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*** START OF THE PROJECT GUTENBERG EBOOK PROF. KOCH'S METHOD TO CURE TUBERCULOSIS POPULARLY TREATED ***

Inconsistent use of develops/developes, and centres/centers has been retained as in the original.

The printed book did not have a table of contents, but has been added for this eBook. Page numbers in the "The first communication" and "Explanatory Notes" have a 'c' prefix.

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DR. ROBERT KOCH.

PROF. KOCH'S
METHOD TO CURE
TUBERCULOSIS
POPULARLY TREATED

BY
DR. MAX BIRNBAUM.

TRANSLATED FROM THE GERMAN
BY
DR. FR. BRENDECKE.

With an Appendix being Prof. Koch's First Communication on the Subject, translated from the
DEUTSCHE MEDICINISCHE WOCHENSCHRIFT

and explanatory notes by the author.

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Translators Preface.

[1-2]

Consumption is curable. From time to time the news of some great discovery rushes over the land like a mighty wave; but never before has the intelligence of a great achievement been received with such universal delight. There is hardly a man, woman or child that does not bewail the loss of some dear relative taken away by Tuberculosis, the most terrible of all foes. More terrible because it stealthily creeps into the system and takes a firm hold before its presence can even be surmised.

Now the appearance of a deliverer is hailed as would the advent of the Messiah. Koch, formerly a poor and obscure student, being especially interested in bacteriology has plodded and worked for years. Even in the year 1882 he has made known to the world the evil spirit in describing the tubercle-bacillus as the specific generator of tuberculosis. We then knew the enemy but had no weapon to fight him. Now Koch has also manufactured the sword with which to combat the evil genius. The experimental tests thus far have not tended to lessen the merits of Koch's remedy. Added applications have resulted in additional success. The investigations are not yet complete; only meager particulars have thus far been given to the public from authorized sources. To guard against misleading representations the translator has undertaken to give to the American public only what has actually been achieved. He felt himself called upon to do this not only because he has followed the progress of Koch's labors with the keenest interest, but also because he himself has worked and labored on this field for many years.

Justly has a vast excitement taken hold of all classes of the people, an excitement that has caused all other contemporary events to fall back. The search for an actual remedy for that exceedingly ravaging disease, tuberculosis, has at last been crowned with success, and even the most uneducated will be able to estimate the significance of this event. [3]

We need but consider, that pulmonary consumption, the most frequent form of tuberculosis, annually demands over 30,000 victims in the cities of the German Empire over 15,000 inhabitants, and out of every 100 deceased 12-13 have fallen prey to this sickness.

The number of sufferers from pulmonary consumption can not nearly be determined, it certainly exceeds all other diseases by far. In the case of many people we can only infer from their appearance and hereditary tendencies, before visible signs can be discovered, that they will succumb to this terrible disease.

And this disease is now curable. Millions of people who have considered themselves doomed, will be given back to life; their regained strength will greatly increase the national wealth. In short, we look forward to an era, such as was not dreamt of even by the most vivid imagination only a few years back. But rather than be carried too far by our enthusiasm, let us study Koch's new method to cure, as far as we are now enabled to pass judgement on it. [4]

First of all we must explain: *What is tuberculosis? What relation does it bear to pulmonary consumption?*

Pulmonary consumption is only one form of tuberculosis, by far the most frequent. This is the reason why pulmonary consumption, pulmonary tuberculosis, consumption and tuberculosis are used as *synonymous* terms.

Tuberculosis is the *general* expression. By that we understand a disease which is generated by a certain kind of organism belonging to the class of bacteria. These organisms are the tubercle bacilli, which were discovered by Koch in the year 1882.

Now these tubercle bacilli settle most frequently in the lungs and here cause serious derangements of the lung tissue. *Pulmonary consumption* is the result.

But the tubercle bacilli will also settle in any other portions of the body and cause tuberculosis. [5]

Frequently the tubercle bacilli nestle in the *larynx* and the result is *laryngeal consumption*.

They may infect the mucous lining of the tongue and nasal passages and cause the rarely occurring diseases—*tuberculosis of the tongue and nose*.

