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IMMUNITY THE FUNDAMENTAL PRINCIPLE UNDERLYING ALL TREATMENT OF TUBERCULOSIS.

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The principles underlying the treatment of disease have in the past been matters of speculation only. What was known to do good had been found to do so empirically, and was handed down from one generation to another in the most dogmatic way. With the birth of the germ theory of disease speculation gave way to exact science, and it became possible to base plans of treatment upon rational theories. In the light of the germ theory of disease, immunity becomes the fundamental principle underlying all treatment of those diseases which are due to living organisms. The usefulness of a plan of treatment must therefore be predicated upon what it will contribute toward maintaining or bringing about immunity.

Certain axioms can be formulated out of our present clinical and laboratory knowledge of germ diseases. These are: 1. That all germ diseases are due to parasitic life of living organisms. 2. That there is in all living organisms an inherent power of protection against parasitic life. 3. That the power inherent in the human organism protective against disease, is potent in direct ratio with normal physical development and normal standard of health. 4. That a proper soil for a given disease germ must exist in a prospective host as a pre-requisite for the establishment of the disease. 5. That the soil necessary for the subsistence and development of any given disease germ in a host may become exhausted. 6. That the normal physical development and normal standard of health with the consequent relative resisting power to disease, are closely related to nutrition in the individual, and in the ancestry from which the individual has sprung. 7. That congenial soil for a disease and inherent resisting power to it, may both exist in their fullest intensity in the same individual at the same time.

Of no germ disease have we, probably, as exact and intimate a knowledge as of tuberculosis. We can therefore lay down the following additional axioms about it as a basis of treatment: 1. That tuberculosis is essentially a local disease, and as such is slow in exhausting the soil in the host in whom it colonizes. 2. That tuberculosis, as a disease in its complete symptom-complex, is a series of colonizations, each colonization, in the complete cycle of its existence, constituting a minor attack. 3. That each colonization which runs its course, leaves the system of the

host less competent to battle against a subsequent attack. 4. That every successive colonization is more extensive and more devastating than the preceding one. 5. That when a colony has been established, cure can only take place either through phagocytic powers of the blood by destruction of the bacilli before the circulation has been cut off from the deposit, or through defensive powers of the system by necrosis and ejection of the mature bacilli, or by encapsulation. 6. That during the process of necrosis and ejection of the mature bacilli re-inoculation may take place.

Upon the general and special axioms here laid down, the scientific treatment of tuberculosis must be based, and the fundamental principle that grows out of them is that immunity must constitute the basis of all treatment.

Immunity to disease is a freedom from liability to disease, because of an innate or acquired condition of the system, which is inimical to the development of the disease. In other words, it is an uncongenial soil for the germs which produce the disease. For the proper understanding of what is meant by immunity, it is first necessary to get a clear conception of what constitutes soil. Soil is a complex condition having both a positive and negative qualification. It may be a condition of the system in which disease germs find something in the blood or tissues upon which they can luxuriantly feed and prosper; or it may be a condition of the system, in which there is lacking something in the blood or tissues, which if it were present the germs could not obtain a foothold. Immunity being conditioned upon soil is therefore of a two-fold nature: 1, natural immunity, and 2, artificial immunity. Natural immunity is that condition of the system in which there is something present in the blood or tissues which inhibits the colonization of disease germs; in other words, it is the innate resisting power to disease. Artificial immunity is that condition of the system in which the specific pabulum for the disease germs has been taken out of the blood or tissues, either by a prolonged resistance to implantation of the germs, or by a successful struggle through an actual colonization of them. Immunity is not a fixed absolute condition, but varies from a slight temporary resisting power to an absolute permanent impediment to disease.

While tuberculosis subscribes to the general laws which govern germ diseases, it differs somewhat from most germ diseases in the matter of immunity. With such diseases as smallpox, scarlet fever and measles, natural immunity is weak, and a single attack of the disease is likely to establish absolute and permanent artificial immunity; with tuberculosis natural immunity is strong, but artificial immunity is exceedingly difficult to establish. Natural immunity from tuberculosis is, however, not possessed by all races and peoples, nor even by all families alike; races that have

