# Some of the More Important Advances in the Diagnosis and Treatment of Tuberculosis

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# SOME OF THE MORE IMPORTANT ADVANCES IN THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS*

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## NEWER IDEAS OF PHTHISIOGENESIS

Among the more important recent advances which have been made in the study of tuberculosis, none is of greater import than that bearing on the subject of phthisiogenesis. This has made a total change in our ideas concerning tuberculosis as a clinical entity, and given a new basis from which to combat the disease.

Years ago the idea of heredity dominated the entire subject of tuberculosis. The clinical disease was looked upon as a direct inheritance from parents to off-spring. The attitude of the medical profession, as well as that of laymen, while that idea held sway, was one of hopelessness. When the theory of infection became thoroughly established, however, heredity ceased to hold sway. Then was developed a great fear of the tuberculous patient. Tuberculosis was looked upon as being a disease which was easily transmitted from one individual to another, and an intimate contact (even though temporary), if it took place immediately prior to the onset of symptoms, was considered to be the most probable source of infection.

During recent years our studies have been modified by increased knowledge, and infection

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in childhood has received an unusual amount of attention. This study was warranted by the frequent findings of pathological lesions, particularly in the lymphatic glands of children; but we have been aided more in our studies by the application of tuberculin tests to large groups of children. This, since the discovery of the cutaneous, percutaneous and intradermal tests, has been a procedure easy to carry out and one unattended by danger. As a result of our studies, we have found that from 70 to 80 per cent. of all children show a demonstrable lesion prior to the age of fifteen years; and it is almost impossible for us to conceive of any child passing through life without coming in contact with a sufficient number of bacilli to produce infection.

## THE RELATION OF EARLY CHILDHOOD INFECTIONS TO CLINICAL TUBERCULOSIS

These early infections produce two effects upon the child. First, from the bacilli in the focus, products are given into the blood stream which stimulate the body cells to the production of specific protective enzymes which render the child resistant (immune) to further infection. This occurs to some degree in all who are infected. In spite of this fact, numerous lesions remain active, and, from them, the disease spreads to produce a clinical tuberculosis. In others, the infection heals and the patient remains resistant to further infection. In still another group, the disease remains quiescent for a time, but later, in spite of increased resistance, the bacilli spreads to other parts of the body to set up new metastases.

The lungs are the most common seat of tuberculosis in adult life. Careful pathological examinations of many bodies postmortem, have shown an infection in the lungs of from 45 to 70 per cent. of individuals. If we take the studies made by Hart, which include material from hospitals for those in good financial circumstances as well as the poor, as giving us approximately the true status of these infections, we can safely say that about 50 per cent. of people who reach adult life have an infection in the lungs. Of this one-half one-third (or one-sixth of all adults) heals, leaving only a scar; another one-third remains more or less quiescent and probably produces few, if any, symptoms which are recognized by the patient; another one-third, shows symptoms of clinical tuberculosis which are recognized as such. This important contribution to our understanding of tuberculosis, forces us to recognize the necessity of controlling the infection of the little child. The younger the child and the more intimately that it associates with open tuberculosis, the more apt the disease is to spread and produce clinical tuberculosis at once or to extend and produce it later.

## THE DIAGNOSIS OF TUBERCULOSIS

In the diagnosis of tuberculosis we are dealing with three separate conditions. First, a healed lesion; second, a condition of inactivity; and third, a condition of activity. An inactive tuberculosis cannot be wholly ignored. It is never free from danger unless it is healed, because it is liable at any time to become active and produce clinical tuberculosis. If we only knew more defi-

nitely the conditions which produce the lighting up of an old quiescent focus, we should be in a better position to give an opinion of the danger from this type of infection. We are in the habit of saying that these infections are started up by a lowering of resistance, such as overwork, excesses, disease, etc. We also know that activity is precipitated by various infections of the respiratory tract, such as bronchitis, influenza and pneumonia; but just what the factors are to be guarded against and how to protect the patient from them, is something that we are not able to determine.

