animals' lungs. As a result of his brilliant experiments he came to the conclusion that phthisis was a specific disease produced by an inoculable agent. Chauvin in 1868 caused Tuberculosis in animals by mixing tuberculosis material with their food. Thus we find the infectiousness of tubercle almost scientifically demonstrated. Still a period of doubt as to the infectious nature of the disease set in

until Cohnheim in 1877, eliminating previous sources of experimental error, successfully inoculated tuberculous material into the anterior chamber of the rabbit's eye. He thus gave conclusive proof of the specific infectiousness of tuberculous material. "Everything is tuberculous" he says, "that can produce tuberculous disease in animals that are susceptible to the disease, and nothing is tuberculous that cannot do this."

Accumulated facts now seemed to indicate that there was a "contagium vivum" in tuberculosis, still the question of the virus causing the infection - its nature and quality gave as yet unanswerable problems. But not for long; for soon we were to have the dawn of Bacteriology, that science which has given so much help to treatment in general, and which more than anything has made possible the modern conception of the rational treatment of phthisis.

Schönlein had in 1839 made the discovery that favus was due to a minute mycelial parasitic fungus. This discovery contained the germ of all future attainments by bacteriology; but its real significance was for long overlooked. In 1850 Rayer and Davaine noted the presence of minute bodies in the blood of sheep dying from Anthrax. These they called "petits bâtonnets." Later (in 1863) when Pasteur had published his observations on lactic acid fermentation, Davaine grasped the fact that the bâtonnets seen by Rayer and himself were not blood

crystals but organisms. And now we are led to consider the invaluable work of Pasteur. By unwearied application of the exact methods of chemical and physical research to the complex problems of disease, he brought disease's phenomena under the domain of scientific law. We find him saying that in the field of observation, chance only favours those who are prepared, and he amply proved the truth of his words in his laborious observations and experiments on fermentation and putrefaction, and in his investigations into the cause and treatment of such diseases as Chicken Cholera, Anthrax and Hydrophobia. By exact experimental methods he gave the final blow to the idea of spontaneous generation as the cause of fermentation and putrefaction. He showed that organisms present in ordinary air caused these phenomena, and that by the exclusion of these organisms fermentation of fermentable liquors and putrefaction of wounds could be prevented. From this followed "Lèsterism," but that does not presently concern. As epoch making work of Pasteur's should be mentioned the separation and the preparing of pure cultures of pathogenic organisms. By successive cultivations of the organisms of Chicken Cholera, Anthrax and Hydrophobia on artificial media, he was able to attain for each an attenuated virus which could be used in producing a varying degree of immunity to the corresponding disease in the animal or person treated.

The foregoing references to Schönlein, Rayer and Davaine, and to the work of Pasteur may, with an appearance of justice, be looked upon as a digression, and as not germane to the purpose of this Thesis, but in reality this is not so; for their work and especially that of Pasteur, led up to and gave stimulus to the classical work of Koch - that work which is the "fons et origo" of the modern conception of the etiology and treatment of tuberculosis.

It was while acting as the government district medical officer of health at Wollstein in the province of Posen (1872 to 1880), that Koch began his work on Bacteriology, and little conception in his then humble and unpromising surroundings could he have had of the eminence to which he was destined to attain in this, the youngest of the medical sciences. Pasteur's methods and technique he at first followed, but he gradually improved on them. As often happens in a new science his first great improvement seemed simple. It consisted in the introduction of solid nutrient media. This method rendered the isolation of pathogenic organisms a matter of comparative ease, whereas with the fluid media in use before, it had always been supremely difficult, and often impossible to get a pure culture of any given organism. By the use of his new method he was, in 1876, able to isolate Davaine's bacillus of anthrax, and thus it was rendered possible for him to demonstrate conclusively by experiment that it caused splenic fever.

From this time onward, Koch was marked out for greater things. He was in 1880 elected a member of the German Imperial Health Office, and here it was that the chief ambition of his life developed, namely, to find the cause of Tuberculosis and if possible to supply its specific cure. At last after innumerable experiments he, by special staining mathods, successfully demonstrated the tubercle bacillus in the fresh grey tubercles of newly killed animals. Next by adopting a medium of solidified blood serum, he was successful in cultivating the organism. It is a matter of medical history as to how thoroughly his work was done. He made the newly discovered bacillus conform to his famous postulates; for he found the germ in the products of Tuberculosis; he made pure cultures of it outside the body, and by the inoculation of these cultures he produced and clearly demonstrated tuberculosis in the animals inoculated. He was thus enabled in 1882 to startle the world by his announcement of the discovery of the tubercle bacillus. As giving some indication of the amount of work involved before the bacillus was found, it is related that his discovery was based on experiments with one hundred and seventy-two guinea pigs, thirty-two rabbits, five cats &c. Simultaneous injections of the most varying substances containing no tubercle bacilli were always negative in hundreds of guinea pigs and rabbits. But from whatever

source the bacillus was got, he proved that its inoculation always produced typical tubercles in the animal inoculated, and it is of interest to note that at this period, Koch regarded the human and the bovine bacillus as one and the same.

And now the essential cause of tuberculosis having been conclusively proved, men turned more hopefully to the problem of its preventive and curative treatment. To kill the parasitic bacillus in the sheltering host became the dream of the anxious research worker and the therapist. Numerous drugs and varying substances were tried by Koch and contemporary workers to attain this object, but as we know failure followed all such attempts. We can imagine how Koch with his knowledge of the general death roll of tubercle, and with his first hand access to the statistics of the ravages of Tuberculosis in his own country, would be stimulated to find a specific remedy for this fatal disease. With the accurate knowledge now possessed of the character and behaviour of the bacillus in growth outside the body, it was comparatively easy to find various conditions, and many chemical and pharmaceutical substances, which would kill it external to the living organism. But when it came to destroying the bacillus within the living animal, the problem presented quite a different aspect; and so far it has always been found impossible

to get a remedy which would kill the bacillus "in situ." Even when remedies easily capable of causing its death in artificial culture, were introduced directly into the lung by inhalation or by the intra-tracheal method, they failed to attain the object in view; for either the remedy reached the bacillus in too dilute a form to be deadly, or if stronger it produced irreparable and prohibitive damage to the lung tissue. During the eight to nine years succeeding the discovery of the tubercle bacillus, Koch tried innumerable remedies for the cure of tuberculosis, but they were almost all failures, and only a very few were even modified successes.

By the end of this time he had elaborated his famous tuberculin, which differed from all previous remedies in that, on inoculation it was most certainly capable of producing a specific effect on all tuberculous foci, and a constitutional effect on tuberculous patients. In his experimental work, Koch found that if a healthy guinea pig be inoculated with a pure culture of tubercle bacillus, first the inoculation wound heals over in a few days. Then within a fortnight a hard nodule appears at the seat of inoculation. This rapidly breaks down and ulcerates, the resulting ulcer continuing until the animal dies. But if such an infected animal is again inoculated but at a different site, then the results

at the site of the second inoculation are quite different: the wound heals as in the primary inoculation, but no nodule forms; instead, in a few days necrotic changes take place at the inoculation site, superficial tissue is shed and a flat ulcer results, which, unlike the ulcer resulting from the primary inoculation, quickly heals - the first infection has given such a degree of immunity to the animal that the second infection does not get a hold. Subsequently, he found that tuberculous animals repeatedly injected with small quantities of greatly diluted sterilised cultures of tubercle bacilli slowly improved from such treatment. He reasoned that the improvement was due to a curative substance or substances contained in the bodies of the killed bacilli. The search for such a substance led, in 1890, to the first preparation of tuberculin, which Koch held to contain the curative principle derived from the bacillary bodies. Three chief preparations of this drug were prepared by him: (1) Old Tuberculin (AT or T); (2) New Tuberculin (TR); (3) New Tuberculin Bacillary Emulsion (B.E).

Now as each of these has its use either in the diagnosis or treatment of tubercle a description of their preparation may suitably be given here, along with some notes on the character and properties of each.

It may be first stated that the three tuberculin

preparations just mentioned, owe whatever therapeutic power they may possess towards tuberculosis, to the production of a greater or less degree of active immunity, i.e. by their absorption by the treated organism they produce changes which stimulate the formation of specific substances (antibodies) in its blood serum. The immunity produced is, therefore, of an indirect and active nature in contra-distinction to the direct passive immunity produced by the use of a specific serum, e.g. anti-diphtheritic serum.

The first preparation prepared by Koch in 1890 was, as already indicated, called Old Tuberculin (AT - Tuberculin alkalinum). It is prepared as follows:-

Pure cultures of tubercle bacilli six to eight weeks old are grown in slightly alkaline veal broth, or one per cent solution of meat extract, with the addition in either of one per cent pepton and four to five per cent glycerine. This is boiled for one hour, then it is reduced to one tenth of its volume by evaporation over a water bath. The fluid is then separated from the bacilli by passing through a Pasteur-Chamberland or a silicate filter. The filtrate is a thick extract containing forty to fifty per cent of glycerine. It constitutes Old Tuberculin (AT). It is neither a pure toxin nor a pure endotoxin: it contains a glycerine extract of the soluble secretions (exotoxins) of

the tubercle bacilli and also the endotoxins extracted by the alkali and glycerine contained in the culture broth, from the bodies of the bacilli, during the one hour's boiling and the steaming over the water bath,

In the foregoing preparation, the aim was to produce by its administration, an active immunisation to the toxins only of the tubercle bacillus: it was held to contain only part of the essential substances of the tubercle bacillus. Later on, it became Koch's aim to produce a tuberculin which on administration would give an active immunity to the tubercle bacillus. The result was the presentation in 1897 of his New Tuberculin (TR = Tuberculin Residuum). In its preparation, fresh cultures of Tubercle Bacilli (dried in vacuo) were thoroughly ground up in an agate mortar. The resulting mixture was then thoroughly mixed with saline solution and centrifuged. The fluid upper layer (TO) was removed. The remainder was emulsified with 40% glycerine. This formed Koch's New Tuberculin (TR).

Later experiments in the formation of agglutinins in the blood of animals treated with bacterial cultures for the purpose of producing immunity, led Koch to assume that the phenomena of agglutination was an essential part in the production of immunity, and that it stood in direct proportion to the degree of immunity arrived at. His experiments also led him to believe that in tuberculosis,

agglutinins were most freely formed when a fine suspension of tubercle bacilli was injected for their production. Now in the natural course of tuberculosis, it has been shown that no specific agglutinins are formed; therefore with the object of attaining to the highest production of specific agglutinins in the blood of the tuberculous human, Koch, in 1901, introduced his New Tuberculin Bacillary Emulsion (BE). This is similarly prepared to TR (New Tuberculin), but instead of centrifugalising the solution got by treating the crushed bacilli with normal saline, it is simply allowed to settle and fifty per cent glycerine is added to give greater permanence. By omitting in the preparation of BE the centrifugalising and the consequent separation into two layers, as in the preparation of his new tuberculin, Koch believed that in experiment and treatment, higher agglutination values were arrived at more speedily and more safely than with his former preparations.

When Koch neglecting the normal dictates of his scientific caution, was persuaded in 1890 to make his too precipitate announcement of his first tuberculin as a curative remedy for tuberculosis, the excitement in the medical world was intense. Ever since the discovery of the tubercle bacillus in 1882 the scientific atmosphere had been increasingly charged with the expectation of such an event; for the etiological factor of tuberculosis

having been indisputably discovered, it was naturally argued that the supply of a specific treatment was only a matter of further scientific work. Thus when Koch announced his cure, he did so at a time fully pregnant with anticipation. The remedy was hailed as heaven born - "A gift of the gods." At the beginning during the period of "Tuberculin delirium," its value as a curative agent in tuberculosis was grossly exaggerated, just as later on its faults were greatly magnified.

These results arose from imperfect knowledge.

As a consequence of his experiments on guinea pigs Koch's theory of the action of his tuberculin was that the tubercle bacillus normally secreted a substance having a necrotic action on the tissues, and that when tuberculin was injected into a tuberculous patient, the proportion of this necrosing substance became suddenly increased and that consequently great reaction took place at tuberculous foci with necrosis and separation of the material thereof containing dead and living bacilli. Reactions were regarded as necessary and curative, and consequently dangerously large doses were given to produce these reactions. The clinical results were generally disastrous, and although some strikingly successful cases were recorded, still many tuberculous patients were injured, and some were hastened to their graves by the large doses wrongfully administered.

The pathologists were almost wholly against the new remedy, and Virchow was particularly virulent in a successful attack against it. He showed that the necrotic action of tuberculin was dangerous, and that it caused local extension of the tuberculous focus, and that if the dose was large enough, or if its administration was continued it was capable of producing generalised tuberculosis. His conclusions were almost fully justified by world-wide clinical experience and as a result the period of "Tuberculin Terror" set in. The preparation thereupon almost universally rapidly sunk into an ignominious obloquy as a human remedy, although veterinary surgeons took it up and have continued to use it as a valuable diagnostic agent in bovine tuberculosis. The writer well remembers this period for it happened in the salad days of his studentship, and his young and ardent hopes for this remedy were rudely shattered in the general great therapeutic disappointment. Koch at this period was bitterly and unduly blamed, but still with characteristic pertinacity, he held to the faith that was in him with regard to his remedy, and he was supported therein by a fair ~~amount~~ number of faithful adherents in his own country, who continued to give tuberculin with greater success as their clinical knowledge of the remedy increased. In all other civilised countries, there were

exceedingly few who continued to have any faith in tuberculin, and still fewer amongst these continued to make any use of it at this period, or for a considerable number of years thereafter. Amongst the latter, the writer remembers with gratifying interest was McCall Anderson, one of his teachers.

Although Koch and the workers with whom he was associated, continued to work at tuberculin with slowly increasing better results, still, outside their own country, the remedy as a therapeutic agent remained for years generally moribund and distrusted. But knowledge in other directions as the result of brilliant research work, chiefly on the part of Wright, was increasing in a manner which was destined to alter all this, and which, especially in England, was fore-ordained to be one of the chief mainsprings of the "Tuberculin Renaissance" of recent years.

Metschnikoff in 1883 basing his premises on his work on the intracellular digestion of invertebrates, had published his theory of "phagocytosis." He stated that the leucocytes were the only protective constituents in the blood which warded off disease. But other observers, especially in Germany, held that the bactericidal substances in the blood and tissue juices (humoral theory) were of much greater importance in this respect, and that the phagocytes simply acted as scavengers in carrying off

the dead or dying bacteria. Again it became a matter of knowledge that bacteria dying in the animal organism, gave off substances into the blood, which attracted phagocytes to the seat of infection. Hence the theory of "chemiotaxis" the phenomena of which was first observed in bacteria by Engelmann.

Medical opinion was divided amongst these facts and theories with an unequal division when Wright began his research work on Immunity, a work which was destined more than anything to indicate the relative importance and necessary correlation of phagocytosis, bactericidal substances (opsonins) and the phenomena of chemiotaxis in the process of warding off diseases and the production of active immunity. Now as this work of Wright and especially that part of it connected with opsonins has made possible, many of the recent advances in the tuberculin treatment of tuberculosis, it will be well here to make some reference to it. Thus we find that Wright, in conjunction with his co-worker Douglas, and following on lines of research already laid down by Leishman, began that brilliant research work which ended in the elaboration of his opsonic theory and the establishment of the opsonic index method, which will be described more fully later on in this paper. Here it may be said that the method is founded on the theory that in the blood serum there are

substances (opsonins) which unite with the invading bacteria and prepare them for the subsequent ingestion by leucocytes. The opsonic index itself may be briefly indicated as the figure expressing the proportion of bacteria devoured by the leucocytes in an infected blood, to those devoured by the leucocytes in the normal blood, and it has been graphically expressed by the following fraction:-

$$\frac{\text{Phagocyte count of the patient's blood}}{\text{Phagocyte count of normal blood.}}$$

Now when the injection of a vaccine (bacteria or toxin) is made, the numerator of this fraction becomes relatively small. This indicates the negative opsonic phase, and during this time a further dose of vaccine does harm. Usually after several days, the opsonic index rises and the numerator of the fraction is increased: this is the positive opsonic phase. During this time a further dose of the vaccine increases the phagocytosis and thereby does good. Now the indication in vaccine therapy and therefore in the administration of tuberculin is to increase the length of the positive phase, and to raise it to as high an index figure as possible. In tuberculosis as in other bacterial diseases, Wright found that this was best done by commencing with a small initial dose of vaccine (tuberculin in tuberculosis) and continuing

the administration by small doses given towards the end of the positive opsonic phase. To enable him to do this in tuberculosis, he elaborated his tuberculo-opsonic index. With this as his guide and control, he was able by small and gradually increasing doses of tuberculin, administered at suitable intervals to tuberculous patients, to build up an optimum opsonic index, and to maintain it at this level for considerable periods of time. Thus he arrived at the best possible state of active therapeutic immunity for the individual patient.