More frequently tuberculosis of the intestines results, the well-known *intestinal consumption*.

The spreading of tuberculosis in the brain is of especial importance on account of the importance of this organ. Very frequently small children are attacked by *tuberculosis* of the *cerebral membranes*, a disease that has heretofore unexceptionally resulted in *death*.

Much oftener than is generally supposed the *kidneys* are the seat of tuberculosis; and also the *suprarenal capsules*, whose functions are as yet entirely unknown, have in postmortem examinations been found to be tubercularly degenerated.

In the diseases of the *bones* and *joints* tuberculosis forms an important part. Those infinitely small and weak tubercle-bacilli have the power to destroy the hard and firm substance of the bones, to soften it and change it to pus. Whole portions of bone may disappear in this way.

Tuberculosis can also destroy parts of the *skin*. In this case it is called *Lupus*. [6]

Finally tuberculosis is found in the *generative organs*. Tubercular derangements are frequently met with in the *testicles* of men, less often in the *ovaries* of women.

The well known children's disease *Scrofula* is considered a preceding stage of tuberculosis by many physicians. This much is certain that Scrofula inclines to tuberculosis.

Let us study the several forms of tuberculosis after this general synopsis; we will begin with pulmonary consumption. [7]

Pulmonary Consumption.

Even before the discovery of the tubercle-bacillus by Koch, different scientists had claimed that pulmonary consumption was caused by the immigration of bacteria into the lungs, and several of them had found bacteria of that kind. But it remained for Koch to bring light upon the conjectures of other scientists, and he established the fact, that the bacillus discovered by him was the real generator of pulmonary consumption. Millions of these bacilli exist in the lungs of the diseased, and millions of them are thrown out with the sputum.

If we take a very small quantity of this thrown out matter and examine it with a microscope, we will find a greater or smaller number of these tubercle bacilli. Of course the preparation to be microscopically examined must previously be colored with some coloring matter, otherwise it is very difficult, well nigh impossible, to detect the infinitely small bacilli. The method of coloring now generally in use consists in discoloring the preparation after the coloring has been completed, it is found that the bacilli tenaciously cling to the coloring matter, and in this way it is easy to recognize the tubercle-bacilli under the microscope.

These bacilli are infinitely minute, they are $\frac{2}{1000}$ to $\frac{8}{1000}$ millimeters long, and about $\frac{5}{100000}$ millimeters in width. Therefore it is absolutely impossible to recognize them with the naked eye. Generally they are somewhat bent, sometimes slightly nicked at one end. [8]

The temperature of boiling water destroys the vitality of the bacilli under all circumstances. Even a temperature of 70° C. is able to lessen the efficacy of the bacilli. Unhappily this temperature is too high to be applied against the tubercle-bacilli in the human body without causing the most serious injury to it. Nevertheless it has been tried, we will speak of this later on.

Then the drugs that kill the bacteria, such as Carbolic Acid, Alcohol, Iodoformether, Ether, Sublimate, Thymol, destroy the tubercle-bacilli so slowly and only in such high concentrations that their application is impossible without endangering the patient. Therefore the prospects of directly destroying the bacilli in the human body had to be given up as impossible.

We are now confronted with two questions:

1. In what manner does the tubercle-bacillus enter into the human organism?
2. Under what conditions is the tubercle-bacillus able to generate pulmonary consumption after it has entered the human organism?

All investigations, both of earlier and later date have established the fact that the tubercle-bacillus is inhaled with the air, and then it is mainly the foul air which is accused. But foul air is especially found in such places where people congregate, as in rooms, barracks, factories, etc. As it is a fact that there are always several consumptives among a number of people, so in this case there will always be occasion to inhale the tubercle-bacilli that have been cast out by the consumptives. Therefore it is not the foul air in itself which generates pulmonary consumption, but the circumstance that in this connection there are always people present which are able to spread and scatter the bacilli. [9]