As clinicians we recognize clinical tuberculosis and inactive tuberculosis. Clinical tuberculosis consists of that type of infection which produces clinically recognizable symptoms. These symptoms are precipitated when the bacilli multiply, and new metastases are formed; consequently the symptoms and signs which accompany clinical tuberculosis may be taken as evidence of the fact that bacilli are multiplying either with or without the formation of new metastases.

*Clinical History*—No procedure in diagnosis is more helpful or of greater importance in determining the presence or absence of clinical tuberculosis than a carefully taken clinical history. We do not pay enough attention to getting the history from the patient. We are too apt to let him describe a few symptoms and let the matter go at that. Taking a history is an art but it is one that is sadly neglected. The clinical history of tuberculosis should elicit the symptoms from which the patient is complaining, and, if taken sufficiently carefully, will show many

symptoms on the part of many different systems of the body. Symptoms are evidences of disturbed function. In taking a clinical history, no matter what the disease, we must not only think of the pathological process, but we must think of the disturbances in function throughout the entire organism. There are some twenty-five or thirty different symptoms which belong to early clinical tuberculosis. It is rarely that we find one patient complaining of all of them, but we will find a number of them present in nearly every case. A better understanding of these symptoms may be obtained if we group them etiologically. In 1913, I suggested that the symptoms of tuberculosis be grouped under three heads: those due to toxemia; those due to reflex action; and those due to the tuberculous process *per se*. Since that time, further study in visceral neurology has shown the correctness of this grouping; and it has also afforded a basis for a better understanding of the individual symptoms and the part that they play in determining the presence or absence of active disease. The groups of symptoms which I have suggested are as follows:

**Symptoms Due to Toxemia**—Malaise, feeling of being run down, lack of endurance, loss of strength, nervous instability, digestive disturbances of the nature of hyposecretion and hypomotility, loss of weight, increased pulse rate, night sweats, temperature and blood changes.

**Symptoms Due to Reflex Cause** — Hoarseness, tickling in larynx, cough, digestive disturbances, of the nature of hypersecretion and hypermotility, loss of weight, circulatory disturbances, chest and shoulder pains, flushing of face, apparent anemia.

**Symptoms Due to Tuberculous Process Per Se**—Frequent and protracted colds, spitting of blood, pleurisy, sputum.

It will readily be seen that the group of symptoms which is due to toxemia, is the same no matter what the toxemia. This group has nothing distinctive of tuberculosis about it. It can be produced by a tonsillar infection, appendicitis, typhoid, pneumonia, syphilis, malaria, tuberculosis, or any other infection. The severity of the individual symptoms will differ, but it will readily be seen that they belong to this particular group.

In our diagnoses of clinical tuberculosis in the past, we have depended greatly upon a slight rise of temperature; but it can be seen that this is not dependable, for any other slight infection may produce a similar rise in temperature. The reflex group has certain definite peculiarities. First of all, nearly all of the symptoms belonging to this group point to structures other than the lung. This is readily explained by visceral neurology. With the exception of the chest and shoulder pains, which are caused through the sympathetic and spinal nerves, all reflex symptoms are produced as a result of stimulation of the vagus system. When infection is present in the lung, this stimulates the pulmonary ends of the vagus, which in turn carries afferent impulses to the vagus centers and produces reflex action in other viscera. In this way hoarseness, irritation of the larynx and cough are produced, and direct attention to the upper air passages. Stomach disturbances, particularly hyperacidity, hypermotility, spastic constipation and intestinal stasis, direct attention to the gastro-

intestinal tract as being the parts involved. The instability of heart action, on the other hand, calls attention to the circulatory system. Fortunately for our diagnoses, it is rarely that we have the symptoms in group 1 without having some of those in group 2, and it is also quite common to find other symptoms which belong to group 3, which we shall now describe.