On his work, the first publication of which was made in 1901, is based the modern British method of Tuberculin administration, especially in localised tuberculosis.

And now it is convenient to consider another essential factor in the modern crusade against tuberculosis, namely, the origin and general spread of Sanatoria and Sanatorium treatment. The value of fresh air in the treatment of Phthisis had for many years been recognised by the medical profession before the introduction of Sanatorium methods. Early pioneers in the advocacy of the healing power of pure air in phthisis, had been Andrew Stewart of ~~Arskine~~ Erskine, Scotland (1747); Wm. Buchan 1783; Benjamin Rush of Philadelphia (1794) and especially George Bodington of Sutton Coldfield near Birmingham. But their advocacy by no means brought

about general adoption of their views in treatment; for phthisical patients long continued to be housed in close, stuffy and unventilated rooms, to be unsuitably clad, and altogether to live unhygienic lives. Neglected colds added to an accepted belief in an hereditary taint, were looked upon commonly as the starting cause of phthisis, and everything was arranged with a view to keep the patient from running the risk of contracting colds. Climatic treatment which, prior to the general adoption of sanatorium methods, was destined to be greatly boomed was not arranged on lines likely to serve the best interests of the patients. Many climates were "per se" looked upon as almost specific in their suitability for the treatment of Phthisis and absurd claims were put forward for them. Consequently we find that unsuitable cases were sent on unsuitable journeys to strange and unsuitable surroundings, where home comforts were often wanting, and where, having regard to the disease under treatment, generally unhygienic and unhealthy lives were lived. The results to the patients were in the bulk bad, and not infrequently disastrous, with the result that the climatic treatment of phthisis gradually began to take a modified place in the estimation of the medical profession. But it should be remembered that it was not the climates that were generally to blame; it was the method of using them that was at fault.

But as has already been referred to, Brehmer about 1859, had already realised in great part the modern view of the value of fresh air and hygienic living in the treatment of phthisis, as it takes shape in the present accepted conception of Sanatorium treatment. He it was who first strenuously practised those methods, which, with modifications and improvements, have been adopted in most sanatoria erected since he first promulgated his views. He advocated fresh air, good food, hygienic living and graduated exercises and these he supplied to his patients in his sanatorium at Göerbersdorf. At first his ideas in the treatment of phthisis were looked upon with suspicion by medical men generally, and his methods were, by many, regarded as those of a crank. He, however, as has been seen, with laudable perseverance, in face of disheartening criticism, persisted in and practised his conception of phthisical treatment, and in this he had the whole hearted co-operation of his pupil and co-worker, Dettweiller. Stimulated by the remarkable successes in the treatment of phthisis, which he was soon able to record, patients were attracted in increasing numbers to his sanatorium. Gradually he and Dettweiller improved their methods, and the latter later on opened a sanatorium of his own at Falkenstein, where he soon had successes similar to those of his old teacher. However, medical opinion generally, tardily

recognised or acknowledged the value of the newer treatment. But a truer knowledge of the etiology and pathology of phthisis was now accumulating with comparative rapidity, and this could not but be to the advantage of what has always, in principle, been a rational form of treatment.

The discovery of the tubercle bacillus in 1882, as we have already noted, immensely increased the prospects and expectations from rational treatment of phthisis, and as a consequence sanatorium treatment became increasingly popular. The method of natural cure now began clearly to be understood, and with this understanding it became obvious how Brehmer and those who followed his methods, had achieved their undoubted successes. The beginning of the sanatorium boom had arrived. Sanatoria now began to multiply throughout Germany. Still at first these did not appeal in strong force to this country, and the fact that, later on, not a few on critical examination were shown to possess vital defects in their system of treatment, and in their hygienic arrangements, did not aid their cause either in Germany or outside thereof. Ultimately, however, Walther at Nordrach in the Black Forest, began his system of sanatorium treatment which was destined to appeal more to English patients, than had those practised at Göerbersdorf or Falkenstein.

Although so far, lagging behind Germany, still knowledge and appreciation of the subject of sanatorium treatment was increasing in other countries, in proportion as faith in the success of climatic treatment "per se" declined. It became obvious that whilst climate might be a help to the success of sanatorium treatment, still it was recognised that it was by no means essential to have a special climate. Granted that the patients could be continuously bathed in cool fresh air, in conditions not too relaxing, and that they could be supplied with good hygienic surroundings, a suitable dietary, skilled medical guidance, good nursing, and a life free from unnecessary worry, then it became recognised that sanatoria could be wisely erected in almost any part of a country where these could be supplied, and where in addition, a healthy, well drained grass covered and not too exposed site could be secured.

With increasing knowledge of the subject, Britain and America which had formerly followed behind Germany, soon began to take the foremost place in the development of sanatorium treatment on the best lines. When the King Edward the Seventh's international competition was inaugurated, inviting medical and architectural essays on sanatoria, it was scarcely expected that, as the result of an eminently fair competition, premier medical

and architectural honours should go to Englishmen, Dr. Latham being found worthy of the first place amongst medical competitors. It soon became evident that Britain had nothing to learn from Germany, but had knowledge to give to her and to other countries in the matter of the construction and management of sanatoria with a view to obtain the best results in the treated patients.

And now the gospel of the sanatorium was rapidly spread over the whole civilised world, and in our own country sanatoria have increased greatly in number, and recent legislation in the shape of the National Insurance Act is magnifying this increase, present and prospective. Its aim is to render sanatorium treatment available for all suitable phthisical cases amongst insured workers, and this forcibly appeals as one of the best aims of a complicated and much discussed Act. When this is accomplished, the undoubted curative and educative effects of sanatorium treatment and regimen will be tremendously increased, and thus will be provided one of the strongest and most successful forces in the protracted fight against tuberculosis.

The limitations and the possibilities of sanatorium treatment now stand clearly out in truer proportion. Much, but not too much is expected of it. Fads such as fancy diets or gluttonous feeding are now deleted from its methods:

a full generous and varied diet is always provided, but the patients now eat to live, and do not simply live to eat. Hygiene and beneficent regimen and discipline are being more and more intelligently carried out in Sanatoria. Their patients are wisely chosen and wisely treated. Their work is highly educative and not infrequently curative to the patient. Sanatorium principles and methods are being carried home by treated patients thus spreading their educative influence, besides giving good results often in what appear most unpromising surroundings; for it is now being generally recognised that with the exercise of intelligence and care, the carrying out of sanatorium methods of treatment is possible in almost any home, and especially so if patient, medical attendant and friends co-operate towards this result.

It may now be safely affirmed that in prevention, early diagnosis and sanatorium treatment plus the aid of tuberculin lie the great hopes of the modern crusade against phthisis, and it may also be safely affirmed that never before have these four requirements been so efficiently supplied as at the present, although much in the efficient crusade against tuberculosis remains yet to be understood and to be carried out. But illuminating knowledge must surely gather as the result of present co-ordinated efforts.

As might be expected in a disease like phthisis, the efficient treatment of which has baffled the ages, many cures, many drugs, and many adjuncts of treatment have been from time to time introduced. Some are almost as old as the history of the disease, some few have remained useful, but the majority have proved useless, and not a few have proved worse than useless. Again since the discovery of the tubercle bacillus we find that some previously existing remedies have been retained, some have been retried and others have been introduced. But of treatment generally, since the bacillary origin of phthisis has been known, this may be said, that it has been based on a less empirical basis than formerly, in that its object has almost invariably been direct or indirect warfare on the tubercle bacillus. Of all present day treatments that on Sanatorium principles possibly with the aid of tuberculin, easily takes first place. Still some reference to various of those secondary treatments and substances tried will not be without interest. Here as one of the best, Cod Liver Oil may be mentioned. Introduced in 1841 by Dr. John Hughes Bennett, it, for a long time was looked upon as having some pronounced specific action in the treatment of Phthisis. We now know that its action was, and is, in great part, that of an easily digested and highly nutritious fat in a chronic wasting disease,

the small amount of Iodine compounds which it contains being almost negligible. Malt Extract, Zomotherapy, the milk cure, Russian Koumiss and its modifications, also stand chiefly as nutriti~~ous~~ *ves* in their relation to phthisis.

The extravagance of the methods and claims of "suralimentation" as introduced by Dēbove is now generally recognised, although at no time more than the present has the true value of a really efficient dietary been more ~~appreciable~~ *appreciated*.

Pancreatic emulsion with Cod Liver Oil, the Hypophosphites of Calcium, Sodium and Potassium and various preparations of Iron, have all been used for their tonic and nutritive effects. Similarly, Arsenic and its derivatives have possessed, and still possess, a considerable reputation as tonics, and as having a valuable influence over the blood forming mechanism.

Likewise, pure beechwood Creosote and the various preparations derived from it, especially guaicol, continue to possess a certain, though modified value; but the virtues of Creosote by inhalation are not now so highly regarded as formerly; probably its best effects when thus administered, are on the accompanying bronchitic and bronchiectic conditions sometimes got in advanced phthisis. The bactericidal effects of creosote on the tubercle bacillus, by any of the methods of present

administration is probably "nil."

As already indicated, after the discovery of the tubercle bacillus, many drugs were used for their supposed inhibitory action on the bacillus. These were administered chiefly by parenchymatous, intra-pulmonary or venous injection, by inhalation or by the mouth. They have now in great part been discarded even as adjuncts to other more efficacious treatments. Amongst them were creosote (already mentioned as retaining a certain value), Iodoform, Corrosive Sublimate, Biniodide of Mercury, Eucalyptus Oil, Menthol, Chloride of Zinc, Carbolic Acid, Peroxide of Hydrogen, Tannin, Cinnamic Acid, Camphor, Formalin &c.

The climatic and sea voyage treatments of phthisis, greatly vaunted at one time are now held to possess a strictly diminished value in the therapeutics of this disease. In this connection it is well to remember that many of Britain's oversea dominions refuse to permit the landing of known phthisical patients.

Various sera from the blood of animals rendered immune to tubercle have been used in recent years in the treatment of phthisis, the guiding idea being to produce a passive immunity in man to the disease. The results, whilst not too encouraging, probably merit the keeping of this method under investigation. Still, it is

difficult to see how this treatment can be successful in chronic cases of phthisis; its most hopeful prospect probably lies in the treatment of early localised disease. Marmorek's serum introduced in 1903 and Maragliano's serum introduced in 1906 are the two chief preparations of this remedy.

Two other methods of treatment introduced in recent years might fittingly be mentioned here, viz. the Vaccine treatment of Wright (opsonic controlled), and Carl Spengler's method of the administration of the blood of rabbits rendered immune to tubercle (IK). The former method is of limited application - a legitimate use for it would be in advanced cases of phthisis with severe secondary infection and cavitation, i.e. in cases in which in England the administration of tuberculin is generally held to be prohibited. Here the employment of suitable vaccines might, exceptionally, bring such cases into a condition in which tuberculin could be legitimately used. The latter method (IK) is strictly on trial. Its advocates applaud its great therapeutic value, and some of them do not hesitate to give it a place superior to tuberculin. Its opponents, on the other hand, with as little hesitancy, say that the remedy is inert in the treatment of human tuberculosis. The writer may here state that at a local tuberculous dispensary he has watched, over several months, its administration

in a series of cases of localised phthisis. Over one half of the cases have improved under treatment, and in the remainder he has not been able to detect any injurious effect from the remedy.

Another method of treatment which is applicable to a comparatively small number of selected cases of phthisis is here worthy of notice, namely, the production by operation of artificial pneumothorax. To Carson of Liverpool belongs the credit of first advocating over a century ago, the possibility of using pneumothorax in a therapeutic manner. Pioneers in the performance of the operation have been Potain in France, and Forlanini in Italy for the closed method, and Murphy in America, and Brauer in Germany for the open method of operating. Presently the operation in phthisis is generally performed after Forlanini's method, and it has for years been almost a routine operation in suitable cases on the continent. It consists essentially in the production of pneumothorax by the introduction of Nitrogen through a canula. Claude Lillington, who, himself, after two years' febrile phthisis, underwent the operation in 1909 with the result that he was able to return to work in England in 1910, has since been a pioneer of the operation in this country. It has given striking results in some cases, but although the sphere of the operation tends to extend, still the patients chosen to undergo it, should be selected with the

greatest care, and such cases should have first resisted the ordinary less heroic methods of treatment. For the operation to be successful, the disease should be almost wholly confined to the side of the chest operated on, if only for the reason that one lung (and that probably a somewhat impaired lung) will have to perform the work of two, whilst the periods of artificial pneumothorax last. Also for obvious reasons, it is essential that the pleura on the side operated on should be free from any but limited adhesions; but prior to operation, the presence of even extensive adhesions is exceedingly difficult and often impossible to make out. Again, in doubtful cases, it may be very difficult to form a correct opinion as to the amount of disease (if any) in the other lung.

In the operation itself when successful, the formation of an artificial pneumothorax gives by the resulting lung collapse, physiological rest to the treated lung; stasis of the lymph channels is secured; spread of the disease is checked in the treated lung, and toxic absorption or auto-inoculation is prevented. The collapse of the lung also brings together the walls of existing cavities: drainage of these cavities is promoted, and their permanent obliteration in successful cases results after repetitions of the operation, and encapsuling fibrosis finally takes place. The healing process here is a pronounced testimony of the value of

rest to a diseased lung. It must be conceded that in careful hands and in selected cases, some brilliant results have accrued from this operation, and these results are all the more valuable from the fact that they have been obtained in cases more or less hopeless from the point of view of any other treatment.

The fact that the operation of producing artificial pneumothorax in phthisis is based on the old clinical observation that the occurrence of a limited pneumothorax in tuberculous disease of the lung, sometimes produces an arrest of the disease, recalls an illustrative case which occurred in the practice of the writer during the autumn of 1903. The patient concerned was J.T. aged 26 years, a joiner by trade. On the evening of 4th September, he expectorated from three to four ounces of mixed blood and sputum. The writer was called in to see him. There was a history extending over twelve months of a gradual loss of energy and flesh, pains in the chest, a cough with a fair amount of morning sputum, and some increasing breathlessness on exertion.

There was present flattening over the right apex with crepitant rales, and distant signs of a cavity could be elicited in the right middle lobe. The patient was put to bed and absolute rest was enjoined and treatment on careful hygienic lines was instituted. About a fortnight later the writer was urgently requested to see him in the

early morning. He had suddenly developed dyspnoea accompanied by a severe pain in the right chest. He was obviously in distress: the pulse was rapid and his face was pale and anxious. The movements of the right side of the chest were restricted and breath sounds were absent over the upper half of the right lung, and V.F. was lost over this area. Pneumothorax was diagnosed. Stimulants and sedatives were exhibited, and the symptoms with continued rest in bed, gradually abated although the lung remained collapsed for some time. As the air in the pleural cavity became slowly absorbed, it was noticeable that, accompanying re-expansion of the right lung, an improvement in the diseased condition had taken place: sputum gradually diminished in amount, the pulse rate became less, and febrile symptoms abated - a slowly progressive improvement had taken place which went on to cure. The man presently is in good health, and for over ten years he has been able to follow his occupation regularly and to enjoy the ordinary life of a workman of his class.