not been exposed to the disease, such as the colored race in the interior of Africa at the present day, and the native races of America before its settlement by Europeans, do not possess it at all; country people possess it in lesser degree than city people; and some families are absolutely devoid of it. This difference may be explicable upon the theory that strong natural immunity really may be artificial immunity gradually acquired through long exposure to the disease by races, peoples or special families. As a rule natural immunity from tuberculosis goes hand in hand with normal physical development and a normal condition of health, and this is true to a much greater degree of tuberculosis than of most germ diseases. Complete artificial immunity is very seldom attained, although a very high degree of artificial immunity may be reached by certain families. Artificial immunity in the individual is sometimes acquired in bone tuberculosis and possibly also in glandular tuberculosis. The reason why complete artificial immunity is so seldom attained is, because when the disease is once established, the natural immunity or resisting power of the person affected gradually gives way and becomes exhausted before artificial immunity can be established. That there is, however, a tendency in every case of tuberculosis toward the establishment of artificial immunity can not be doubted, for we have evidence of it not only in the gradually increasing chronicity of the disease, but in the degeneracy of the tubercle bacilli as the disease advances. Could the natural immunity of the individual be maintained at a normal standard, a very large number of cases would undoubtedly recover, as artificial immunity would ultimately be acquired and the germs would no longer find congenial soil for the establishment of new colonies. There are really very few cases of tuberculosis in which recovery does not, take place from the first attack, and in many cases complete restoration to health follows a second, a third, and even a fourth attack; but unfortunately after each attack there is lower physical tone—a lower natural immunity, and recovery is slower and less complete, with the chances of ultimate permanent recovery greatly diminished.

In the treatment of tuberculosis the great and important object should be the maintenance of natural immunity and the establishment of artificial immunity. Everything possible should be done to maintain the normal standard of health, first by preventing the waste of force, and secondly by stimulating the organs which have to do with nutrition. To prevent the waste of force it is necessary to suspend all activity over and above that which is necessary for a normal circulation and the proper action of the emunctuaries. Over-work among the poor, and over-exercise among the well-to-do are serious impediments to recovery. There is a popular idea, shared by too many physicians, that tuberculosis is due to inactivity of the lungs, and that the natural remedy is a great deal of out-door exercise. The mischief caused by this erroneous idea is beyond calculation. As well might one expect a typhoid fever patient to recover under a régime of hard labor, as a person suffering from tuberculosis while pursuing an active career. Absolute rest is the proper treatment in all cases of tuberculosis so long as there is marked variation of temperature and excitability of circulation. Not only will the resisting powers of the patient be conserved by such treatment, but the nutritive powers of the system will be greatly increased. Loss of weight will cease, appe-

tite will improve, digestion will grow better and the general condition of the patient will show marked improvement after a few weeks' rest in bed. When the acute symptoms have subsided and the circulation approaches a normal condition, passive exercise may be taken with benefit. Watchfulness should, however, be maintained, so that even passive exercise may be suspended the moment evidence of disturbed circulation reappears. Not until the circulation becomes normal, and all evidence of activity of the disease has disappeared, should fatiguing exercise be permitted. There is no rule of practice of greater importance to the welfare of the patient than this; for a single fatigue may be the turning point in the case from the road to recovery to the road to fatality.

By advocating rest and partial inactivity during the convalescent stage I do not wish to be understood to favor indoor life or to oppose open-air treatment. On the contrary, I deem it of the greatest importance that even in the most acute stage pure, fresh air be supplied to the patient night and day, and that the whole mode of life be regulated with this end in view. There is nothing inconsistent, however, between the ideas of absolute rest and plenty of fresh air, for such rest can be secured even in the open air if necessary, and can always be had in well-ventilated rooms. Sleeping-rooms should be kept well ventilated night and day, and where they can not be properly heated the patient should be sufficiently protected by clothing to permit of thorough flushings at frequent intervals. The ideal treatment for tuberculous subjects is really only attainable in sanatoria, where everything can be so planned that patients may spend most of their time out of doors even in the acute stage of the disease; where the sleeping-rooms can be well ventilated, and where the physical exercise can be regulated to suit the requirements of each case. In home treatment we must do the best we can, but with the two ideas of rest and plenty of air always in mind and as the basis of every plan of treatment and every act of life.

Next in importance to preventing the waste of force, is stimulating the nutrition so as to make up for the ravages of the disease. Tuberculosis being a parasitic disease, and one which usually attacks some important part of the machinery of the body concerned in nutrition, there is bound to be a loss in nutrition and a deterioration from the normal standard of health. In proportion as this loss can be repaired will treatment of the disease be successful. In this connection the close relationship and interdependence of the respiratory and digestive tracts in the function of nutrition and their common government by the pneumogastric nerve must be ever kept in mind. As this nerve supplies both the lungs and the stomach, an embarrassment to the lungs is bound to prove an embarrassment to the stomach. In treating tuberculosis of the lungs the most constant attention should therefore be given to the stomach, and every weakness and incapacity anticipated. By reason of nervous inhibition and perverted nervous function growing out of the diseased condition of the lungs, appetite is often wanting, or a morbid craving for food, which, if taken, will prove injurious, exists. Want of appetite and morbid cravings of food must therefore not be heeded, but a liberal and judicious feeding must be pursued. An ample supply of easily digested food at frequent intervals will probably give the best results. The largest amount of nutrition

with the smallest amount of labor to the digestive tract should be the golden maxim by which every article of diet is judged. Artificial aids to digestion, both in the stomach and in the intestines, can always be employed with advantage. Great care should be exercised in giving drugs, such as alteratives and cough medicines, by the stomach, for the purpose of influencing the course of the disease. The good that may be accomplished with such drugs is more than counterbalanced by the impediment to nutrition which they bring about and the consequent deterioration in natural immunity. There are many drugs, such as strychnia, alcohol, cod-liver oil, hypophosphites, mercury, the mineral acids and the vegetable tonics, which may be used to advantage for maintaining natural immunity. They should, however, all be used with care and only when indicated for a specific purpose. Animal and vegetable ferments, such as pepsin, pancreatin and diastase are likewise most useful remedies for this purpose when judiciously used.