A reference to group 3 will show that these symptoms point more or less directly to the lung, and, as such, help us to localize the focus which produces not only the toxic group but those symptoms which are reflexly shown in other organs. Unfortunately the symptoms of this group are not always present early. Pleurisy (dry more frequently than pleurisy with effusion), however, is commonly found as an early symptom of tuberculosis. It is due to a subpleural or a pleural metastasis and means active tuberculosis. The fact that it rarely lasts more than a few days and disappears for the time being, has made us undervalue its seriousness. The serious part of pleurisy is that it shows that the disease process is active and that metastases have taken place in the pleura or subpleural tissue from some other focus. It should make the diagnosis of clinical tuberculosis itself, unless we can definitely prove beyond doubt that the pleurisy is of different etiology. In this connection, I wish to insist upon the fact that dry pleurisy is just as commonly tuberculous in origin as pleurisy with effusion. Spitting of blood is nearly always tuberculous in origin. The preponderance of the number of instances in which it has a tuberculosis back of it as compared with other factors which produce hemorrhage, is so great that spitting blood of it-

self (unless we can definitely prove that it is due to other cause) should make the diagnosis of clinical tuberculosis.

Frequent and protracted colds or bronchitis often means active tuberculosis. Sometimes the activity is limited and the symptoms of toxemia as well as the reflex symptoms which accompany it, pass over in a short time. It is characteristic of this, however, that it usually recurs, sometimes after a short period and sometimes after a long period; but, any bronchitis or cough which holds on for a period of more than two or three weeks and which is accompanied by symptoms of toxemia, should be considered as being most probably of tuberculous origin.

Sputum from the lung can be of two different types. It can come from the tuberculous ulcer or it may come from the increased bronchial secretion which results from increased vagus stimulation.

After a continued use of this etiological classification of symptoms during the past four years, I have found it to be of the greatest importance in determining between clinical (active) tuberculosis and inactive lesions.

It will be noticed that there are certain symptoms which may be considered as localizing symptoms. While the symptoms belonging to the toxic group can belong to any toxemia, and those of the reflex group with the exception of the chest and shoulder pains can come just as well from an inflammation of any other important internal viscus; yet there are certain symptoms which may be considered as localizing symptoms. Those which point to the larynx (cough and hoarseness), under certain conditions are localizing

symptoms; particularly if toxemia is present and persists for any length of time; for the non-tuberculous acute infections which invade the larynx, as a rule do not show persistent toxemia nor do the hoarseness and cough persist. The symptom of reflex pain is also localizing in its nature. It is a reflex in which the afferent impulse travels from the lung through the sympathetic nerves and expresses itself on the surface of the body through the spinal nerves. Consequently it is not haphazard in its location. The particular localization of pain in tuberculosis is in those segments of the cord which are in direct relationship with the sympathetics which return from the lung. The ones which give the most pronounced symptoms are the third and fourth cervical.

By carefully analyzing the symptoms elicited in taking the clinical history, one may diagnose or exclude active clinical tuberculosis in a large per cent. of patients; and when we add to this the data obtained on careful physical examination, we can almost positively diagnose or exclude clinical tuberculosis without finding tubercle bacilli in the sputum. All data found on physical examination are localizing in character, and when added to the clinical history make clear the nature of the process which has caused the disturbance in function noted.

*Examination of the Patient*—Contrary to the usual advice or usual statements regarding physical examination of the chest, I have found that most valuable data can be gained from inspection and palpation; in fact, the presence or absence of active tuberculosis can be determined in a very large percentage of cases (nearly all) by

careful inspection and palpation. Inspection should include the respiratory rhythm, the condition of the muscles and subcutaneous tissue and skin, as well as the general appearance of the patient. As a part of the sympathetic reflex from the lung, we have impulses traveling to the cervical portion of the cord and there being transferred to the motor nerves, the same as previously mentioned in connection with sensory nerves. This stimulation produces an increased tone in those muscles which take their origin from the cervical segments of the cord. Their motor reflex is shown best in the third and fourth cervical segments, these being the ones which receive the greater portion of the afferent impulses from the lung. The muscles which show it best are: The central tendon of the diaphragm innervated through the phrenics, the sternocleidomastoideus, scaleni, pectoralis, trapezius, levator anguli scapulæ and rhomboidei. Other muscles are also involved but these are the ones of greatest diagnostic value because of their situation and ease of examination. While the process is active, these muscles show spasm. If the disease process becomes chronic, they, together with the subcutaneous tissue and skin over them, degenerate; consequently if upon inspection we note a diminished respiratory excursion or a degeneration of some of the muscles with the skin and subcutaneous tissue over them, or an apparent increased tone of some of these muscles, this gives us at once an indication of the presence or absence of pathological processes within the underlying lung, and suggests the probability of the process being active or quiescent.