Luckily the physical qualities of the tubercle-bacilli are such that they mostly adhere to the ground or floor and are rarely scattered in the air as dust; otherwise pulmonary consumption would be much more frequent than it is at present. Unfortunately the bacilli are very often

spread through uncleanness of the people, because they touch objects with their fingers to which the tubercle-bacilli chance to stick and then they touch their mouth or nose with these fingers. In this way bacilli can be taken into the system especially easily with the food. Children are particularly exposed to contamination, crawling about on the ground, on which, perhaps but recently, a consumptive has spit, and more so because they often have the habit to put all sorts of things and also the generally dirty fingers into their mouth. [10]

On the other hand there are various obstacles in the way of tubercle-bacilli entering the lungs. The distance from the mouth to the lungs is long and narrow; all sorts of projections check the further penetration of the bacilli. The trachea and the air-passages of the lungs possess equipments arranged for the purpose of ejecting small foreign substances, thus also to throw out the bacilli. In short it is not too easy a matter for the bacilli to penetrate into the lungs.

And yet this happens only too often. For instance, in some people the passage from the mouth down may be a wide one, so that the bacilli can enter more easily; the protective arrangement by which foreign substances are removed may be deranged, it may be wanting in some place or its functionary qualifications may be bad; especially frequent this is the case after enfeebling diseases, which are associated with severe cough, as measles, whooping-cough, etc. This is the reason why pulmonary consumption is strikingly often observed to follow just these diseases.

But the tubercle-bacillus can also enter the body with the food, as stated before. The acid gastric juice is a protective agent which considerably lessens the danger of infection by tuberculosis.

It has not been definitely decided at the present time whether the drinking of milk from tuberculous cows brings with it the danger of tuberculosis for mankind. It will certainly be best to avoid such milk, especially when the cow's udder is found to be tuberculously diseased or when tubercle-bacilli can be traced in the milk. [11]

The use of meat as food may also become dangerous to man, but this is a rare occurrence. It is particularly dangerous to eat the liver, kidneys and lymphatic glands of tuberculous animals. The boiling heat while cooking generally destroys the bacilli contained therein and so lessens the danger from this source. It is of no little importance, to call particular attention to the fact that our chickens are very often severely infected with tuberculosis.

The question, whether a consumptive can *infect his surroundings*, may be answered thus, that this does *not* happen as a rule. Several unhappy circumstances must come together to make this possible. Above all things a direct transmission of tubercle-bacilli in some way into the body of the healthy person, then the bacilli must cling and propagate in the same, which is only possible when there is an inclination to this disease, of course this inclination is quite common.

Pulmonary consumption is *not hereditary* in the strict sense of the word. Only an inclination to this disease is transmitted. As the danger of contagion of those having such disposition is very great, so as a rule the disease makes its appearance sooner or later. [12]

On the other hand it must be considered that the penetration *only* of the tubercle-bacilli into the body is *not* sufficient to generate tuberculosis. If they do not find the ground adapted to their nourishment and propagation they perish. It may be assumed that every person is placed in such circumstances at some time that he will take in tubercle-bacilli; but only a certain percentage will get consumption. In the remainder the bacilli perish without leaving even a trace.

Very often the inclination to pulmonary consumption may be recognized from the external characteristics. As a rule the respective individuals have a slight body, thin lean skin, weak muscles, delicate skeleton, a long, narrow, flat chest, flattening of the regions over and below the shoulderblades, wide intercostal spaces, a winglike projecting of the scapulæ, long neck, clubby, knoblike appearance of the ends of the fingers.

Furthermore it has been found, that pulmonary consumptives on an average have a *smaller heart* than is essential to a healthy body. On the other hand the volume of the lungs of consumptives is very often abnormally large.

There are a large number of *diseases* that predispose to pulmonary consumption. It is mainly the *enfeebling* action of the same, which brings about such results. For this reason the *chronic* diseases contribute so much toward the multiplication of the number of consumptives, because they stipulate a continuous weakening of the organism and an emaciation of the system. To these belong Bright's disease, which very often turns into pulmonary consumption, greensickness or chlorosis, anaemia, continued febrile diseases, severe chronic suppuration, chronic catarrh of the stomach, frequent pregnancies, childbed diseases. Thus we may often see young chlorotic girls afflicted with consumption, especially when they marry young and enjoy the honeymoon to its utmost limits. Then also women will easily become consumptive when they give birth to a child every year, especially when the social conditions in which they live are of an unfavorable nature, and they are perhaps inclined to consumption already. Childbed on the whole inclines to arousing the dormant inclination toward pulmonary consumption. [13]

Of other diseases we have mentioned measles and whooping cough, as diseases that are only too easily succeeded by consumption. To these may be added typhus, especially when it is of a more protracted nature, and the reconvaescence is slow and incomplete.