In the matter of artificial immunity we seem to be at the dawn of a great day. Much can already be accomplished with the methods and remedies at our command, but what we can do now is merely a foreshadowing of what is to come. In the past, climate has been our chief resource as a means for the attainment of artificial immunity. With a better knowledge of tuberculosis and more careful observations of the results of treatment, a change seems to be coming over medical opinion as to the value of climate as a therapeutic agent. Personally I have long since abandoned the idea that there is any specific power in climate over tuberculosis. That climate may contribute something to the maintenance of natural immunity I have no doubt; but as between the advantages to be derived from the best climate and those which accrue to the average patient in comfort and nutrition at home I believe the preponderance to be on the side of home. Whatever advantage there may be in climate will only be attainable to the majority of persons suffering from tuberculosis when sanatoria have been established in appropriate places to which patients can either be admitted free or upon payment of nominal board.

There has been much disappointment in the serum treatments. They one and all aim to establish artificial immunity and thus to bring about a cure. Personally I have had no experience with any of them and I am therefore not in a position to speak of them with authority. I have, however, read all the literature upon the subject within my reach and have kept close watch upon reports of cases treated with animal immunizing agents of any kind. I believe that all contain some merit, and in the hands of the proper persons are legitimate therapeutic agents. I have not used them because of lack of intimate knowledge of them, and also in part because of diffidence inspired by conflicting reports about them. That their genesis is upon correct principles, however, I am thoroughly convinced, and I look forward with great anticipation to the discovery of a specific remedy along the lines upon which they have been worked out.

Of drugs that have the power of contributing to the establishment of artificial immunity we have at least two that are worthy of confidence. These are iodine and creosote. In my opinion iodine approaches nearest being a specific for tuberculosis of all agents now known. That it is an absolute specific where it can be properly applied I am certain, but the great diffi-

culty lies in the application. I have for many years obtained the most decided results by daily inunctions with a solution of iodoform or eucrophen in oil. The virtue of these drugs lies undoubtedly in the iodine, and the mode of action appears to be the production of nascent iodine in the blood by the decomposition of the iodoform and eucrophen, and a consequent inhibition of the tubercular process. The treatment is successful in proportion to the incipency of the disease and the integrity of the circulation throughout the deposit. Of incipient cases that I have treated nearly all have recovered, and of advanced cases many have shown remarkable improvement and some have recovered. The reason why incipient cases recover so much more readily than advanced cases is because after necrosis has begun in a tubercular deposit medication through the blood is no longer possible, and the only hope of recovery lies in the prevention of new deposits. And here the importance of artificial immunity as a factor in the treatment of tuberculosis becomes evident. In proportion as artificial immunity can be attained the chances of reinoculation grow less; and if absolute immunity can be established recovery is assured. Iodine might possibly give this absolute immunity could a method be devised of keeping the blood thoroughly under its influence until all danger of reinoculation has passed.

Creosote is undoubtedly also a most valuable immunizing agent in the treatment of tuberculosis, and stands a close second to iodine. It must, however, be used in very large doses to get the full effects of which it is capable. A dosage of fifty drops of pure beechwood creosote three or four times a day ought to be reached. This amount can easily be given if the dose is gradually increased and copious liquid vehicles, which in themselves are not prejudicial to the stomach, be used. Hot water is probably the best vehicle in which it can be given, but milk is sometimes preferable. When milk is used the drug should be given after meals, so as not to interfere with the appetite. Wine, alcoholic beverages, and oils are objectionable vehicles, because they may prove embarrassing to the nutritive process and can not well be taken in large enough quantities to properly dilute the creosote. With the special preparation of creosote I have very little experience.

LIFE HISTORY OF BACILLUS TUBERCULOSIS IN ITS RELATIONS TO THE TREATMENT BY TUBERCULIN.

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It is said by Hirsch that about one-seventh of the mortality that exists among civilized men is due to tuberculosis in its various forms; and when we consider the dreadful mortality due to this group of diseases, there is rather a remarkable fact that confronts us in studying the life history of the tubercle bacillus, namely, that it is apparently, when compared with many other species of bacilli and bacteria, very much less virulent and deadly.

Let us compare for a moment the tubercle bacillus with the Klebs-Loeffler bacillus of diphtheria. The tubercle bacillus, it is true, can be inoculated on raw