*Palpation*—Palpation should be used to confirm the data brought out on inspection or to bring out new data. Sometimes the motion of the chest wall can be determined by palpation better than by inspection. The condition of the muscles and subcutaneous tissue, their increased tone and degeneration, are readily determined by palpation. By palpation we can also determine the condition of pulmonary tissue and in this way pick out areas of infiltration, the presence of cavity, thickened pleura, pleural effusions, emphysema and other pathological processes.

*Percussion*—In the light of our muscle studies, percussion deserves more attention than it usually receives. Percussion is often done in a haphazard manner; on the contrary, it should be done following out certain definite rules. All muscles should be in a state of perfect relaxation when percussed, otherwise our data will not be reliable. If we compare percussion over muscles on one side of the chest which are taut, with muscles on the other side which are relaxed, we shall find a higher percussion note caused by the muscles on the former side. Where we find degeneration of muscles and subcutaneous tissue, we must allow for this in our percussion findings. Degeneration of soft tissues over the chest will lower the percussion note and give a decreased resistance to the fingers. On the other hand, increased tension of muscles will give an increased note and increased resistance to fingers.

*Auscultation*—In interpreting the data found on auscultation, we must also take into consideration the character of the muscles and subcutaneous tissue, likewise the presence or absence

of pleural thickening and the attendant pathological changes found in the intercostal muscles.

A careful clinical examination, utilizing the clinical history and the data derived by examination thus described, will give us definite grounds upon which to base a diagnosis in nearly all cases which come to us for examination. The symptoms belonging to groups 1 and 2 and the localizing symptoms of group 3, and the further localizing symptoms and signs based upon vagus and sympathetic, sensory and motor reflexes will tell us almost without doubt of the presence or absence of disease within the lung. Then when we add to this the data found from ordinary methods of auscultation and percussion, little doubt should remain in the examiner's mind.

*X-Ray in Diagnosis*—When the x-ray was first brought forth it was thought that this would give us definite information regarding disease within the thoracic cavity, but greater experience has proven that the x-ray is far from accurate in its picture, and its interpretation is often further from accuracy. Small early lesions do not always cast a sufficient shadow to be recognized, even when the plate is made by an expert rœntgenologist. On the other hand, severe disease can nearly always be determined and some of the smaller early lesions can be shown by expert rœntgenologists.

An x-ray plate should be given about the same value in diagnosis as a physical examination. An expert physical examination should be considered as most reliable. An ordinary x-ray plate should be considered as having about the same value as an ordinary physical examination, and a poor

plate should be considered as having no value at all,—the same as a poor physical examination.

*Tuberculin Test*—Tuberculin, contrary to what is usually said, may be used to great advantage in the diagnosis of active clinical tuberculosis. If the tuberculin reaction is an antigen-antibody reaction, and if the degree of reaction depends upon the specific sensitiveness of the body cells, then tuberculin should be of advantage in determining the presence or absence of active tuberculosis; because the greatest sensitiveness is present in early cases when the disease is active and when the body cells are called upon to produce specific enzymes to destroy tubercle bacilli. I have come to rely upon a prompt marked reaction to full strength Koch's old tuberculin, as meaning a definite active clinical lesion. I may not be able to locate the lesion. My diagnostic ability may not be sufficient, but I consider, when I find such a reaction, that a definitely active lesion is present somewhere in the body.