Furthermore all those workmen that have to do with dust, are exposed to the danger of being stricken with pulmonary consumption. The dust enters the lungs, irritates and injures the same and so produces a favorable soil for any tubercle bacilli that may happen to penetrate. On the whole metal dust is more injurious than mineral dust. Workmen, that are exposed to animal dust, as furriers, saddlers, brushmakers, fall prey to consumption much oftener than those, that fulfill their vocation in air pregnant with vegetable dust. According to statistics workingmen are stricken with pulmonary consumption as follows: of glass workers 80 per cent., needle grinders 70, filemakers 62, stone cutters 40, mill grinders, lithographers, cigarmakers, brushmakers, stone-polishers 40-50, millers 10, coal workers 1 per cent. [14]

Pneumonia may culminate in pulmonary consumption: but on the whole this rarely happens. Much oftener it is the case with Pleurisy. But it is assumed and rightly, that most people who are attacked by pleurisy, are already consumptive.

A hemorrhage of the lungs may nearly always be considered a sure sign that consumption has taken hold of the respective individual; but such a hemorrhage certainly forms considerable danger to falling a victim to tuberculosis, if the individual is as yet free from the same.

Age has a particularly decided influence on the origin of consumption; it is extremely rare before the third or fourth year, from that to the seventh it is more frequent; it most frequently occurs in the age from the fifteenth to the thirtieth year, and from there on the chances are again fewer. In very old age it is again very rare. [15]

There seems to be no essential difference as regards sex.

Insufficient or defective nourishment acts as a promoter in various ways. Even the nourishing of infants with poor milk, with bread or flour-pap increases the disposition to pulmonary consumption. If this defective nourishment is continued, scrofula will surely follow and this is a stage antecedent to consumption.

Pulmonary consumption is relatively more frequent among the *poorer* than the *well to do people*, this is partly due to the meagre and scanty food of the poorer, and that they are obliged to subsist almost exclusively on vegetable diet. The higher the meat prices rise and the less the majority of the people can afford to procure meat, the larger will be the number of consumptives. The poorly nourished offer a good soil for the tubercle bacilli in consequence of their weakness. The tissue offers little or no resistance to the growth of the bacilli, these propagate and destroy the powerless and yielding organism with fearful rapidity.

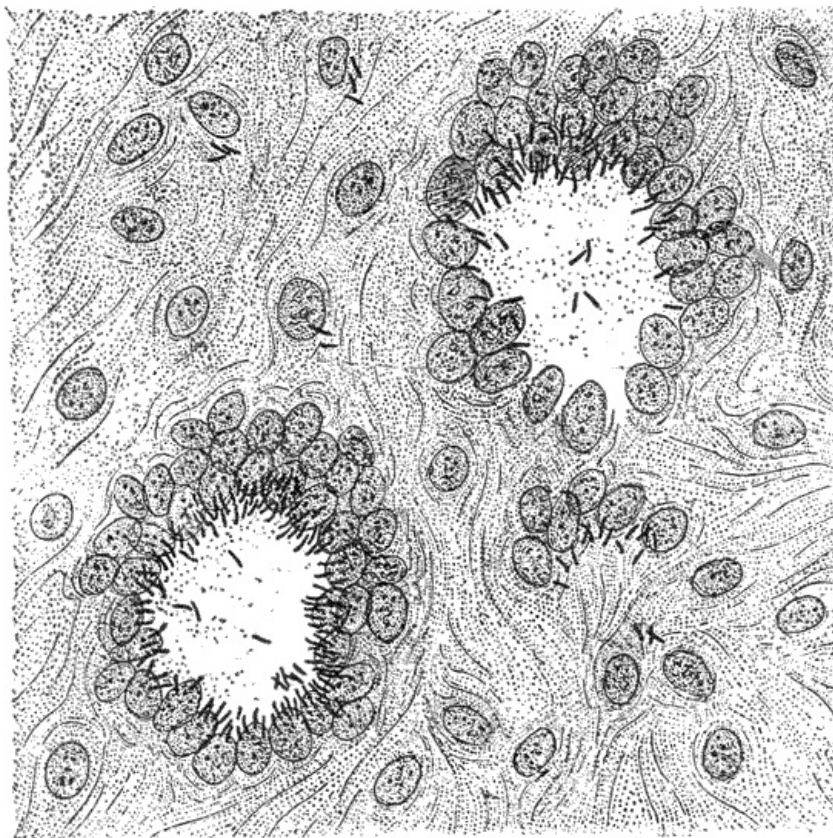
The *frequency* of pulmonary consumption increases with the *size of the cities*, or, which is the same, with the number of proletarians. Extreme hunger and want are less frequent in the country than in the city. [16]