Lastly, one of the most important adjuncts to sanatorium treatment may be fitly mentioned, namely, the Tuberculous Dispensary. For many years Sir R.W. Philip of Edinburgh, had insisted on the necessity for the introduction of the dispensary unit in the administrative

control of Tuberculosis. He advocated the tuberculous dispensary as a central point in the co-ordinated system of measures for dealing with tuberculosis. As a direct result the first Tuberculosis Dispensary in the world was opened at Edinburgh in 1887. From his prevision and from his conceptions as to the best methods of dealing with tuberculous disease, has gradually developed under his guidance, the so-called Edinburgh Co-ordinated System of dealing with tubercle, a system which in recent years has been copied all over the civilised world. In this System, the dispensary acts as a receiving centre for patients, an inquiry centre, an educative centre for disseminating useful information, a centre for tuberculin treatment to suitable cases, and a distributing centre, in which suitable cases are sent to sanatoria, and hopeless cases are sent to special hospitals where such exist, or, failing that, arrangements are made for their domiciliary treatment. We know that in this country since the passing of the National Insurance Act, there has been a great increase throughout the country, in the number of dispensaries, mostly state supported. The work that is being done by these institutions is of considerable and increasing value. They enlist the essential co-operation of the general practitioner, and this is of the utmost importance. Early diagnosis and efficient treatment results. This applies both to insured persons and to their dependents, and under the Act as part of the

treatment extra nourishment is supplied free in the shape of "Sanatorium Benefit" where from poverty or other reasons such is required. Taken altogether, the dispensary is proving itself an indispensable unit in the modern co-ordinated system of dealing with tuberculosis.

KOCH AND THE GERMAN SCHOOL

A consideration now of the method of tuberculin treatment at present adopted in Germany and the continent generally, and in great part in America, will be of interest. We find that Koch in his original researches with tuberculin fully appreciated the tremendous potency of his preparation in its action on man affected by tuberculosis. Thus in 1890 he stated that whilst a healthy guinea pig showed no symptoms of perceptible harm with a dose of 2 ccs of Old Tuberculin, a dose of 0.25 cc was capable of producing an intense reaction in man. Stated in relation to body weight this means that $^{1}/_{1500}$th of the quantity giving no perceptible action on a guinea pig, gives a marked result in man.

But what was not at first appreciated was the real <u>danger</u> of the intense reactions in man, following on unregulated and large doses of tuberculin, until that danger

obtruded itself in no uncertain manner to the undoing of tuberculin, as a general remedy for phthisis, during the ensuing ten years or so.

Now the development of the method of administration of tuberculin carried out by the so-called German School may be said to date from the publication of the clinical results and observations of Goetsch in 1901, a publication which received Koch's endorsement. Goetsch stated, as the result of his personal work, that phthisis could be treated with large frequent doses of tuberculin, if, instead of starting with a large dose, small doses were used to lead up to it. Later we find Koch stating that it is not advisable continuously to give only the smallest doses of tuberculin, and that it must not be forgotten that in tuberculosis it is a question of active immunisation, and that it can only be to the advantage of the patient that not too low a degree of immunity should be attained. We also find him saying that, if he is not mistaken, the fable of "the tubercle bacillus rendered mobile still haunts many a brain."

From such sources and such statements have arisen the present day methods of tuberculin treatment practised in Germany and the continent generally, a method which, by gradually increasing the dose, aims at the assimilation of large doses of tuberculin, whilst avoiding

reactions as far as possible. By these increasing doses, given at short intervals, it is claimed that a degree of tolerance to the drug is produced, such that large doses of it, and also of auto-tuberculin, can be borne with impunity. The method claims that it increases the antibody content in the body, by suitable doses of antigen (tuberculin): that it directs the increased antibodies to the focus of disease, by setting up a focal reaction: that it abolishes any inconvenient sensitiveness of the tissues to the toxic action of tuberculin, by establishing tolerance.

In the German School contra-indications to the giving of tuberculin in phthisis are held not to be very numerous, and a fair proportion of them are considered as temporary or as being capable of removal. Thus we find that the drug is given, under conditions, to cases of phthisis in all stages of the disease. The decision for or against tuberculin treatment, is made on the merits of the individual case considered as a whole, and not on the consideration whether or not the patient's condition should be classed under Stadiums I, II or III.

As contra-indications or hindrances which are observed to the administration of tuberculin in phthisis by the German School method, the following may be stated:

1. Rapidly increasing disease, especially (as commonly occurs) with mixed infections.

2. Fever. Suitable methods to reduce the fever should all be tried. If successful then the way is held to be clear for tuberculin: if unsuccessful, or only partially successful, then it is advised that tuberculin should be given in very small doses and its effect noted. Not infrequently when given in this way, the drug, it is held, has an efficient antipyretic effect.

3. Rapid pulse of 120 or over.

4. Haemoptysis. The tendency is not to regard this even as a temporary contra-indication, except in the event of a considerable haemorrhage. It is contended that tuberculin often tends to stop a temporary haemoptysis.

5. Accidental concomitants, such as diabetes: organic heart disease with poor compensation; the menstrual period; epilepsy; also a high degree of nervousness on the part of the patient towards the treatment, may render the treatment impracticable.

6. Tuberculin should not be given where there is no possibility of proper control.

7. Presence of any intercurrent acute disease.

And now we come to the method of administration of tuberculin to the patient according to the German School. First of all each patient is carefully examined medically before the decision to give tuberculin is arrived at. When it is decided to give the drug, then various methods of administration are available, namely:

1. Subcutaneous.
2. Intravenous.
3. Intra-pulmonary.
4. Tuberculin inhalation.
5. Oral administration.
6. Per rectum.
7. Percutaneous.

Of these methods, the subcutaneous easily takes first place and it is the one usually adopted. Of the others, the intravenous is the only one that really competes with it, and any difference between it and the subcutaneous method is mainly that of degree and time.

Let it be supposed that the subcutaneous method is chosen, then various sites for injection may be adopted. Koch advised that the injection should be made under the skin of the back between or below the shoulder blades, alternately on each side, because here the skin is loose and also this position gives little tendency to local reaction. For the patient's convenience the forearm is often chosen, but here the skin is less loose, and there is more likelihood in this position of producing a painful

local reaction. The skin of the breast near the mammary glands is considered a convenient and good site, both for the patient and administrator, and it is found that a local reaction is seldom got here. Whatever the site chosen, injections to avoid reaction must be made into the loose connective tissue between the cutis and fascia. If you inject into the cutis, you get a painful local infiltration. Again, the more insoluble substances the preparation of tuberculin chosen, contains, or the more concentrated the injection, the more readily is a local reaction produced.

To illustrate the German method, a course of injections of Old Tuberculin (AT) will be described. This preparation, a concentrated one, is one commonly used in Germany for the giving of a complete course of tuberculin treatment. For purposes of injection a 1 cc. glass syringe with fine platinum-iridium needles, is required. The syringe should be accurately graduated into ten divisions (each division = $^{1}/_{10}$th cc.) For convenience of administration, various dilutions of the original preparation (AT) are made. These dilutions are readily prepared by using the graduated syringe. The diluting fluid is phenol in normal saline, strength 1 in 200. The dilutions may be made as follows:
Let the original preparation, Old Tuberculin (AT) as

received from the chemist, be called A. Then five convenient dilutions, B, C, D, E and F. may be made as follows:

For solution B.

Take ½ cc (½ syringeful) of solution A (AT)
and 4½ ccs (4½ syringefuls) of the diluent. Mix.
Then 5 ccs contain .5 cc AT
and 1 cc " .1 cc AT
and 1 division of syringe = $\frac{1}{10}$ cc contains .01 cc AT

For solution C.

Take ½ cc (½ syringeful) of solution B.
and 4½ ccs (4½ syringefuls) of the diluent. Mix.
Then 5 ccs contain .05 cc AT
and 1 cc " .01 cc AT
and 1 division of syringe = $\frac{1}{10}$ cc " .001 cc AT

Pursuing a similar method for the remaining solutions, a series of five dilutions is given each one tenth the strength of the one immediately preceding, and a convenient method of labelling the stock bottles containing these dilutions is to express on each label what $^1/_{10}$ cc (1 division of the syringe), contains of the original preparation AT. Thus the labels would read as follows:

(B) $^1/_{10}$cc = .01 cc AT
(C) $1/_{10}$ " = .001 cc AT
(D) $^1/_{10}$ " = .0001 cc AT
(E) $^1/_{10}$ " = .00001 cc AT
(F) $^1/_{10}$ " = .000001 cc AT

All tuberculins and their dilutions should be kept in a dark cool place. It is well to renew the dilutions every three or four weeks. Turbid dilutions should always be rejected. In the whole technique of preparing dilutions, and of administering tuberculin, strict surgical cleanliness is necessary.

Coming now to the administration of tuberculin to the individual, we will suppose for the sake of clearness, that the patient selected receives the rising doses of tuberculin without reactions, then, pursuing the German method, a course of injections of Old Tuberculin (AT) {using the foregoing solutions A, B, C, D, E. and F. and commencing with the weakest solution F and the comparatively small dose of $^{1}/_{10}$cc of this solution or .000001 cc AT (a more usual initial dose would be .00001 cc)} would work out in a manner something like the following:

		Intervals between doses.	Full time occupied.
<u>F solution</u> - doses as follows:			
1/10cc(1dvsn.of syringe)	= .000001 cc AT		
3/10cc(3 " " ")	= .000003 cc AT		
6/10cc(6 " " ")	= .000006 cc AT		
10/10cc(1 syringeful)	= .00001 cc AT		
<u>E solution</u> - doses as follows:		1 day	1 week
1½/10cc(1½ dvsn.of syringe	= .000015 cc AT		
3/10cc(3 " " "	= .00003 cc AT		
6/10cc(6 " " "	= .00006 cc AT		
10/10cc(1 syringeful)	= .0001 cc AT		

		Intervals between doses.	Full time occupied.
D Solution - doses as follows:			
1½/10cc(1½ dvsn.of syringe)	= .00015 cc AT		
2/10 cc(2 " " ")	= .0002 cc AT		
3/10 cc(3 " " ")	= .0003 cc AT		
5/10 cc(5 " " ")	= .0005 cc AT		
7/10 cc(7 " " ")	= .0007 cc AT		
10/10cc(1 syringeful)	= .001 cc AT		
C Solution - doses as follows:		3 days	5 weeks
1½/10cc(1½ dvsn.of syringe)	= .0015 cc AT		
2/10 cc(2 " " ")	= .002 cc AT		
3/10 cc(3 " " ")	= .003 cc AT		
5/10 cc(5 " " ")	= .005 cc AT		
7/10 cc(7 " " ")	= .007 cc AT		
10/10cc(1 syringeful)	= .01 cc AT		
B Solution - doses as follows:			
1½/10cc(1½ dvsn.of syringe)	= .015 cc AT		
2/10 cc(2 " " ")	= .02 Cc AT		
3/10 cc(3 " " ")	= .03 cc AT	twice weekly.	3 weeks
5/10 cc(5 " " ")	= .05 cc AT		
7/10 cc(7 " " ")	= .07 cc AT		
10/10cc(1 syringeful)	= .1 cc AT		
A Solution (Old Tuberculin,undiluted) - doses as follows:			
1½/10cc(1½ dvsn.of syringe)	= .15 cc AT		
2½/10cc(2½ " " ")	= .25 cc AT		
4/10 cc(4 " " ")	= .4 cc AT	weekly	5 weeks
6/10 cc(6 " " ")	= .8 cc AT		
10/10cc(1 syringeful)	=1.0 cc AT		

Full time occupied for foregoing course = 14 weeks.

The above doses are for an adult. Children would receive on an average about half of these quantities.

Naturally this course would be modified as to time and dose, to suit individual cases. If the patient reacted, then in all likelihood from unavoidable interruptions,

the time occupied would be much longer than 14 weeks, and probably the maximum dose of 1 cc AT would not be capable of attainment. Again, the course may be, and often is, repeated after an interval, the former maximum dose being more quickly reached by starting with a larger initial dose and more rapidly increasing the doses. On the other hand the treatment may be continued by repeating the maximum dose at increased intervals of 10, 14 and 21 days, and finally once a month, for as long a period as is thought necessary.

During any course of tuberculin, the temperature of the patient is taken at least four times daily, and carefully charted. This along with the patient's general condition as to improvement or the reverse, forms the truest guide to the continuance or interruption of the course, and these two things also unfailingly indicate dangerous reactive symptoms on the patient's part.

Finally, it may be said that the principles and methods observed in the giving of all tuberculin preparations by the German method, are similar to those which have just been more or less fully described for Old Tuberculin, with necessary modifications to suit the individual patient, and the particular preparation of tuberculin used. The treatment adopted for reactions when they unavoidably occur, is rest in bed and stoppage of all tuberculin injections, until the temperature and symptoms subside.

WRIGHT AND THE ENGLISH SCHOOL.

Having considered the rise and methods of the modern German School in relation to the administration of tuberculin, it will now be convenient to give a similar consideration to the corresponding modern English School. It has been shown that the initial impetus in Germany and the continent to the revival of tuberculin as a therapeutic agent, came from the clinical side of medicine, and that it had its origin in great part from the work of Goetsch.

In England, on the other hand, the impetus to the renaissance of tuberculin administration was fated to come from the side of medical research. As has already been indicated this impetus originated in the brilliant work of Wright and his co-workers, upon the mechanism of active immunisation by bacterial products in general. In 1903 we find Wright stating that tuberculin inoculations have been definitely invested with the character of therapeutic inoculations of a tubercle vaccine, destined to call forth an anti-bacterial reaction in the organism, and that "we ought to cautiously exploit in the treatment of localised tuberculous affections, the tubercle vaccine, which we owe to the ever fertile labours of Koch." Now as this conclusion was arrived

at by Wright, as a result of his work on the tuberculo-opsonic index method, a description of that method naturally finds a place here. Speaking generally, in the opsonic index method the serum of the patient is compared with the serum of a healthy individual, or the mixed serum of several healthy individuals, as to its power of preparing bacteria in an emulsion, for being taken up by healthy washed leucocytes.

In the technique of the method there are required:

1. A preparation of Serums.
2. A preparation of Normal leucocytes.
3. An emulsion of Tubercle bacilli.

Preparation of the serum.

About ½ cc of blood is collected, preferably in a Wright's blood capsule, from the patient and is allowed to clot. It is then centrifuged to separate the serum. A ½ cc blood from the control individual or individuals is similarly treated. The straight end is then broken off each capsule, and the serums are taken up in separate pipettes. These serums must be used quite fresh.

Preparation of Washed Leucocytes.

Allow about ½ cc of blood to drop from the pricked finger of the observer into a test tube containing a solution of 1.5% Sodium Citrate dissolved in .85% Sodium Chloride solution. Mix to prevent coagulation.

Thoroughly centrifuge. Pipette off the supernatant fluid. Add more saline. Mix and again centrifuge and remove the supernatant fluid as before. The upper layer of the corpuscles which contains the greater number of the leucocytes is now pipetted off into small tubes and set aside for use.

Preparation of the Emulsion.

With a slow growing organism like the tubercle bacillus, it is most convenient to get a dead culture from the wholesale chemist. This is thoroughly ground up in an agate mortar, with a small quantity of .85% saline solution. The mixture is then added to a tube containing several ccs of saline solution and centrifuged. The fluid suspension is then pipetted off and diluted until it shows only a very slight turbidity, when according to Wright it will contain the most appropriate amount of bacteria.

These preparations having been made, equal parts of the patient's serum, the washed corpuscles and the bacterial emulsion are mixed together, using as a measure a capillary tube on which a mark is made as by a grease pencil, about one inch from one end, whilst the other end has a rubber teat attached. The patient's serum is drawn up to the mark, then an air bell is allowed to enter,

next the emulsion is drawn up, then another air bell, then the corpuscles in the same manner. The tube's contents are then blown out on a slide, thoroughly mixed, and re-aspirated into the tube. The ends of the tube are then sealed up and the whole is incubated at 37°C. for fifteen minutes. A control preparation with the normal serum of the control individual or individuals, is also made in the same way. From the contents of the two tubes, films are made on slides which have been rubbed once or twice with the finest emery paper, to facilitate an even smear. These films are either fixed in corrosive sublimate solution and then well washed and stained, or they are fixed and stained by using Leishman's stain.

In each film, the number of bacteria in not less than 100 leucocytes (preferably 200) is counted, and the average number per leucocyte thus arrived at. The ratio which this average in the case of the patient, bears to the average in the control prepared with normal serum is called the opsonic index of the patient's serum, e.g.

Patient's serum + Corpuscles + Bacteria –
Average bacteria per leucocyte = 1.5

Normal serum + Corpuscles + Bacteria –
Average bacteria per leucocyte = 3.

$$\text{Opsonic index} = \frac{1.5}{3} = .5$$

Great expectations were raised in the medical world on the publication of Wright's opsonic index method. In the first wave of enthusiasm caused by his work, a new era of successful scientific treatment of, as yet, unmanageable troubles was foreseen. But adverse criticism did not long lag behind. Amongst the chief objections it was stated that the method was unduly prone to experimental error, and that it was so much subject to the personal equation of the observer that a uniformity of results was absolutely excluded. It was also stated that a normal opsonic index did not exist, and that we had no means of determining what the normal index should be. Finally, it was objected to on the practical ground that the amount of time required for the performance of the method would greatly militate against its general adoption.