*Sputum*—Such a simple matter as examination of sputum requires more consideration than it receives. When bacillus-bearing sputum is plentiful, then there is little trouble in finding bacilli, but under such circumstances the finding of them adds little if anything of diagnostic value. When the sputum is scarce and the bacilli are rare, a careful technic must be used in order to avoid error,—in fact, an early diagnosis should not be based on the presence or absence of bacilli in sputum. The presence or absence of bacilli simply means the presence or absence of necrotic areas. Active clinical tuberculosis is often pres-

ent for months and even for years without such necrosis occurring.

Much time may be saved by having the patient collect all of the sputum raised for a period of three days. This should be put into an incubator and allowed to ferment, and then after shaking and thoroughly homogenizing it, a specimen should be made. The percentage of error after this procedure is decidedly small. Antiformin and the Ellermann and Erlandson technic may also be used. Where bacilli are not found, the sputum should be examined for lymphocytes. Sputum with a high lymphocyte count should be looked upon as suggestive of a tuberculous process. Anything above 30 or 40 per cent. of lymphocytes is suggestive of tuberculosis and above 50 per cent. is diagnostic. The albumin reaction may also be utilized. It has been shown during recent years that tuberculous sputum is very apt to give a definite albumin reaction. If the albumin content is greater than normal, it should be considered as suspicious of tuberculous inflammation.

## PROGNOSIS

The prognosis in tuberculosis is very different now from what it was a few years ago. Within the memory of the present generation, tuberculosis was considered to be almost hopeless. During the last twenty years, however, much has been done to change this opinion, and if the diagnosis was only made early and the proper measures applied, the hopeful attitude toward this disease would grow much more rapidly. Most patients suffering from tuberculosis are still treated under unfavorable circumstances. It is necessary to

treat them in the home, where it is very difficult to create a helpful atmosphere and give them the surroundings, both physical and psychical, which are necessary to give them the best aid in cure. The sanatorium movement has been greatly hampered by the fact that most institutions are insufficiently manned and the operating expenses have been kept so low that patients have not been given the full benefit that should be derived from such care. Most public institutions have also been more or less under political control, and this has resulted in many instances in the admission of patients who were not in condition to receive benefit from therapy. Another thing which has greatly interfered with obtaining better results, is the meager understanding which we have possessed of the real nature of the disease. We are only now beginning to understand tuberculosis and the tuberculous patient; but with the knowledge which is continuously unfolding, the results in the future should be much better than they have been in the past. Much depends upon the character of material under treatment and very much upon the method of handling the patient. My institutional practice has been largely among those who are able to avail themselves of good care. Most of them have been those of the middle class. They have been treated in an institution under excellent circumstances. The records which we have made have been very gratifying. During the past three years we have not failed to secure a satisfactory result in a single case of early clinical tuberculosis. In the moderately advanced cases, we have secured an arrestment of the disease in 68 per cent. In the more advanced cases we have secured an arrest-

ment in about 40 per cent. of all those who remained in the institution more than three months.

One of the most important factors in the prognosis of tuberculosis is the time element. In many patients we have failed to secure a result because treatment was interrupted too early. Tuberculosis is a chronic disease. The susceptibility of individuals to the bacillus differs,—so does their power of overcoming its ravages. One patient will make as much headway to apparently the same degree of infection in six months as another will in nine or ten months. My rule is never to be discouraged as long as I can see improvement; and this has led me to obtain many favorable results where I would have failed had I tried to put all patients through in a definite term of treatment.

## TREATMENT

The real advance which has been made in the treatment of tuberculosis during recent years, consists not so much in finding new remedies, but in a better understanding of the disease and patient and a better application of the remedies and measures which we have long known. In spite of the fact that we have not found a "cure" for tuberculosis, we have made such progress in our knowledge of the disease and the intelligent application of measures, that an arrestment is possible in nearly all cases, providing the diagnosis is made early and the remedies at hand are intelligently applied under favorable circumstances.