That the climate has an important influence on the appearance of pulmonary consumption has long been known. In certain elevated regions this disease seldom or never appears. This experience has been attained in Switzerland and many other mountain regions. Furthermore the Plateaux of Peru and Mexico are considered free from consumption, but also lowlands like Iceland, the Kirgheez steppes and the interior of Egypt are known to be exempt.

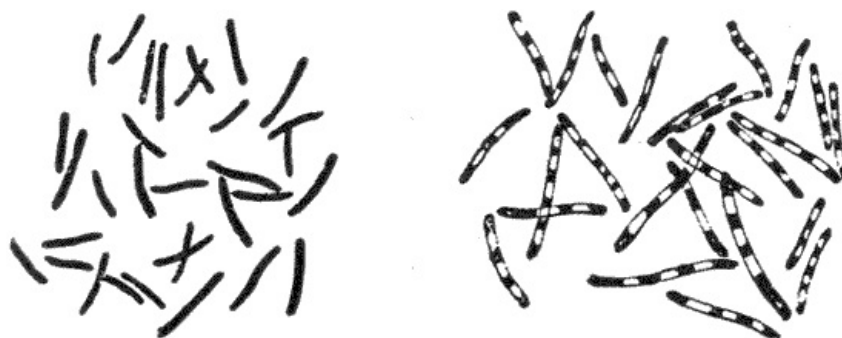
Damp and windy climate, especially with very high temperature, or abrupt changes in the temperature promotes consumption; on the other hand it is less frequent in the more moderated climates, especially if they are dry.

Now when the tubercle bacilli have settled in the lungs, they cause various symptoms. One of the most frequent is *cough*. In the beginning of the disease a short, clear but light, very often dry cough appears. During the further development of pulmonary consumption the cough becomes more periodic; it appears early after awaking, in the afternoon after dinner, and evenings at lying down; it may disappear entirely in the meantime or may be light only; but then as a rule it is no longer dry, but may be attended by expectorations of a varied nature.

[17]



Section of a tuberculous knot in the lungs, in which two cavities are seen filled with numerous bacilli. The bacilli distinctly appear as dark lines as a result of the coloring. Enlargement 900.



Tubercle bacilli, Enlargement 2000.
To the left bacilli without spores, to the right bacilli with colorless sections which are thought to be spores.

The tubercle bacilli destroy the lung tissue and change it into pus, which is coughed out. In this way larger and smaller cavities are formed in the lungs; finally the cavities may even take more space than the remaining lung tissue. When cavities have already been formed, coughing comes easy and with abundant expectoration. Toward the end of life the coughing and spitting stops as a result of the extreme feebleness and weakness. [18]

The violence and frequency of the cough depends mainly whether the larger bronchial tubes and the trachea are affected; the more this is the case, the more violent the inclination to cough. Further the strength of the cough depends on the excitability of the patient; the greater this is, the more as a rule will he cough. Sometimes the position of the patient is of influence; if he lies mostly on the diseased side the expectoration becomes more difficult and coughing increases.

Coughing is generally that symptom which soonest attracts the attention of the patient and his surroundings. For that very reason consumption is in its beginning stages easily confounded with such other diseases as are also accompanied by cough.