Notwithstanding these criticisms, however, the method in spite of admitted shortcomings, has fully demonstrated its value as a guide to the specific (tuberculin) treatment of tuberculosis. This it has achieved chiefly by the regulation of the safe dosage of tuberculin, and of the proper intervals between the doses. Commencing with minimal doses of New Tuberculin (TR) in localised tuberculosis, Wright found that the immediate effect of inoculating a tuberculous patient with tuberculin was to produce a fall of the opsonic index (negative phase), this

fall being succeeded by a rise of the index (positive phase). The negative phase he found to correspond with a rise of temperature, and a feeling of lessened well being on the part of the patient. The positive phase he observed, corresponded with a rise of antibacterial power in the blood, evidenced by the fact that in visible localised tuberculous conditions (e.g. lupus and superficial tuberculous glands) a tendency towards healing was produced: also it was evident that this rise of antibacterial power corresponded with a feeling of increased well-being on the patient's part.

In tuberculous patients Wright aimed at the maintaining of the opsonic index at as high a level as possible. This he accomplished by giving the smallest doses of TR that would elicit a satisfactory immunising response on the part of the patient. In order to get the best results (and he was arguing chiefly from the results of work on localised tuberculosis), he said that these small doses should be repeated, only when the effect of the preceding inoculation was passing off, and that the dose should be cautiously increased only when that previously employed was ceasing to evoke a sufficient immunising response. He found that the best interval between the doses, was one somewhere between 10 and 14 days. His whole work he checked and regulated by his opsonic index method.

Although chiefly because of its tediousness of performance, Wright's opsonic index method does not lend itself to everyday practice, in the administration of tuberculin in pulmonary phthisis, yet, its value here is still undoubted in giving the clue to difficulties in doubtful cases. It also possesses the merit of giving us light in the matter of cause and effect as between administration of tuberculin on the one hand, and the patient's temperature and other clinical symptoms on the other. And thus the proper appreciation of a carefully kept temperature chart as a guide to tuberculin treatment in phthisis has been made possible. Now this, in conjunction with a rigid regard to the patient's general condition as to progress or otherwise, forms, clinically, the readiest guide to tuberculin administration, and by clinical methods and the results thereof will specific treatment of phthisis be finally judged.

In tuberculin therapy as applied to phthisis as has already been shown, the present English School takes origin from the work of Wright who advocated minimal doses of tuberculin at long intervals, whilst the present German School arose out of clinical work in which larger doses at shorter intervals were given. Now, in view of the differences in origin of the two schools, it is not surprising to find that marked differences yet exist in

their methods of exhibition of the drug. Still as clinical knowledge and experience accumulates the tendency is for these differences in the tuberculin treatment of phthisis to become less pronounced. The English School still holds that Wright's method of minimal doses of tuberculin at long intervals, is the best for localised tuberculosis; but in phthisis it is practically recognised that a modification of the more heroic German method can be adopted with advantage. Now, speaking generally, the English method of tuberculin treatment of tuberculosis of the lungs, differs from the German chiefly in that, in the English method (a) the doses of tuberculin are on the whole smaller, (b) generally the less toxic preparations of tuberculin are given first and the more toxic are worked up to very gradually (c) the intervals between the doses, and especially the initial doses, tend to be longer.

As a consequence of the foregoing, by the English method, less tuberculin is administered in a given time, and, therefore, a complete course of tuberculin treatment generally covers a longer time than under the German plan. Thus, an average English course beginning with a small initial dose of PTO (.00001 cc to .00005 cc) might work gradually on to TR and from TR possibly to a final administration of Old Tuberculin. The whole course, if

uninterrupted, would extend to about a year, whereas in a former part of this Thesis, a suppositious example of the German method has been given, which arrives at a maximum dose of 1.0 cc Old Tuberculin in about fourteen weeks. Apart from these differences, the technique of the present English method is essentially similar to that of the German School: the upper arm, however, is commonly chosen as the site of injection in the English method.

The method of giving massive doses of tuberculin, and of practically ignoring the resulting reactions as practised presently by Löwenstein and others in Germany, and recommended and practised in England by C.Wilkinson and his pupils, has not been spoken of. The concensus of medical opinion seems to be against this method. Severe focal and general reactions, especially when repeated, must surely weaken the unfortunate patient, and they cannot but cause frequent local extension of tuberculous foci, and they must supply an ever present risk of generalised tuberculosis.

VARIOUS TUBERCULINS AND THEIR VALUE IN TREATMENT.

The name tuberculin was first used in 1884 by Pohl Pincus in a paper much ahead of its time, in which he proposed to use bacterial extracts for treatment, and in which he made use of the terms Tuberculin, Variolin and Scarlatinin in speaking of these extracts. Koch himself first called his old tuberculin "lymph," and the name "Koch's lymph" was commonly used for a time.

To the beginner the number of varieties of tuberculin is exceedingly confusing. This number has increased chiefly from the desire, laudable in itself, to find a remedy better than those preceding, or to correct acknowledged or supposed faults in previous preparations. Again the confusion to the intending user of tuberculin is not lessened by the fact that each of its preparations carries with it its meed of praise and its burden of blame and dissatisfaction and none is found perfectly satisfactory.

Still it may be stated that all tuberculins possess, in varying degrees, these points of unity, viz:-

(a) They all on administration are capable of producing the tuberculin reaction.

(b) They produce similar blood changes in the patient, and

(c) Clinically they all give similar results.

Now the good got in treatment from the various preparations depends not so much on inherent differences in the prepara-

tions, as in the skill with which the administrator uses the particular preparation chosen. Therefore it is of the first importance that he should thoroughly understand the particular forms of tuberculin he uses, and for this reason it is wise that he should well consider and strictly limit his choice to not more than two or three preparations, at any one time.

As in the various tuberculins there are differences, chiefly in method of preparation, in toxicity, and rate of absorption on administration, it is well that some particulars regarding the more commonly used tuberculins should here be given. Accordingly, the common varieties used will now be shortly discussed in the following order:-

1. Old Tuberculin (AT or T).
2. Albumose free tuberculin (AF)
3. New Tuberculin (TR)
4. New Tuberculin bacillary emulsion (BE)
5. Sensitised bacillary emulsion (SBE).
6. Beraneck's tuberculin (TBk)
7. Tuberculins derived from the bovine bacillus,
   e.g. (a) Old Tuberculin, bovine (PT)
   (b) New Tuberculin, bovine (PTR)
   (c) Tuberculin bacillary emulsion, bovine (PBE).
   (d) Perlsucht tuberculin, original (PTO).

1. Old Tuberculin (AT or T). This, Koch's first preparation, is an extract soluble tuberculin containing extra-cellular toxins produced by the tubercle bacillus, together with some of its endotoxins. It is the chief

preparation for diagnostic use, and in recent years, especially in Germany, it has been greatly revived as a curative agent, and in Germany and the continent, good results from its use have been reported in all classes of phthisis. In England, when administered, it is usually used last in the course of tuberculin treatment, after tolerance to the weaker preparations (e.g. PTO and PT) has been established. Its toxic properties are due chiefly to contained proteins derived from the culture medium in which the tubercle bacillus is grown.

2. Albumose free tuberculin (AF). Recognising the toxic qualities of his old tuberculin which were derived from its growth medium, Koch attempted, and was finally successful in growing his bacillus on an albumose free culture fluid, and ~~rising from~~ using such a culture he produced his albumose free tuberculin. Like AT it is an extract soluble preparation and it enjoys an increasing reputation. It is well borne in sensitive difficult cases, as its use avoids unexpected reactions. It is useful in all cases, but chiefly so in open advanced cases of phthisis. From its toxic free properties, it is held, as especially indicated in ambulant treatment, where the patient and his conditions are necessarily under limited control. Under such conditions it seems destined to have a growing reputation.

3. New Tuberculin (TR). This is an endoplasm preparation, and consists of the insoluble fragments of the tubercle bacillus. Koch's original intention in the making of this prepation was to flood the body with the fragments of tubercle bacilli, and thus to get an immunity to the bacillus itself. But it is now held that all forms of tuberculin have essentially the same action. This preparation is the form favoured in the treatment of localised tuberculosis by Wright's method of minimal doses at long intervals. It is also considerably used in cases of phthisis.

4. New Tuberculin bacillary emulsion (BE). This is a mixture of extract and endoplasm tuberculins. It is similar to TR, the only difference being that in its preparation the supernatant fluid containing the more soluble products of the tubercle bacillus is not removed. It is a true bacterial vaccine, and it is therefore slowly absorbed, and it exerts a mild and prolonged action. Like TR it is said to possess a pronounced antipyretic action, and thus it is indicated for use in febrile cases of phthisis.

As a drawback to the use of TR and BE it has been stated that on administration they are liable to irregular absorption, and that thus by accumulation they may give unexpected reactions.

5. Sensitised bacillary emulsion (SBE) In the preparation of this variety the tubercle bacilli are triturated with specific tuberculosis-immunising serum at 37°C until disintegration takes place. This treatment is supposed to destroy the toxic qualities of the contained tubercle bacilli. It is recommended as being useful in advanced cases of phthisis, its action being similar to Koch's bacillary emulsion.

6. Beraneck's tuberculin (TBk). This is stated to be a good example of a milder acting tuberculin. In its preparation it was the aim of Beraneck to include all the immunising substances in the bacteria themselves, and also in the culture fluid, and to exclude any toxins possessing no immunising power. This tuberculin has been well spoken of by some authorities and Sahli gives it the preference over Koch's old and new tuberculins.

7. Tuberculins from the bovine bacillus, e.g. (a) Old Tuberculin, bovine (PT); (b) New Tuberculin, bovine (PTR); (c) Tuberculin bacillary emulsion, bovine (PBE); (d) Perlsucht tuberculin original (PTO).

These preparations were made in view of the fact of the existence of two kinds of tubercle bacillus - the human and the bovine, both pathogenic to man. In treatment by tuberculin some administrators follow C. Spengler in the use of bovine vaccine for tuberculosis in man due to the human bacillus, and vice versa. Others,

and these appear to form the majority, hold that the use of "unlike vaccines" is irrational. The bovine preparations are generally held to be less toxic than the corresponding preparation from the human bacillus, and it is a common practice in England to give a course of PTO or PT before administering TR or AT.

PRESENT DAY TREATMENT AND ILLUSTRATIVE CASES.

In any consideration of the present methods of treatment of phthisis, the outstanding feature that arrests attention is the recent great awakening of public opinion, as to the importance of the subject. Now this awakening is not confined to any one country, but it is general over a great part of the civilised world. From Germany, America, Scandinavia, Switzerland, Italy and Great Britain and many of her oversea dominions come reports of the rousing of the public conscience to the vital importance of attacking the Great White Plague, in a co-ordinated, sustained and public supported campaign of treatment, preventative and curative. The supreme gravity of tuberculosis and of tuberculosis of the lungs especially, as a death producing and life spoiling disease, was never so generally realised as it is to-day. But coincident with this realisation a great wave of optimism has arisen with regard to the treatment of the disease, and it has displaced the almost fatalistic view, which was common in medical as well as lay minds prior to the discovery of the tubercle bacillus and the demonstration of the curability of phthisis. And this optimism has in a degree passed on to the individual patient. The swing of the pendulum with regard to the treatment of tuberculosis is decidedly towards hopefulness at the present time, and

probably as often happens in the presence of a great increase of enthusiasm, that swing is more pronounced than knowledge or quality of treatment so far justifies - time will tell.

Foremost in the campaign of treatment is the great modern extension of sanatoria, and of sanatorium treatment and principles as applied to the patient's home and surroundings. Never was the doctrine of fresh air and sunlight, good food and general hygienic living so generally appreciated or so generally carried out as at present. Its educative influence is capable of profound effects from a public health point of view, whilst its value in the treatment of phthisis is an established fact. Linked to the sanatorium is the tuberculous dispensary, which as has been shown in a former part of this thesis, is a co-ordinator in the modern schemes of the treatment of phthisis. Hospitals and homes for far advanced cases are being increased in number. Open air schools and sanatoria and special institutions for tuberculous children are in existence and are being added to. Not a few general hospitals are adding tuberculous dispensaries as a means towards the more efficient treatment of tuberculosis.

Again, besides the general adoption of elaborate tuberculosis schemes by municipal bodies and County Councils throughout the United Kingdom, various national associations, societies and like bodies exist for dealing with the tuberculosis problem.

In the working of all schemes the endeavour, after prevention is provided for, is to put the individual patient in the best possible position for successfully coping with his disease. This means first, as already indicated, treatment in a sanatorium or treatment at home on Sanatorium lines, with or without the administration of tuberculin.

Where residence in a sanatorium is not convenient, or is not thought necessary, as in ambulant or in far advanced cases of phthisis, then in the former tuberculin treatment plus careful instruction in the principles of hygienic living is given, whilst for the latter domiciliary or institutional treatment is provided. Nor is the enlightened use of drugs neglected, especially in chronic advanced cases of phthisis. Again, besides tuberculin we have other substances available which are held to have immunising qualities, such as immune sera and the other immunising substances chiefly introduced by Spengler.

In cases treated at home under domiciliary treatment the patient's whole environment, and habits of living are carefully looked into. Everything that may tend to lessen his chance of recovery or that may increase the risk of spreading phthisis is, as far as possible eliminated. The patients themselves are given careful instructions as to their mode of living, and their acquiescence and co-operation in the methods of treatment, are, as far as

possible secured.

It is always possible and practicable in Sanatoria to get good surroundings for the patient, and to treat him on ideal lines. But no patient, even were it economically possible , can live the life in a sanatorium beyond a certain time, varying with the individual, without incurring the danger of serious disadvantages to his general character. In such surroundings, if too long continued, he must ultimately suffer more or less from harmful self-concentration, and he must sustain grievous loss in character from the continued lack of the moral training which follows from the bracing effect, of, as far as possible, facing the every-day duties, trials and obligations of life. Therefore, there comes a time when, in the best interests of all concerned, the patient returns to his own home either to go on increasing in health and ability to work, or, after a time to go steadily downwards towards dissolution. It is doubtful, desirable as it may be in many instances, if even for the latter class of cases isolation hopitals will ever be popular, and the attempt to make isolation compulsory will not enhance their popularity. But in home treatment it is not difficult to effectively destroy the great dangerous mass of infectious matter from a phthisical case, mainly by the efficient collection and destruction of the sputum in a moist state.

It is exceedingly encouraging to find with what comparative ease, sanatorium principles with regard to hygiene and fresh air, can be carried out at home, and especially so with patients who have had a three to six months' residence in a sanatorium. Even the most unpromising surroundings can be immensely and cheaply improved; for cool, fresh air and sunshine where available cost nothing, and the open window is always at one's disposal, whilst by a little ingenuity, as in the use of window tents, roof shelters, fresh air sleeping porches, and the like, much can be economically done to bring about excellent hygienic conditions for the treatment of phthisis. In fact, in this respect, the rich have few advantages unattainable by the poor. By such means, accompanied by good food, a sufficiency of medical guidance, and the co-operation of the patient, much can be achieved. Cure may be given, but short of cure, life can always be lengthened, and many useful years can be added to the mass of life. Symptoms can invariably be ameliorated, and work of a hygienic educational value can be pressed home.

Drugs and so-called specifics which at one time formed almost the sum total in the treatment of phthisis, with the rise of Sanatoria fell much into abeyance. But the tendency now is not to despise the help of drugs. Much good is got from them in suitable cases. They may

be given as general tonics or to increase appetite, but their chief role is to relieve distressing symptoms not always controlled by fresh air treatment and dieting, e.g., they may check useless cough and vomiting, may ease pain, may help difficult expectoration, may check diarrhoea and night sweats, may induce sleep in insomnia, and exceptionally in febrile cases they may be given for their anti-pyretic effect.

In far advanced or hopeless cases, drugs or any adjunct to treatment, that helps the patient or makes him more comfortable, should certainly be used; for here to ease suffering and to prolong life are the two main duties of the physician, after he has attended to the hygienic environment of the patient.