Unfortunately we have no definite direct method of curing tuberculosis. All measures upon which we rely are indirect, in that they are not able to produce the specific action of de-

stroying the tubercle bacillus. They may be divided into two classes: The first, those which make the body cells more active and more capable of responding in the production of defensive substances; the other, those which stimulate the cells to the production of enzymes and stimulate the tissue cells about the focus of infection to an increased production of fibrosis.

The measures which are better recognized, such as open air, favorable climatic conditions, food, rest, exercise, hydrotherapy, heliotherapy and psychotherapy, likewise measures for the relief of distressing symptoms and complications, all act toward the same end,—that of producing a more stable nervous system and better physical state. When the patient is thus kept in a normal nervous and physical equilibrium, his body cells are better able to combat the infection.

*Open Air*—The question of open air treatment may now be approached more intelligently than at any previous time in the history of medicine, because we have learned that the element in open air which is important in preventing and healing tuberculosis, is not the increased amount of oxygen in the open air as compared with confined air. We have also learned that the harmful effect of air which is found in closed rooms is not due to the excessive amount of C.O.2 contained in it. Recent studies have shown that the benefit produced by open air is due to its physical effects upon the body. Air is of benefit to the human organism in proportion to the manner in which it stimulates the nerve endings which are found upon the surface of the body, and in proportion to its influence in aiding the organism in elimin-

ating heat and other deleterious substances. Thus open air is put on the same basis as climate, the influence being one of surface action rather than a respiratory factor.

*Climate*—It is still important to insist upon a rational understanding of the influence of climate in healing tuberculosis. Medical opinion varies from the extreme which looks upon climate as being the main factor in cure, to the other extreme which looks upon it as having no effect whatever. Neither of these opinions is tenable. No one can study the history of the human race and its achievements, without realizing the fact that climatic influences are very markedly reflected in our physical and mental capabilities. It is also evident that climate may be a factor in disease, because the efficiency of the human organism is affected by different degrees of heat and cold, by the different stimulation which is produced by the impact of wind, the degree of humidity in the atmposhere, and by other well known meteorological factors. Climate, however, is not a cure for tuberculosis; but like other well-known remedies, is one that may be utilized to the advantage of the patient. It comes so far down the list of necessary measures, however, that it should no longer be thought of as the first factor in cure. The most important factor in the cure of tuberculosis is intelligent guidance. No climatic condition, no matter how favorable, can make up for the intelligent guidance of the physician who is able to understand tuberculosis and to obtain the co-operation of the patient during the long period necessary for a cure to be obtained. It is better to be treated intelligently un-

der climatic conditions which seem unfavorable, than to be without adequate guidance under the best climatic conditions that can be found. Where favorable climatic conditions can be added to intelligent guidance, this factor, like properly regulated rest and exercise, hydrotherapy, psychotherapy and open air, will add its part to the cure of the disease.

*Rest*—The newer work in the treatment of tuberculosis emphasizes the importance of rest in therapy. Personally, I have found it extremely important to treat patients at rest as long as the disease is clinically active, and longer if there be any particular reason which experience tells me should still require it. During rest the demands upon the body for normal repair are less exacting than during exercise; and, when the organism is required to fight an infection such as tuberculosis, it is best to save it from all extra demands. Rest is called for during active clinical tuberculosis from another standpoint. Increased bodily action increases the acid content of the tissues, and, inasmuch as a patient affected with pulmonary tuberculosis suffers from suboxygenation, he naturally has a tendency toward increased tissue acidity. The destructive enzymes which are responsible for the breaking down of pulmonary tissue, act strongest when the alkalinity of the blood is reduced. Consequently rest may be looked upon as a factor in the prevention of necrosis.

*Exercise*—When clinical activity is over, however, then it is extremely desirable to improve the patient's physical strength. Exercise should be carried out, beginning very cautiously and in-

creasing as the patient's tolerance improves. I always endeavor to have the patients able to do a considerable amount of work equivalent to from three to six miles walk per day, before treatment is interrupted. If physicians would be successful in handling tuberculosis, they must give a greater proportion of their attention to the patient as an individual. Entirely too much thought has been riveted on the pathological anatomical changes in the tissues, and not enough to the patient as a human being. It is essential to build up as strong a nerve and physical equilibrium as is possible, and if the patient can be brought up to a point of physical strength where his condition will permit him to do a considerable amount of physical work, before he is discharged from the physician's care, the disease will be much less apt to relapse.