At the same time we know of exceptional cases where cough was entirely absent in the first stages of the disease, or was at least so slight that it was overlooked, and under such conditions the pale and poor appearance and reduced strength is mistaken for chlorosis or some other anaemic affection, also the existing febrile excitements are wrongly judged, or on account of lack of appetite or light derangements of the stomach a stomachic affection is surmised, until suddenly a hemorrhage of the lungs clearly defines the true nature of the ailment. [19]

On the other hand the cough may become so violent that vomiting is caused at the same time.

Nevertheless many consumptives describe their cough as very unimportant on account of their innate sorrowless nature, and they will not even be discouraged by the gravest symptoms. Often however it is fear that induces the patients to make light of their coughing, their spitting blood, their losing flesh and to place but little importance on these circumstances. A *hoarse* cough is a sure sign of a diseased *larynx*.

Many consumptives complain of cutting pains between the shoulderblades, under the clavicles or in the side; but these are rarely intense and are often entirely wanting. Unfortunately it is unknown to the average layman that the internal organs may suffer extensive tearing down without an indication of pain.

The *Expectoration* of consumptives which is thrown out by coughing with great exertion, is but scant in the beginning, as a rule phlegmy, glassy transparent and sticky. It is one of the suspicious symptoms of developing pulmonary consumption if this lasts for any greater length of time. Sometimes sharply defined, yellowish stripes, at times branching, appear in the same. Later on the expectoration becomes more purulent, and of greenish-yellow or greenish-gray color. [20]

Still later the patients throw out rounded lumps of greenish yellow or yellowish green color, which flatten out like a coin in the spittoon. They sink in water which is a sign of forboding evil.

Blood appears in different quantities in the sputum of consumptives. Bloody streaks are of no importance; they may appear with every violent cough. On the other hand the casting out of *pure blood* is indeed serious.

The *quantity* of blood thrown out during an attack may be very different, varying from a few drops hardly a teaspoonful, to hundreds of grammes, even more than a liter. It is generally light red, filled with airbubbles, foamy, and is largely coughed out in coagulated lumps. The coughing of blood is sometimes preceded by a feeling of oppression, rushing of blood to the head and palpitation. Some patients experience a sweet taste in the mouth even before the bleeding. In many cases all preceding symptoms are missing and the patient is suddenly attacked by blood coughing during some more vigorous movement, during the exertion of coughing or even without any direct cause. [21]

Blood coughing seems to appear somewhat more frequently with the *female* sex than with the male and has with them unmistakable relations to menstruation, as with the sick it often sets in before, often after or even during the same and at such times more frequently than at others.

It is of great importance for the layman to know that a hemorrhage rarely leads to inevitable death. Fatal hemorrhages are always preceded by warning attacks. Blood coughing may appear at any stage of consumption. In some cases it is particularly lasting. Sometimes the patients experience considerable relief from their feeling of oppression after a hemorrhage.

A number of the consumptives as a rule complain of *difficulty* in *deglutition*. This is caused by ulcers on the posterior wall of the larynx.

With many patients the *appetite* is *undisturbed* for a long time, and there are consumptives that will eat a comparatively large dinner during an attack of fever reaching 40° C. Generally the desire to eat disappears during the course of the disease, especially toward the end of the sickness.

The *stool* may be normal or costive, but is very often diarrhoetic. Twelve or more evacuations may take place during a day; as a rule they are much increased by gasses and are of bad odor. They weaken the patient very much and hasten the end. [22]

One of the most constant attendants during the course of consumption is the *Fever*. It is rather irregular. In cases of slow process the fever is often very insignificant; often it is only a state of general excitement that takes hold of the patient afternoons, slight dizziness, increased lustre of the eyes, slightly flushed appearance, somewhat increased pulse, which invites to test the temperature of the body by means of a thermometer, which by the way shows it to be about 38° C. With quick consumption the fever is generally high.

Sweat is also a characteristic sign. The exceedingly debilitating effect of night-sweats is well known.