And now the writer purposes giving short clinical histories of some cases of phthisis which have occurred in his experience, and also to mention the principles and methods adopted in their treatment. And these cases the writer thinks well to divide into two headings. (A) Patients who have been treated without the use of tuberculin, and (B) cases within his experience, which, in addition to general treatment, have received the benefit of tuberculin treatment either at or from the West Riding C.C's Tuberculous Dispensary at Rotherham, upon the practice of which the writer has been privileged to

be in attendance during the past six months or so. During this time he has been receiving, and is receiving, personal instruction in the principles of tuberculin administration, and he is also having the advantage of personally administering the drug.

In the introductory part of this thesis a classification of Advanced Phthisis was submitted, a classification which was founded mostly on a clinical basis. The cases (A) and (B) which are now to be spoken of fall under one or other of the heads of this classification.

(A). Cases treated without the aid of tuberculin.

Case 1. L.R. an intelligent school-boy.

This was a case which occurred nearly at the beginning of the writer's career as a practitioner. When first seen the boy was 13 years of age, thin, and poorly nourished. His mother had a stiff knee-joint which had resulted from tuberculous synovitis, and three of his younger brothers and sisters had died in infancy of "consumptive bowels." His father had been treated for phthisis.

A history existed of cough with increasing shortness of breath for over twelve months previous to my seeing him. Dulness was found at the right apex, and numerous crepitant râles were heard over both lungs. The case was febrile. The patient was put to bed, and the importance of fresh air, rest, and suitable food was

insisted on, and on these lines was he treated. The appetite was fairly good, and there was little difficulty in feeding with suitable food. Cod liver oil with malt was given, but drugs with the exception of an occasional mixture to improve digestion (HCl and Nux Vomica) were not used. The patient gradually improved, and at the end of 12 months physical examination of the chest gave no signs of active disease. At this time the writer was setting up his first horse and trap, and he wanted a lad simply to sit in his trap when driving out daily on a country round. As soon as he was able the patient was tried for this duty, and the writer watched the result with interest. It was quite satisfactory. The lad continued to do so well that in a year's time he began, in addition to driving out with the writer, to do a little work about the garden.

In about another two years' time he was able to act as the writer's groom. Altogether he was in this employ for over six years, when he left a young man free from all traces of disease, and able to earn his own living.

He is now (13 years later) in constant work, married, and the father of two healthy children.

Case 2. J.A., a near relative of the writer.

In the spring of 1897 when about 20 years of age, this young man had an attack of Pleuro-Pneumonia. Prior

to this he had enjoyed almost unalloyed good health. From this illness he had a tardy convalescence, and during it he came down from Scotland to the writer's residence to recuperate. Then he was well nourished, of fresh coloured countenance, cheerful and he looked fairly fit, but on exertion he easily became short of breath and tired. On examination occasional mucous râles were heard, on inspiration, over the left apex and over the left middle lobes in front and behind. At the beginning of his stay, his temperature in the evening registered from 99° to 100°F remitting in the morning to 98°F. or a point or two under this. The appetite was excellent; sleep was sound; there were no night sweats; the pulse was not greatly increased in rapidity. Complete rest was given for a fortnight when the febrile symptoms abated. Then the patient began to go out with the writer in his (the writer's) trap, and he was soon able to enjoy and to derive benefit from long country drives and gradually increasing walking exercise. Pulse and temperature were carefully watched but they remained steady. He was put under excellent hygienic conditions night and day, and a healthy appetite, was well supplied with good and suitable nourishment. Cod liver oil was well taken and digested. After about six months' residence with the writer he determined to go back to work,

and much against the writer's wishes he returned to Scotland. So far the patient's case was not advanced. He was able to work fairly regularly for about four years, when he broke down with a recurrence of lung mischief. With rest he became sufficiently well to risk the gratifying of his wish to come to visit the writer again. But on this occasion a very much different condition was found. There were signs of extensive disease in both lungs. His sputum was not excessive, but his morning sputum showed the presence of numerous tubercle bacilli. His urine was acid, and it gave a heavy albuminous precipitate. His face was pale, puffy and pasty, with occasionally a faint malar flush. He had wasted, but still he was fairly nourished. He showed fever of a hectic type, and at first he was greatly troubled with night sweats, the night sweats, however, disappeared in great part under fresh air treatment. Rest, hygienic living, good food, with an abundance of pure milk was supplied. Soon it was found necessary to give absolute rest. His bedroom had a southerly exposure. The walls of the room were color washed. The floor was stained and varnished and devoid of covering, save for two movable rugs; there were no curtains, no excess of furniture and the window was kept open night and day. So long as his strength allowed he had regular warm baths at night,

subsequently he was sponged in bed. Drugs were not much used. Cough which became troublesome was relieved by a simple mixture containing Potas. Bicarb, Potas. Citr. and 3 minim doses of liq. Morph. Hydrochlor. In diarrhoea which, in spite of strict regulation of the diet, was troublesometowards the end, an occasional dose of castor oil, followed by subnitrate of Bismuth was found the best treatment. The course of the case was almost wholly free from painful symptoms, but its hopelessness was soon easily apparent. The patient became progressively weaker, and more emaciated. The ankles, feet and legs became oedematous. The pulse increased greatly in rapidity. Death ensued from asthenia in about three months from the patient's arrival at the writer's house.

Case 3. W.A., aged 21 years, a brother of the preceding patient. Over 13 years ago he contracted what was at first regarded as a severe cold. This finally prevented him from following his occupation (a sedentary one), and for over three months he steadily lost flesh. Finally, it was arranged that he should come to the residence of the writer for treatment. He arrived at the beginning of April. When I first saw him his general appearance at once suggested a serious condition. When the writer had last seen him he was well nourished and in ordinary health. Now he was much emaciated. His cough was troublesome and he had a large amount of sputum.

Shortness of breath and weakness were pronounced. The pulse ran constantly over 100. There was continuous fever. On examination both lungs showed unmistakeable signs of acute caseating phthisis. Prior to this illness the lad had been active, bright and healthy from childhood, and singularly free from even minor illnesses. The only suspicious former condition was a wasting illness during primary dentition, which was suggestive of a tuberculous basis. The case was now evidently one of very acute phthisis, and as the result showed one of the most rapidly acute cases that the writer has ever seen. The patient was treated in the same house, and under the same conditions as his brother. During suitable weather he was wheeled out on to a grass covered plot in the adjoining orchard. Here he lay resting under the shade of the blossoming fruit trees, whose healthy condition proclaimed the purity of the atmosphere. But in spite of his ardent wish to live, and the presence of a strong "spes phthisica," his constitution utterly failed to make even temporary progress towards improvement. Dr.Burgess of Sheffield was called in , in consultation and his prognosis was necessarily of the gravest kind. All that could be done was to make the poor lad's short time as comfortable as possible. He was carefully and assiduously nursed. His appetite which was poor, was tempted with many and variable delicacies. Milk and milk foods were best liked

by the patient, and these formed the major part of his diet. Night sweats could not altogether be prevented and the giving of a pill containing zinc oxide and extracts of Bellad. & Hyoscy., was helpful. Tepid sponging was also of use and added much to the patient's comfort. The cough, though frequent, was no more than sufficient to clear the lungs of the constantly profuse sputum, and therefore no drug treatment was considered wise for it. A cupful of hot milk and rum often helped, especially in the early morning, to the loosening of the sputum which had collected in the lungs during sleep. Creasote was given in capsule, in the hope of lessening the sputum, and for its wholesome effect on the gastro-intestinal system, but with only moderate results.

The outlook being without hope, the patient was helped to dress and allowed to sit up in his room when he felt so inclined; but soon, owing to increasing weakness all inclination to get out of bed disappeared.

During the last few weeks of life troublesome laryngitis supervened, and swallowing and use of the voice were painful. This laryngitis proved a most distressing complication to the patient. It enjoined rest of the voice and the exhibition of sprays and inhalations. Of the former a preparation containing cocain and glycerine acid carbolic was found most useful,

whilst of the latter, a teaspoonful of a solution of equal parts of Tinct. Benzoin Co. and Tinct. Belladon. in a pint of steaming hot water was sometimes of help.

Efficient means were taken to destroy all sputum in the moist condition, and all precautions were taken to combat the liability of infection to others.

But all that could be done for the patient was to increase comfort, to relieve and ameliorate symptoms as he rapidly became weaker and weaker. The sadly wasted body and limbs: the emaciated face with sallow skin drawn tight over its bony prominences; the sharp pinched nose of bluish cast: the large pathetic eyes set in sunken sockets, all proclaimed the unrelenting nature of the wasting disease at work.

The pulse increased in rapidity until finally it was almost uncountable, and the breathing became extremely rapid and shallow as the young life panted to its end, death taking place within three months from the patient's arrival at the writer's house.

The family history of the two foregoing cases, is interesting from the point of view of hereditary predisposition. The maternal grandfather died of chronic phthisis, aged 73 years. His only son died in young manhood of acute phthisis. The patients' father and mother were cousins once removed, thus introducing an element of consanguinity into the family history. In

the patients' own family one sister had in childhood a tuberculous arthritis of the knee joint for which excision was found necessary. In young womanhood tuberculosis of the ankle joint finally demanded a Syme's amputation, and about ten years later tuberculosis of the lungs ensued and caused death. A brother died, aged ten years, from tuberculous meningitis. Two brothers remain alive and healthy. Apart from tuberculosis, this family's history as to health could fairly be described as good, i.e. no flaw of constitution is discernible and even minor departures from health are few, until the tubercle bacillus makes its fatal presence felt.

Case 4. Mrs. G., aet 33 years. This was a case which ended in acute caseating tuberculosis of the lungs. The family history is interesting. Her father and four of his brothers died of consumption at ages ranging from early manhood to middle age. She had one boy, aged 5 years, and a girl, aged 8 years, who both died of phthisis. A cousin by the paternal side, aged 21 years, who is presently under the treatment of the writer for a recrudescence of chest trouble, considered herself for a time, cured of her consumption, as a result of a four months' course of treatment which she underwent, under Nathan Raw at Liverpool, five years ago. When Mrs. G. became a patient of the writer she was in an advanced condition of tuberculosis of the lungs. She was anaemic and her

state of nutrition was poor. She was at first given a mixture of the hypophosphites with little apparent result, and later Fowler's solution in mixture was given. Cod Liver Oil could not be taken, plain or in solution with Malt Extract. A petroleum emulsion was ordered, and this had a salutory effect on the bowels, and much relieved a troublesome constipation.

The teeth were decayed and foul and directions were given for the cleansing of the mouth. The patient was intelligent, and although she was poor and her home surroundings indifferent, still coal was plentiful and cheap, and one had little difficulty in getting a clean room, with a good fire and a constantly open window. Nourishment was plentiful, if not always of the most suitable kind. Regular cleansing and sponging of the skin was prescribed. Rigid instructions were given as to the disposal of the sputum, and these were well carried out. Progress was uneven but was generally downwards, sleeplessness was a troublesome symptom towards the end and in spite of strictly regulated hygienic conditions recourse had to be had to an occasional draught containing Potas. Bromid and Chloral Hydras.

Death took place from exhaustion in about twelve months from the patient first coming under my treatment.

Case 5. G.D. Married, father of 3 healthy children. He first came under the writer's treatment when he (the

patient) was over 30 years of age. Until 5 years prior to this time he had been a groom in gentleman's service. Then he succeeded to an off beer licensed grocery business.

This change proved serious for him as he began to indulge too freely in beer drinking. When the writer first saw him he had had a haemoptysis, and had brought up nearly ½ pint of bright frothy blood. He had for some years been troubled with a winter cough with considerable morning sputum. He was fairly well nourished. His family history was poor, as he was the only surviving member of a family of six, the others having died of phthisis mostly in youth. He was kept strictly at rest in bed, the bedpan being used. The immediate fear from the haemoptysis, on the part of the patient and his friends, was met by assurances that bleeding "per se" was not usually seriously dangerous to life. Cold milk diet was prescribed. A hypodermic injection of morphia was given, and in a day or two the haemoptysis having ceased, to the patient's diet were gradually added milk puddings, eggs, fish and bread. He was then given a bitter tonic for a flagging appetite. Within a fortnight he was well enough to be up and in a few weeks he was able to get about. He was troublesome to manage, and declared he was all right. He returned to his duties which were of a light nature. During the next seven years he had three attacks of

haemoptysis, and after the third attack when he was strong enough, he was sent to a sanatorium where he stayed for four months. This experience was valuable to him in health and also in that it taught him the value of fresh air and hygienic living, and gave him a truer idea of the serious nature of his disease. He came back, generally much improved; but his improvement was temporary, for within 18 months' time he had another severe haemoptysis and from this time until his death, which took place about six months subsequently, he gradually became worse and weaker. His sputum increased in amount. His shortness of breath became markedly pronounced; his cough was troublesome; his pulse became more rapid; his sleep was broken; his appetite became poor and the disease rapidly advanced in both lungs.

In his last illness he was treated on strictly hygienic lines, and this was rendered the more easy because of his former residence in a Sanatorium. He died within nine years of the writer'first attending him, worn out by his phthisis. Amongst the drugs and adjuncts used in this case were:- For the haemoptysis, Morphia in hypodermic injection. For the flagging appetite, generally a mixture containing Soda, Tinct. Rhei and Infus Calumb. Creasote with equal parts of Absolute Alcohol was found useful in this case and was periodically used with an inhaler for prolonged periods at a time, ten to twelve

drops of the mixture being placed on the lint pad of the inhaler, as often as necessary. This was well borne and the patient declared that it lessened his offensive sputum and subdued his cough. Cod Liver Oil was also found useful during the progress of the case, and the patient found no difficulty in taking the pure oil. His wife, who had been a cook in one of the best families, was an intelligent woman, and the continued life of the patient in spite of his drinking, for so long a period as nine years from the beginning of his ultimately fatal disease, was in great measure due to the intelligent nursing and dieting, which she, as a devoted wife bestowed on him.

Case 6. J.A. Married and father of a numerous grown-up family. When last seen he was about 60 years of age. He had then been a patient of the writer for about 12 years. He dated the beginning of his trouble from a severe feverish cold with spitting of blood which occurred over 25 years ago. From this illness he made what he thought was a good recovery, but he never became so fit for his work (that of a farmer) as he had formerly been. His disability had been of a very slowly increasing nature, and he had very gradually developed a pronounced shortness of breath on exertion. He had had many attacks similar in nature to his initial attack, with feverishness, pains in the chest, cough, with a moderate amount of sputum,

occasionally streaked with blood, and sometimes accompanied with a fair amount of haemoptysis. Since the beginning of his trouble frequent rests from work had been necessary, and thus on an average he had not worked more than nine months in each year. The writer has attended him in about a dozen of the kind of attacks described. He now works irregularly as a small farmer, but his home conditions owing to the help of his family of sons, are comfortable.

Even now in an attitude of rest he looks to the casual observer, a well preserved man for his years. He stands about six feet in height, full whiskered, fresh coloured, weighs about sixteen stones, heavy and muscular of limb, and of full well-nourished body, - a handsome man of the massive type. But on closer examination, even when he is clothed, it is noticeable that his left shoulder droops unnaturally, and that the left chest is apparently less full than the right. Nor is his colour the ruddy bronze of the outside worker in rude health, but it is of more delicate hue, and in conjunction with the lustre of his full grey-blue eye and his clear fair skin, gives indirect evidence of a certain delicary of tissue texture. As he walks and talks he betrays an evident difficulty in finding breath for the combined exertions. An examination of his unclothed chest discloses an almost completely fibrosed left lung; the left shoulder droops; the left intercostal spaces are contracted, and although the

area of cardiac dulness is little if anything increased, the apex beat is displaced ¾ inch outside the nipple line, this probably is the result of the pulling of fibrous bands in the lung aided by the chest collapse.

Treatment here has been the guiding of the attacks. For each mild haemoptysis a cold milk diet and perfect rest in bed has always been sufficient. After from two to three weeks of complete rest he has usually been able to get about, and he has generally been in a position which rendered a return to some of his work necessary, within eight to ten weeks. Iron and arsenic have been most useful as tonics, and though appetite and digestion have generally been good, still when they have flagged a mixture, such as Sodium, Gentian and Nux Vomica, has been found useful.

The man has been a temperate sensible liver always. He is intelligent, and has studied his symptoms without morbid introspection, the result being that he lives, and his circumstances and occupation allow him to live, a good hygienic life. He enjoys fresh air, and his occupation being that of a farmer has always led to an open air life. He is a strong and practical advocate of the virtues of Cod Liver Oil.