*Heliotherapy*—During recent years heliotherapy has been suggested as having special therapeutic effect in tuberculosis, particularly in joint and bone tuberculosis. Its action seems to be generally supposed to be due to its direct effect upon the bacillary process. There is considerable question, however, about this. It seems more plausible that the favorable action of heliotherapy is equally an indirect one, and is due to its effect upon the surface of the body. In pulmonary tuberculosis, this action is undoubtedly the greater. While the general understanding is that heliotherapy produces its effect through the direct rays of the sun, yet those who are not situated so as to secure a more or less constant application of direct rays, can do their patients great good by exposing them to diffused light.

Artificial light from various electrical lamps is also of value. Heliotherapy must be classed among the measures which improve body metabolism and when used intelligently it will be of value. It must be used cautiously and adapted to the patient.

*Pulmonary Compression*—Pulmonary compression has been utilized rather extensively during the last five years, although it was first suggested many years before. Pulmonary compression is not a "cure" for tuberculosis, although it does exert a favorable influence on some cases where the disease is progressive in spite of other measures. Much of the earlier enthusiasm regarding its use is passing away, and those who are studying it carefully are gradually determining the cases in which it is particularly effective. When this has been determined, its usefulness will be much greater than it is at the present time. It is not simply filling the pleural sac with air, but adapting the measures to the patient and the conditions within the thoracic cavity, that produce the favorable result. It requires diagnostic skill and a good basic knowledge of the disease, tuberculosis, in order to make this measure anything more than an experiment.

*Psychotherapy*—One of the most important factors in the treatment of tuberculosis is psychotherapy. Psychotherapy should be placed along with other tonic measures such as rest, exercise and properly regulated diet. We are just beginning to appreciate the tremendous importance of nervous influences upon bodily functions. It is impossible to have normal cell activity unless we have nerve equilibrium. Consequently, this side

of medicine demands its just share of attention at the hands of those who wish to treat disease, and particularly those who wish to treat a chronic disease such as tuberculosis. It has been shown recently that the depressive emotions, such as fear, anger, rage, discontent, worry, and such physical discomfort as pain, all inhibit the important functions of the body. By acting through the sympathetic nervous system, they cause a general relaxation throughout the non-striated musculature and an inhibiting effect on most of the important secreting glands of the body, the effect of which is to produce a decreased metabolic activity.

It must also be remembered that psychotherapy does not only have to do with the discharge of nerve force through the sympathetic nervous system, but it also has an important bearing on the higher psychical centers which are able to influence every body action. With this understanding, psychotherapy takes its place as a measure of great importance and far reaching in its influence.

*Tuberculin Treatment*—The substances which are active in the production of immunity and those which favor increased fibrosis, result from the tubercle bacillus itself and come from either those which produce the infection or from tubercle bacilli grown on artificial media without the body. We speak of these artificial products as "tuberculins." The products which result from the focus of infection are in all probability, at least in part, of the same nature as artificial tuberculins. We formerly thought that one of the factors of particular value in tuberculin was

its power to produce immunization; but the more I study tuberculosis, the more I am convinced that the active infection in the body produces as much immunity as the patient requires; and I am gradually coming to the opinion that the more valuable aid afforded by tuberculin lies in its ability to produce a hyperemia about the focus of infection, thus promoting scar tissue formation. If we could have a tuberculin which would contain all of the substances of the tubercle bacillus in their proper proportion, I do not doubt that we could produce a high degree of immunity by its administration; but in all early cases of tuberculosis and in all advanced cases where the patient is making satisfactory progress against the disease and preventing its spread, I think we are justified in assuming that the natural infection itself has endowed the body cells with a high state of specific defense,—probably as high as is possible to be obtained.