During the course of pulmonary consumption extreme *emaciation* of the patient is brought about. All tissues are subject to the same, most marked is the disappearance of adipose tissue. This symptom is of the greatest importance as a continued increase in weight means improvement and even cure. Therefore weighing the patient from time to time gives a sure meter for the course of the disease.

The *course* of pulmonary consumption is very different. With quick consumption the end comes within two or three months. Chronic pulmonary consumption may last for years. With this improvements in the fine season alternate with deterioration in the winter. [23]

Concerning the former *treatment* of pulmonary consumption, this will also be applied in the future in the same manner as far as preventive means and general hygiene is referred to.

For every one will prefer to remain exempt from consumption although it may now be possible to cure those afflicted. The lately published and popularly treated precautionary measures, especially with reference to the expectoration of consumptives retain their full value.

Henceforth the sputum is also to be thrown in a *spittoon* which is either entirely empty or on account of easier cleansing has the bottom covered with a thin layer of water. It should not be permitted to fill the spittoons with sand or sawdust as the tubercle bacilli can be easily thrown up with the dust.

In the case of a *sudden attack of cough* a *cloth* should be held to the mouth to hinder spreading of the fine spray, the same should also be used for wiping the mouth. However the cloth must soon be dampened and cleaned.

As bits of the sputum easily stick to the *beard* especially the moustache overhanging the lips, therefore lung consumptives are advised to wear a short or no beard. [24]

Glasses, spoons, etc. used by consumptives must only be used by other persons after a thorough cleaning with hot water.

The lungdiseased person should abstain from all active and passive *kissing*, in unavoidable cases kissing should be done on the forehead or cheek only, or hold out those parts only to be kissed. In the same way he should avoid to touch objects with his mouth that may possible be put in the mouth by other persons, especially children, for instance toy-trumpets.

In the case of *death* from pulmonary consumption, the walls of all rooms and apartments used by the deceased should be rubbed down with fresh baked bread, which is a sure method of removing the bacilli. The bread crumbs that may have dropped on the floor may be removed by a thorough scrubbing with soap, brush and lye.

Upholstered furniture, beds, clothes and wash should be cleaned in a disinfecting place.

Do not wait with precautionary measures till some member of the family has been attacked by pulmonary consumption, but make preparation to prevent the infection while everybody is still sound and healthy.

This care ought to begin in a measure with the *birth of a child*. The same should not be nursed by a mother with diseased lungs nor by a wet-nurse with like affections. Generally wet-nurses are only tested for syphilis; scrofula and tuberculosis receive altogether too little attention. [25]

An important precautionary measure consists in the supervision of the *food*. The abattoirs and dairies should be placed under the supervision of practical physicians, and the sale of products derived from tuberculous cattle be prohibited. This refers to the milk in the first instance. Tuberculous cows should be excluded from dairy-farms. Raw milk should be avoided as much as possible as boiled milk has the same value.

The *meat inspection* must be strictly conducted especially with reference to tuberculosis in the case of beef, pork and chickens. Sheep are not subject to tuberculosis.

The *associations* of children in school and on the play-ground should be watched; do not let them visit in strange families before making thorough investigation as to their sanitary relations.

The health of *servant girls* should receive greater attention than formerly, as the disease is often carried into the house by them as investigation has proven.

In the *schools* and kindergartens the teacher ought to insist that children do not spit on the floor or in the handkerchief; in case of necessity he should keep sick children out of school and he should especially follow these precautionary measures as regards his own person. [26]

The *cleaning of the floor* of a room should always be done in a damp way.

Moving into another house it is advised to rub down the walls with fresh baked bread.

As regards *societies*, every society and every health resort without exception and if possible every hospital should be obliged to have its own apparatus for disinfection and to make extensive use of it. Smaller societies may unite to procure an apparatus of the kind.

Especial attention should be given to the *sprinkling of the streets* during the dry season.

The state and the larger congregations should make it a point to maintain *institutions for consumptives*, beyond the city limits if possible, a healthy location in the country preferred.