Case 7. Mrs. B. This person first consulted me about six years ago, when she was 30 years of age. She then complained of a severe and persistent cough. She

said that she had been subject to a cough in winter time for several years. She exhibited the typical crippled gait of an old hip joint disease on the right side. Examining the limb, one found that it was generally wasted, quite 2½ inches shorter than its neighbour and on the hip and the side of the thigh were the marks of former sinuses. The active condition had been one of childhood, and had been quiescent since she was a child. Despite some pelvic deformity she had borne five of a family by unaided labour.

Generally she was not emaciated, but she was markedly anaemic, and she said that she had for a long time been rather short of breath and easily tired. The case at this period was one of incipient phthisis with few physical signs in the chest. Treatment was difficult as the patient was the wife of a working man of moderate earnings, and possessing a family of young children. Therefore constant help could not be afforded in the home. And being, as she said, not much worse than she had been before, she could not be made to realise the gravity of her condition. At this time treatment in a sanatorium would have given the best chance, but that was, in the circumstances not practicable. The next best thing was to enforce as much rest, as much nourishment, and as much fresh air as possible. This was done, and the patient being intelligent carried out the advice given to the best of her ability.

As adjuncts to treatment Cod Liver Oil was prescribed and a mixture containing Tinct. Ferr perchlor and Liq. Arsenicalis was ordered. For constipation which was present the use of Cascara Sagrada tablets was advised.

The patient lived in the country and markedly improved with the advent of summer weather, to fall back again with the onset of the dark cold days of winter. In this way she lived with irregular health until the onset of last winter when she became an absolute invalid, and was confined to her room, and mostly to her bed until the end. During her last illness I was in constant attendance. The case was now of a far advanced nature. Both lungs, but especially the right gave marked evidence of fibrosis greatly the result of the adverse conditions she had always been under, and which had militated against treatment of her old standing disease. Cavitation and softening of the lungs were present. The case had got beyond the region of hope, and all that could be done was to treat symptoms, to bend the circumstances of the case as far as possible, to the comfort of the patient, and to use every means to avoid carrying of the infection to others.

The patient suffered from a severe pain in the right chest. This was much exaggerated by an excessive cough, therefore a mixture of Potas Bicarb and Liq. Morphin Hydrochl. was given, and Belladonna liniment was applied

to the side on a piece of lint under oiled silk. The cough was lessened, but the pain was not subdued. Great relief to this pain was subsequently found from strapping the whole side of the chest with strong adhesive plaster. Sleeplessness and occasional night sweats were troublesome towards the end. Most good was got from 8 grain doses of Sulphonal for the sleeplessness. For the sweating sponging with vinegar and water was useful, also the administration of 1/100gr Atropin at bedtime helped considerably.

Milk, eggs and light white fish, latterly constituted the most important part of the nutriment; but towards the last week or ten days the patient subsisted chiefly on Sherry Whey, albumen and barley water. Death occurred from emaciation and exhaustion at the beginning of this year.

(B) Cases treated with the aid of tuberculin.

As already stated these cases have been treated at or from the West Riding County Council's Tuberculous Dispensary in Rotherham, upon the practice of which the writer is privileged to be in attendance. At this institution presently, about fifty tuberculous cases are treated each week, under the tuberculosis officer, Dr. Wm. Barr. In all the cases the patient's history is first carefully gone into, and a thorough physical examination is made. If the diagnosis is presumptively

or certainly phthisis, the patients are each supplied with a clinical thermometer, and are carefully instructed how to take their rectal temperature four times a day (8 a.m., 12 noon, 4 and 8 p.m). A card, ruled in columns, is also supplied and the patients are shown how to record their temperature thereon. This card they bring with them on each visit to the dispensary. There the temperature is carefully charted by the nurse. Sputum examinations are made by a skilled bacteriologist. The patients are regularly weighed.

The temperature chart and the patient's general condition, furnish the chief guides for or against the commencement of tuberculin treatment. If the temperature is unfavourable the patient is instructed to rest in bed for a fortnight, in order to subdue the fever. Only when the temperature chart is favourable is tuberculin treatment commenced. The "optimum" morning temperature taken in the rectum, before rising, is considered to be 97.7°F. (The importance of temperature taken in the rectum, morning and evening, as an aid to the diagnosis of doubtful cases of tuberculosis, was first taught to the writer, over 20 years ago, by his respected teacher Sir Wm. Macewen). Hygienic instruction is always given to the patient, and they are carefully taught as to the disposal of sputum. The use of drugs is limited, still they are used as adjuncts

when conditions seem to justify. The homes of the patients are subsequently visited and their condition noted. The patients here again receive instruction as to hygienic living, and are especially taught the value of the open window.

Patients insured under the National Insurance Act, when unable to work, receive the Act's allowance of 10/- per week and where it is thought necessary, an extra allowance in suitable nourishment to the amount of 5/- per week (Sanatorium Benefit) is recommended. Cases suitable for Sanatorium treatment are referred thereto for an average period of three months, to return if possible, to ambulant treatment at the dispensary, the endeavour being to fit them for work.

In some cases the patient from various reasons continues to work more or less regularly whilst receiving dispensary treatment.

The following is a list of cases with notes. The treatment of these cases the writer has followed whilst attending the work of the foreging dispensary.

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2. "Encyclopoedia Britannica," 11th Edition.
3. "Encyclopoedia Medica."
4. "Evans' Journal," July 1912 (Evans, Sons, Lescher & Webb Ld.)
5. H. FRENCH, "Medical Laboratory Methods."
6. HUTCHISON & COLLIER, "Index of Treatment."
7. "KLEBS' Tuberculosis."
8. LATHAM & ENGLISH, "System of Treatment."
9. PROF. McKENDRICK'S "Physiology."
10. NOTHNAGEL'S "Encyclopoedia of Medicine."
11. "Practitioner," May 1908. "Opsonic Method" number.
12. "Practitioner," Jany. 1913. "Tuberculosis" number.
13. "Practitioner," Sep. 1913. ("Coppock.")
14. RIVIERE & MORLAND, "Tuberculin Therapy."
15. TAYLOR, "Practice of Medicine."
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D I A G R A M S

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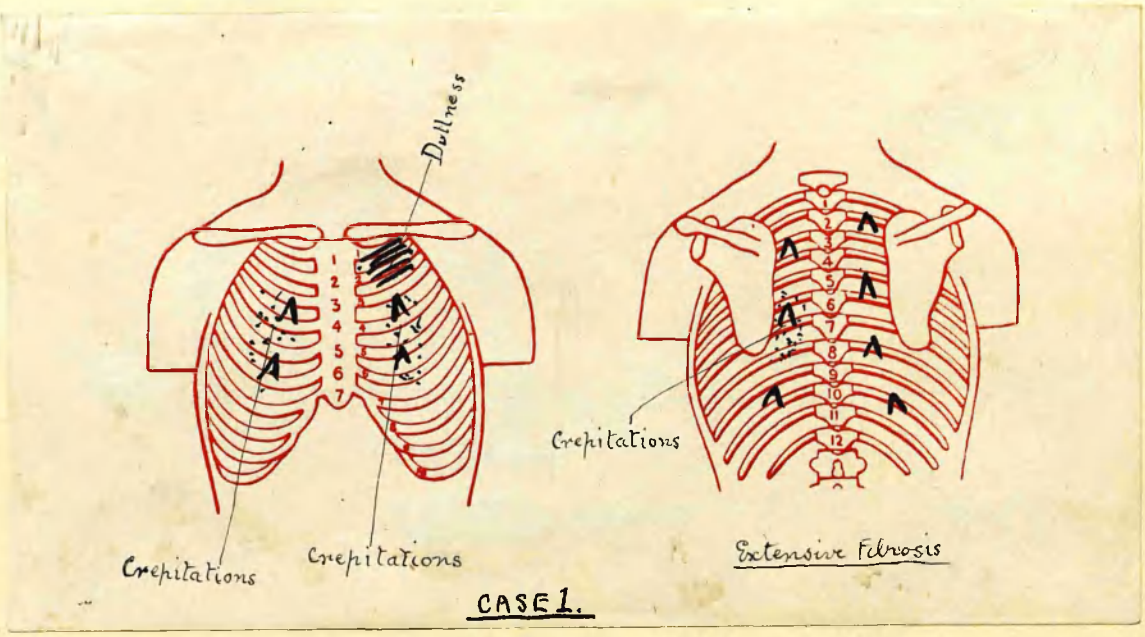
INITIAL EXAMINATION OF CHEST



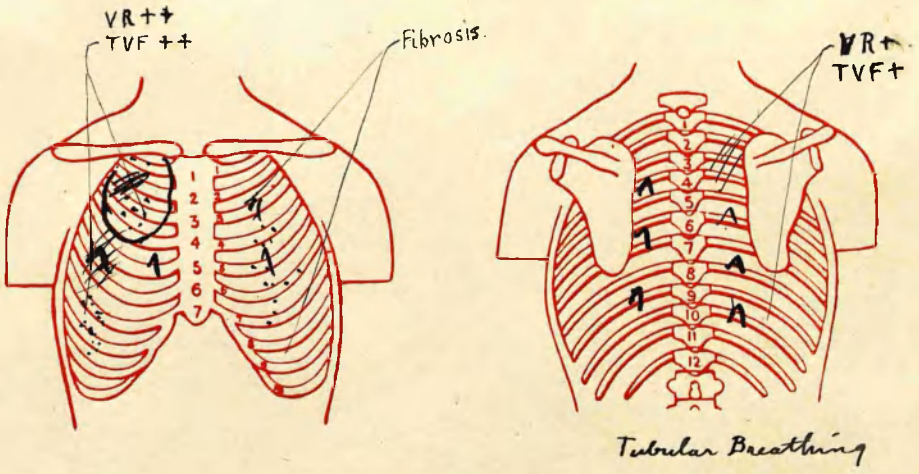
CASE 1.

1. A. C. ♂ aged 38 years: Miner: Married: Father of 4 boys and 3 girls, all healthy.

On first appearance at Dispensary: Thin: Poor nutrition: Good muscular development: Very bad teeth: Has had a cough for about 14 years with large amount of sputum: Had Pneumonia 14 years ago when he was in bed 7 weeks: Subject to winter cough: Has night sweats: Pain in chest: Fair appetite: Has worked irregularly up to 3 weeks ago: Voice very husky.

Home conditions: 11 in house, including 2 lodgers (5 being over 10 years of age): 3 bedrooms: Good air space in front and rear of house: Through ventilation: Drainage of house is good.

Treatment: PTO once weekly: Heroin and chlorodyne for cough: Ol Morrhnoe. Improving and continues to work irregularly.



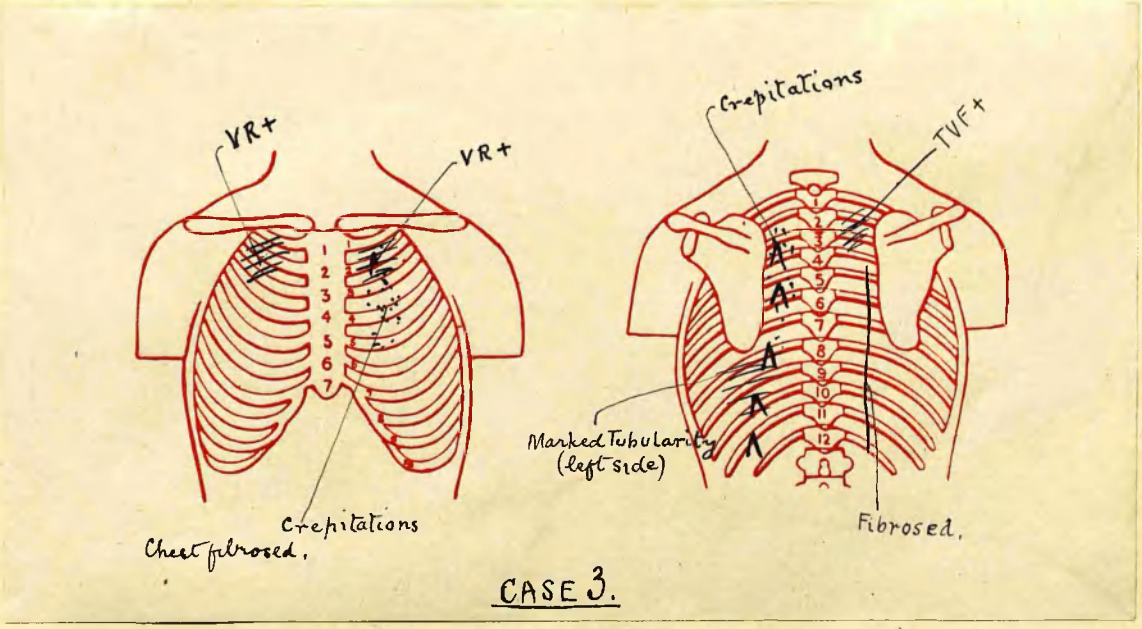
CASE 2.

2. C. G. ♂ aged 19 years: Farm servant: Single.

On first appearance at Dispensary: In poor condition: Muscular development poor: Teeth fairly good: Tongue coated and raw: Nose breather: Cough and shortness of breath present for 13 weeks: Had splendid health until a year ago: Had Bronchitis as a child: Has cough and fair amount of sputum: His sputum has been blood streaked several times: Has pain in right chest going through to back: For 6 months has been very short of breath: Lost about 2 stones in weight in 10 months: Appetite poor: Has not worked for 13 weeks.

Home conditions: 4 in house all over 10 years of age: House one in a row: No dampness: Gas lighting: Air space in front good, behind, limited: Two bedrooms and attic: Two living rooms: Found window in bedrooms open: Through ventilation: Good drainage: Ashpit: No animals kept: Home clean.

Treatment: Rest did not bring this man's temperature down, so specific treatment could not be tried. He lies at home dying. Domiciliary treatment is being supplied.



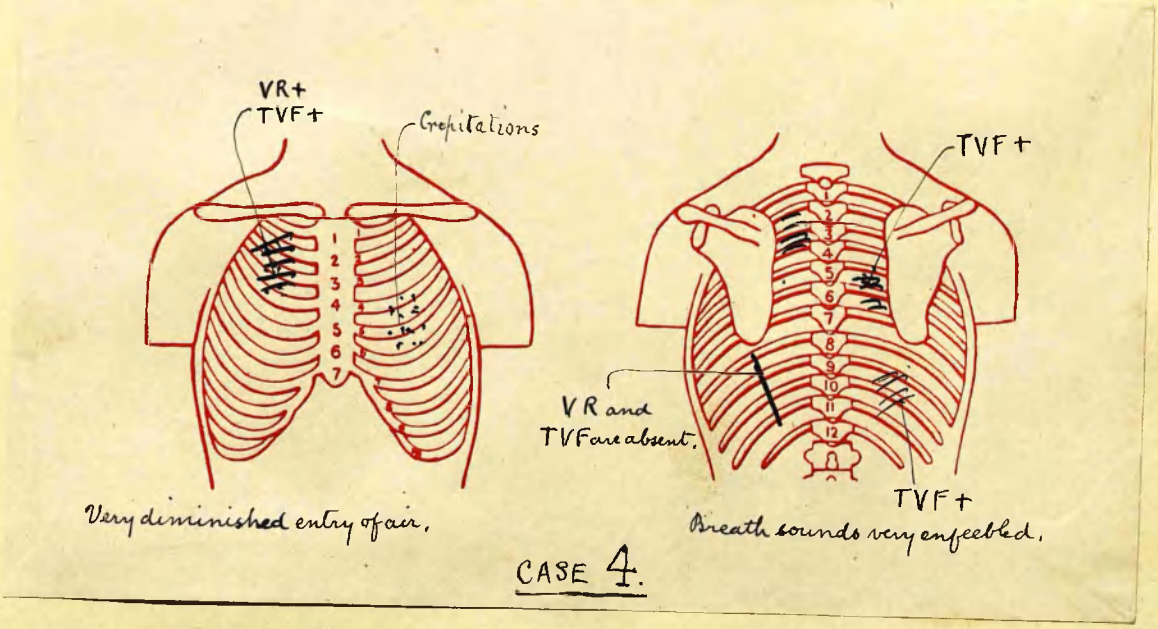
CASE 3.

3. O. E. B. ♂ aged 34 years: Miner: Single.

On first appearance at Dispensary: Good muscular development (weighs 12½ stones): Shows malar flush: Teeth dirty: Tongue clean: Nose breather: Has been coughing up blood off and on for past 10 years, about 2 oz. coughed up 2 days ago: Well until 10 years ago when he had haemoptysis: Has had winter cough for 10 years: Had Influenza frequently: No family history: Sputum about 2 oz. daily: Has pains in chest shooting to back: Very short of breath: Diarrhoea troublesome in summer: Digestion good: Thinks he gets stouter.

Home conditions: a lodger: House clean: No dampness: Good light: Air space front and rear of house good: 3 bedrooms and 3 living rooms: Windows kept open: Ventilation and drainage good: Dustbin.

Treatment: PTO about twice weekly, followed by TR. This man continues at work.



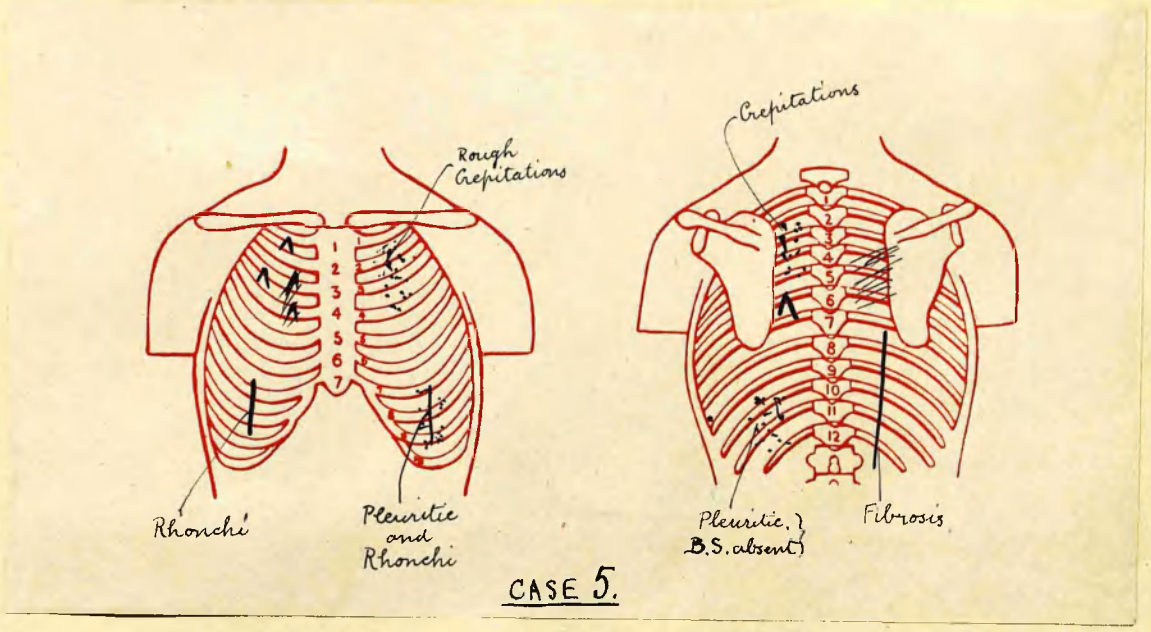
CASE 4.

4. S. H. ♂ aged 31 years: Fireman: Married: Father of three children:

On first appearance at Dispensary: Thin and pallid: Nutrition bad: Poor muscular development: Teeth dirty and decayed: Tongue slightly furred: Chest circ:- Inspn 33½": Expirn 30": Nose breather: Complains chiefly of Bronchitis: Health good until 18 months ago: Subject to winter cough, but has had more or less constant cough for 18 months: Free sputum in morning, very little during the day: No haemoptysis: No night sweats: Has had pain in chest which has now gone: No shortness of breath: Digestion good, but his appetite not quite so good: Has lost weight: Feels weak and unable to work: No laryngeal symptoms.

Home conditions: House in a very dirty condition: 2 bedrooms and 1 attic: 2 rooms downstairs: 12 in the house: Patient and wife and 3 children sleep in one bedroom: 5 people sleep in other bedroom and two in the attic.

Treatment: PTO weekly: Ol Morrhnoe: "Sanatorium Benefit" = 5/- per week extra nourishment allowed:
This man continues to work irregularly.



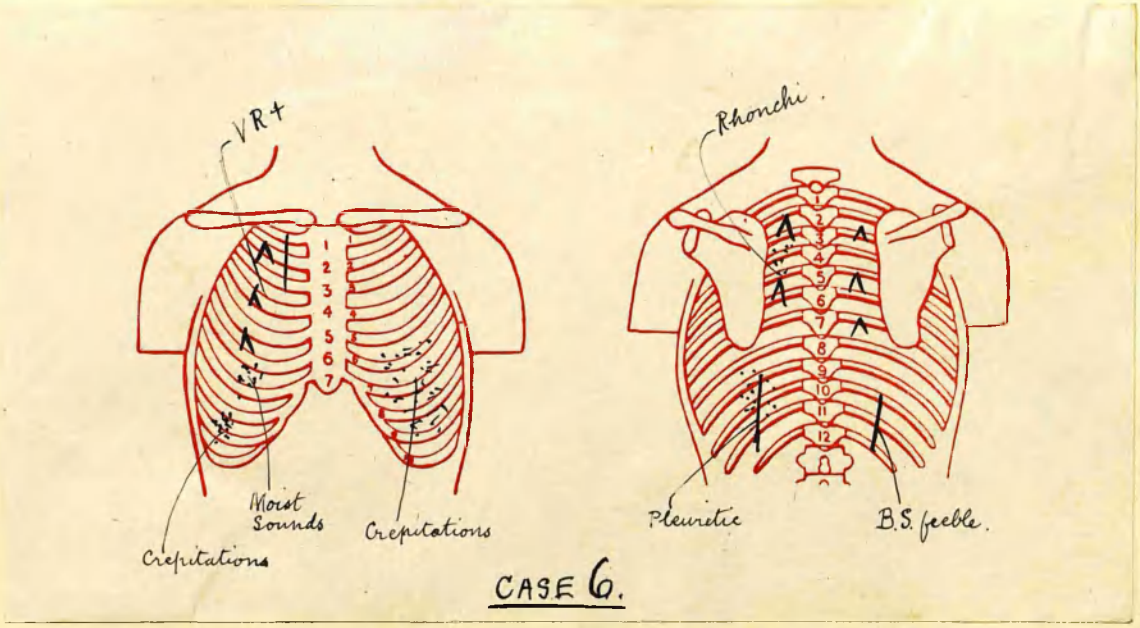
CASE 5.

5. M. D. ♂ aged 28 years: Miner: Single.

On first appearance at Dispensary: Fairly well nourished: Weighs 11 stones 6 lbs; Nose breather: Chest circum: Inspir^{n} 39½"; Expir^{n} 36½": Has had a cough for 2 years, worse in early morning: About 5 oz. sputum in 24 hours, streaked with blood occasionally: Had Bronchitis 2 years ago: Pleurisy 4 years ago: Previous to present illness health has been good: Had Influenza 4 years ago: Has 2 brothers and 5 sisters all healthy: Slight night sweats: Has pain in left chest: Short of breath on exertion: Indigestion present: Losing weight: Appetite poor: Still working: He is a lodger.

Treatment: PTO weekly: Mixture containing Tr Rhei Co. Nux Vomica and Inf Gentian.

This man continues to work irregularly.



CASE 6.

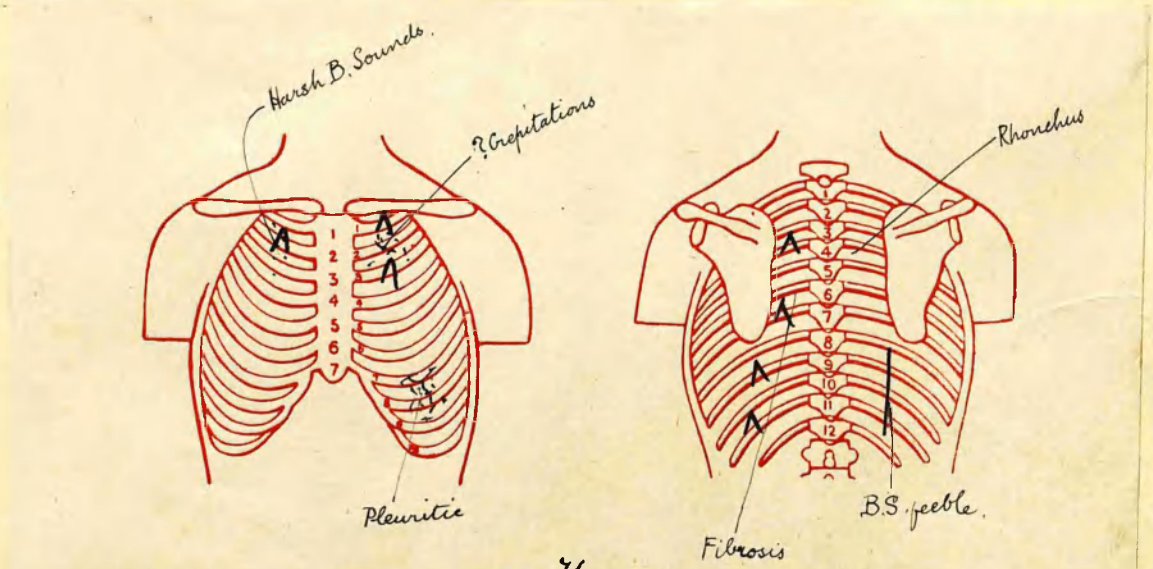
6. H. A. ♂ aged 46 years: Insurance Agent: Married: Father of 3 children.

On first appearance at Dispensary: Pallid, sallow and poorly nourished: Muscular development poor: Good artificial teeth: Tongue furred: Nose breather: Circ. of chest - Inspn. 31½"; Expn. 29½": Has troublesome cough and tired feeling: Has had Pneumonia 3 times, 1st attack 10 years ago: Has had Influenza several times: Family history unknown: Has always had cough: Sputum present, mostly during the daytime: No haemoptysis: No night sweats: No pain in chest: A little short of breath: Thinks he gets thinner and has felt especially weak during past fewweeks: Not working: Father and Mother living.

Home conditions: House clean: Dry: Good lighting: Air space in front good, behind fair: Of 5 in house, 1 is under 10 years of age: 2 bedrooms: 2 living rooms: Windows not kept open (instructions to open given): Drainage good: Dustbin: Gets 10/- per week from Nat. Insurance Act and 10/- from a club:

Treatment: IK once a week.

He now continues to work irregularly as an Insurance Agent.



CASE 4.

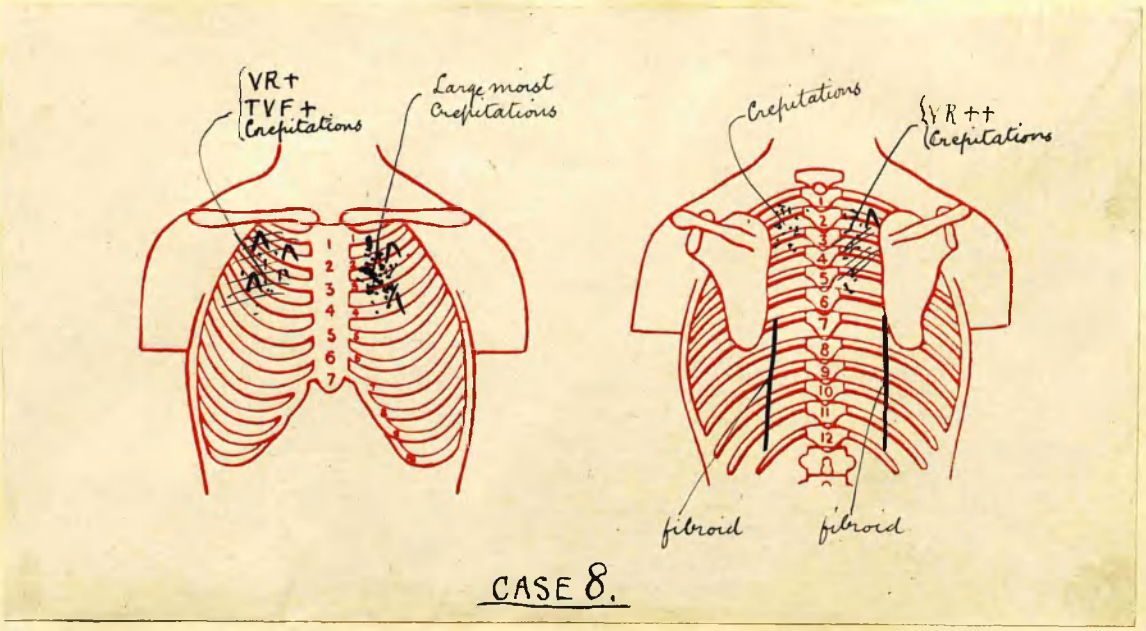
7. W. B. ♂ aged 48 years: Miner: Married: Father of five children: One child has cough and has never been strong.

On first appearance at Dispensary: Color good, but not of robust appearance: Fair muscular development: Nutrition fair: Teeth bad: Tongue furred: Nose breather: Weighs 10 st. 5 lbs: Has had pain in left chest and troublesome cough for over 12 months: Has winter cough: Pleurisy 1 year ago: Has had Influenza twice: A little sputum in the morning: No haemoptysis: Occasionally has night sweats: Very short of breath: Gets thinner: Very poor appetite: Feels weak: Not working for 8 weeks.

Home conditions: House clean in a country village: Dry: Fair lighting: Good air space in front and behind: Seven in house - 5 over 10 years and 2 under 10 years of age: 2 Bedrooms: 2 living rooms: Windows closed - (instructions to open given): Drainage only fair: No dustbin:

Treatment: PTO about thrice weekly followed by TR.

Not working.



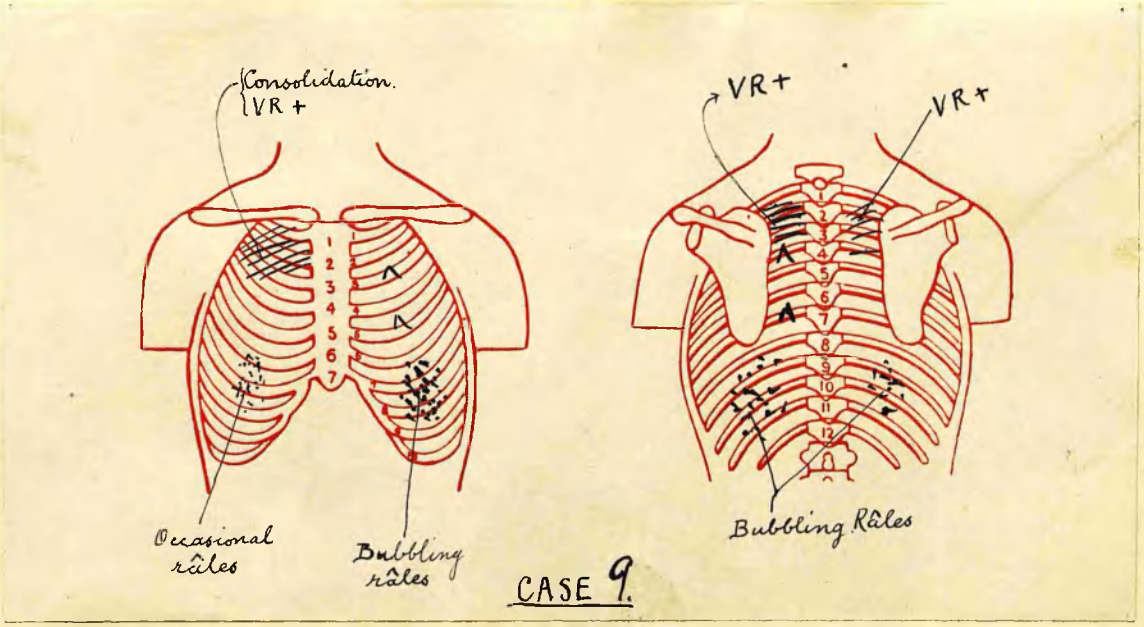
CASE 8.

8. E. C. ♀ aged 27 years: Housewife: Married: Mother of 1 child.

On first appearance at Dispensary. An intelligent woman, fairly well nourished, of good colour but rather delicate in appearance: Weighs 8 st: Nose breather: Has had troublesome cough for 2 years and pain in left side of chest: Pleurisy present: Mother died of Tuberculosis: Cough severe on exertion: White sputum: Night sweats for 4 months: Somewhat short of breath: Diarrhoea sometimes: Has lost 7 lbs. in weight: Appetite is poor: Feels weak.

Home conditions: House in a row, in good condition: Western aspect: No damp: Gas lighting: Good air space in front and behind: Three in house: One under 10 years of age (baby): Two bedrooms: Two living rooms: Windows kept open: Through ventilation: Drainage good: Ashpit: No animals kept: Good and clean house: Tenant before Mrs. C. died from Phthisis, the house not being subsequently disinfected: Very febrile: Rapid pulse.

Treatment: Ordered to bed first for complete rest and subsequently recommended for Sanatorium treatment. Gave Syr. Hypophos Co. No specific treatment so far. This is a primipara case and the outlook is not good. The writer has had several such cases and they have all done badly after accouchement.



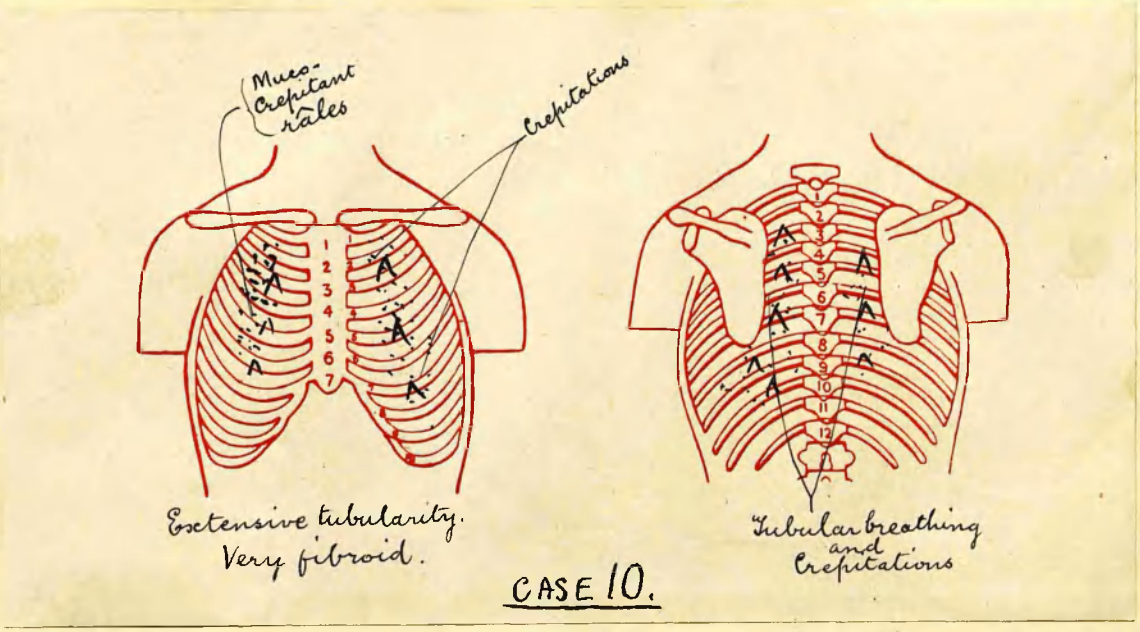
CASE 9.

9. I. K. ♂ aged 12 years: Schoolboy.

On first appearance at Dispensary: Pale: Thin: Anaemic looking: Mouth breather: Has had a cough for 3 years: Large amount of sputum in early morning: Had Pleurisy 12 months ago when was in bed 7 weeks: He has always been delicate: Has 2 brothers and 2 sisters, one brother attends dispensary and the other is delicate: Has night sweats: Has pain in chest: Short of breath on least exertion: Losing weight: Appetite not very good: Left shoulder considerably higher than right: Chest pigeon shaped: Marked depression over both apices.

Home conditions: Only fair: House not very clean: People not very intelligent: Difficult to secure ventilation, as advice to open windows is often found neglected.

Treatment: PTO weekly: Did not improve: IK now being tried: Syr. Ferr Iodid and Cod Liver Oil are being given as adjuncts. The case has been a difficult one, but is now doing better. There is a slight increase of weight, the boy looks better. Sputum is decreasing and febrile symptoms are less constant.

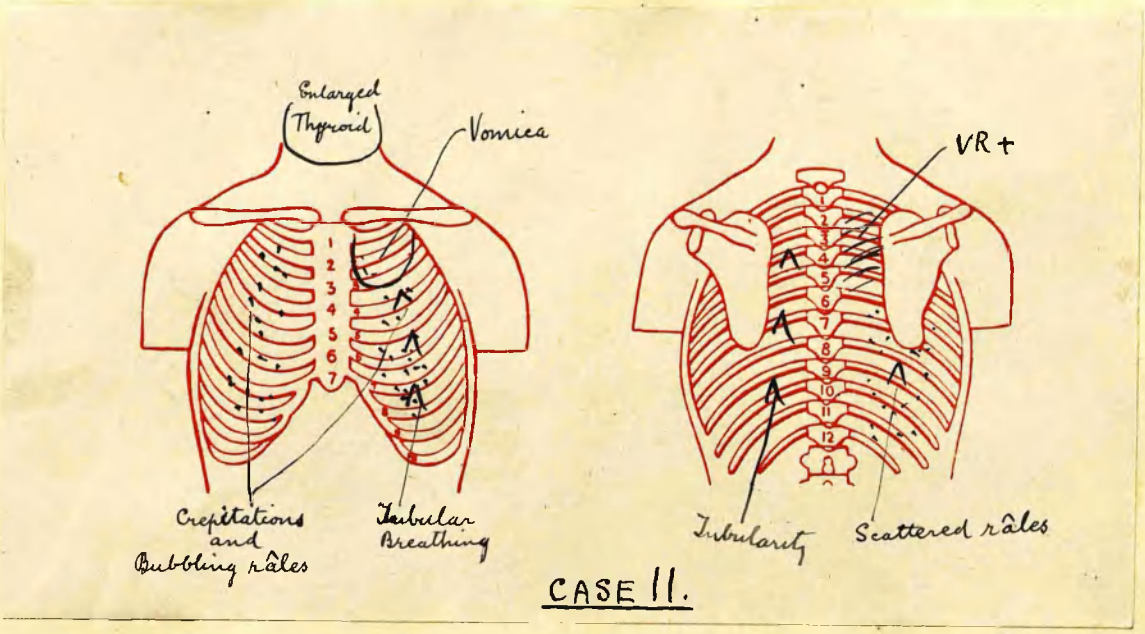


CASE 10.

10. A. K. ♀ aged 25 years: In domestic service.

On first appearance at Dispensary: Of good appearance: Well nourished and of good muscular development: Has several decayed molar teeth: Cough has been very troublesome for last few months, accompanied by a fair amount of sputum: Pain in chest and between shoulders: Previous health has been fairly good: Has two sisters and 1 brother all healthy: Has had haemoptysis several times, last about a fortnight ago to the extent of about ½ pint: Has occasional night sweats: Short of breath on slight exertion: Is getting thinner: Appetite fairly good: Presently unable to work.

Treatment: Heroin given for cough. Course of IK then TR given in weekly injections. The case is improving under treatment, but the final outlook is not good.



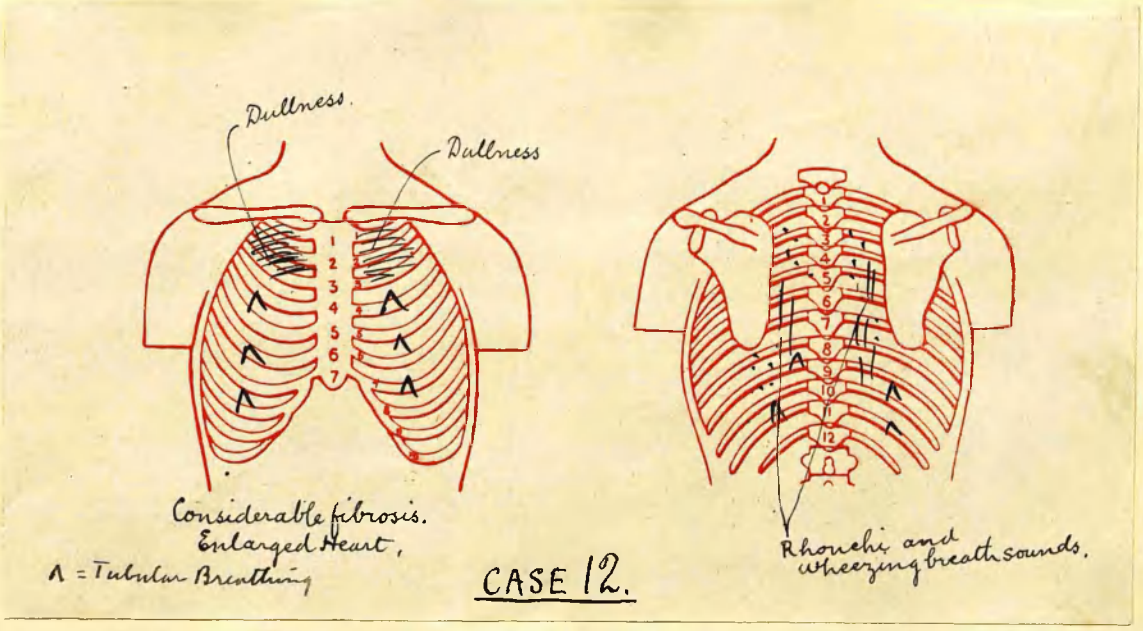
CASE 11.

11. Mrs. E.A.H. aged 33: Housewife: Has 2 children.

On first appearance at Dispensary: Pale: Thin: Poorly nourished: Poor muscular development: Has enlarged Thyroid: Pulse 126: Feels tired and short of breath: A cough present for 4 years: Heavy sputum sometimes streaked with blood: Frequent pains in chest and back: Previous to this illness had good health: Has night sweats: Digestion is good: Appetite good: Losing weight: Still able to do her own housework: Weighs 6 stones 12 lbs.

Home conditions: Good working class house: Clean: 2 bedrooms: 2 living rooms: Good air space in front and behind: Good light: The windows are kept open and the house is well ventilated: Through and through house.

Treatment: Courses of PTO: PT and IK. Heroin for cough: No permanent arrest of the disease.



CASE 12.

12. S. N. ♂ aged 40: Labourer: Married: Has 2 children, healthy.

On first appearance at Dispensary: Pale and Haggard expression: Nutrition and muscular development poor: Teeth bad: Tongue clean: Has had cough for last 3 years - worse during past 3 weeks: Pneumonia 7 years ago: Sputum of large amount and streaked with blood occasionally: Feels tired and short of breath: Has not felt really well since he had Pneumonia: Has had Influenza: Works occasionally: Occasional night sweats: Pain in left side: Indigestion occasionally: Has lost 14 lbs. in weight in 1 year: No loss of appetite.

Home conditions: House fairly clean: Ample air space in front, fair behind: 3 bedrooms: 2 living rooms: 5 in house (Lodger): 3 over 10 and 2 under 10 years of age: Ventilation fair, but windows opened irregularly: No animals kept: Earns average of 26/- weekly when able to work.

Treatment: PTO and PT courses. Bitter tonic prescribed: Has been in attendance since May 1913: He loses weight steadily: Progress of disease is retarded by treatment, but that is all.

SUMMARY AND CONCLUSIONS

The more the subject of the treatment of phthisis is studied, the more it is found to bristle with difficulties, practical and theoretical. Still progress is undoubtedly being made.

When we turn to this country's statistics we find evidences of a great decrease in the death-rate from Tuberculosis during the past fifty years. For example, we learn that the mortality rate from all forms of tuberculosis during that period has decreased approximately 50% for adults and 70 per cent for children. Now the phthisis death-rate has shared largely in that decrease.

But when we enquire as to what this decrease is due, we find that there are many causes at work besides improvement in direct medical treatment. It is known that an increase in the tuberculous death-rate always results from periods of dear food, poverty and hard living amongst the poorer classes. On the other hand the decrease of the tuberculous death-rate during the past fifty years has coincided with the provision of cheaper food, increased wages, better housing, and better sanitary and preventive arrangements amongst the populace. These have undoubtedly been considerable factors in the causation of the reduced death-rate; but there is also

the question to consider of a probable growth of racial immunity, the effect of which on the death-rate is difficult or impossible to correctly judge or assess. And here a rather sinister thought creeps into consciousness. If by improved preventative and curative treatment, we, as one of the results, in great measure destroy this racial immunity, shall the then existing populace be in a position, with regard to tubercle, comparable to that of those uncivilised or remote peoples who, as the result of their initial experience of phthisis are almost decimated by it? This thought is pressed the more home by the fact that, so far, we have no specific against phthisis such as we have in vaccination against small pox; or if instead of making comparison between a chronic and an acute disease we compare phthisis with Syphilis, then even here we have no specific against tuberculosis comparable to Mercury or Salvarsan in Syphilis. However, 'twould be folly to allow thoughts such as these on a subject so problematical as racial immunity, to influence us in any degree, to slacken our efforts in the present fight against tubercle.

Phthisis is peculiar in that any immunity it recognises whether naturally or artificially produced, varies much in the individual, but is always strictly limited and relative.

We know that the tubercle bacillus grows readily on the devitalised tissues of its host, whilst tissues of full vitality successfully throw it off. Therefore, apart from mere symptomatic treatment, our main efforts as practical practitioners must continue to be directed to the sustaining of the tissues' resistance at the highest level possible, and here lies the rationale of all modern dietetic-hygienic treatment.

General drugs are helpful in quite a secondary sense, but of specifics we have none that has been fully proved. Tuberculin is the nearest approach that we have to a specific. We know that it has a selective action in and around tuberculous foci, and that it is capable of giving opposition in the treated organism, to the tubercle bacillus, in a more direct manner than other remedies. And there is a considerable aggregation of practical evidence that it is distinctly helpful in a proportion of cases of phthisis; but it is yet on trial, and it would be wrong to term it a specific in the strict sense of the term.

It is rather unfortunate that from tuberculin as from all other means in use in the modern compaign against tuberculosis, too much seems to be expected by the lay mind and especially by the lay mind of those who are members of the governing bodies spending public money (not too freely probably) in the modern fight against tuberculosis.

Therefore the medical profession should be careful not to encourage that attitude of lay mind which looks upon the efficient control, if not the practical extinction of all forms of tuberculosis as within a near and measurable distance, and this attitude where it exists is regarded by the holders as the logical result of the modern efforts - (with all its propaganda) - to achieve this end. In the light of present knowledge it is not justifiable to say other than that the fight must be a long one, although its outlook is now immeasurably more hopeful than ever it has been in the history of man. And on these grounds it is imperative that every justifiable effort should be used in so promising a combat, and it is wholly right that every legitimate means of fight should receive the hearty support of people and state.

Of the unprecedented efforts that are being made presently against tuberculosis, we want honest statistics, and we also require honest interpretation of clinical experiences. These will form a guide to the army of research workers, who are unselfishly devoting their time and talents to the scientific elucidation of the problems of this protean disease, in the supporting hope that the specific remedy or treatment may be the result.

Research work is the crying need in the furtherance of improved treatment of phthisis as of all forms of

tuberculosis. But research work is expensive and notably tedious and its workers cannot exist on unaided enthusiasm. Funds are necessary to support such work, and more liberal funds are required than legislation and private generosity have, so far provided.

Coming to the individual patient who is afflicted with phthisis, it can be freely admitted that never has his prospects of help, improvement and cure, been so bright as they presently are. In hopeful cases, sanatorium methods plus judicious tuberculin treatment, probably gives the best chance of cure, and of these two tuberculin as presently used and understood, is by far the most supplemental. And in less hopeful cases it can be said that much can be done by sanatorium methods and all that these imply, to ease pain, prolong life and make it more useful and comfortable.

In conclusion, it may be said that every worker, however humble, in the fight against tuberculosis of the lungs, can do work of value, and when dissatisfaction at apparent lack of results from personal work, especially in the treatment of far advanced phthisis, creeps in upon us, as sometimes it will, then we should be of good heart remembering that -

"Though the difficulties throng
And the struggle may be long,
Yet to patient brave endeavour,
Cometh utter failure never."