Every one individually protects himself best from consumption by a methodic habit of *washing with cold water*, cold rubbing and baths. River and sea baths are generally of excellent results; short shower baths with cool water lasting 20–40 seconds are to be applied later on; they do not only harden the skin but excite deep inhalations and exhalations and in that way act as gymnastics of the lungs. More direct is the action of muscular exercise, such as gymnastics, riding horseback or bicycle, driving, skating, rowing, etc. The carriage of children must be regulated, the drooping forward of their shoulders must be corrected by strengthening the muscles of the back and shoulders by means of dumbbell and other exercises. [27]

All this must still be observed in the future. On the other hand above all the numberless remedies will be dropped that have heretofore been applied as presumably specific remedies for consumption.

Creosote, which was so much praised at its appearance a few years ago and still applied, because of the non-existence of a better remedy, will be dropped into obliteration and with it Guajacol which was just getting to be the "fashion".

All the various inhalation methods that have matured in later years will disappear from the picture plane as far as this has not ever now happened.

The medical remedies, which were given for the torturing cough, for hemorrhage of the lungs, sweats etc., will in most cases be superfluous after this. Hemorrhages will now and then still be experienced as the same may set in unexpectedly.

The diatetic cures with whey, koumiss, grapes etc. will retain their importance and also the bathing resorts will be hunted up by patients as formerly. [28]

The owners also of special institutes for curing pulmonary consumption need not despair with the idea that they will not be needed in the future. On the contrary, those needing cure will flock to them in all the greater numbers, as they now know that they certainly will be restored to health within a definitely limited time.

[29]

The other forms of Tuberculosis.

Of the other forms of tuberculosis *laryngeal consumption* is very often combined with pulmonary consumption. It is estimated that this is true of at least one-fourth of all cases of pulmonary consumption.

At first laryngeal consumption can not in any way be distinguished from an ordinary inflammation of the larynx. A certain weakness and sensitiveness of the organs however is suspicious, also great liability to hoarseness. On the other hand laryngeal consumption may exist without any sort of ailing to the patient.

These appear later, however, when lung tuberculosis is progressing. The larynx shows more distinct outlines on the lean throat, difficulty in swallowing is experienced, pains radiate toward the ear. Food and drinks come up again after being swallowed.

The painful cough has a hollow, barking, harsh sound, provokes vomiting, and the sputum together with foul breath consists of foamy, slimy, purulent lumps. Breathing gradually becomes more difficult and louder. [30]

As regards the duration of laryngeal consumption it generally runs parallel with pulmonary consumption. If the latter progresses more rapidly so also will the destruction of the larynx by the tubercle-bacilli be a more rapid one and vice versa. In several cases it has been observed that, if pulmonary consumption progressed or remained without any extraordinary symptoms, those with diseased larynx have lived for years, with alternating improvements and diminutions, and also an occasional suspension of all symptoms, till on account of often only a trivial, evil influence a new stimulus is given and the disease found an unexpectedly rapid completion of its course.

Until now only few cases of laryngeal consumption could be looked upon as really cured. Lately it has been tried to accomplish cures especially by the application of caustics. This will not now be necessary. But those afflicted in this way, will henceforth be obliged to try and live in air free from dust, to travel south during the winter and to subject themselves to a general strengthening treatment.

Tuberculosis of the tongue is relatively very scarce. The individual in such a case nearly always shows pronounced pulmonary tuberculosis. Sometimes tuberculosis of the tongue is combined with tuberculous sores on the lips and also on the anus. [31]

Tongue tuberculosis forms small ulcers, generally on the rim, very seldomly on the back of the tongue. They always are very small, generally about the size of lentils or peas. They often remain unchanged for months. At times they are very painful, though as a rule the pain is mild. The male sex is attacked by tongue tuberculosis especially frequently.

The treatment before this consisted in cutting out all the diseased parts; now it will be much simpler.

Nasal tuberculosis appears similar to the common stopping up of the nose. But when ulcers are formed, the secretions from the nose take on a purulent somewhat malodorous character. But if the affection is neglected, the secretion becomes bloody and of very bad odor.

Until now nasal tuberculosis had been treated by applying caustics to the ulcerated portions.

Tuberculosis of the intestines or intestinal consumption is especially found in *children*. The

appearance of the same is already characteristic; the limbs are emaciated and withered; the old-looking wrinkled face shows a harsh contrast with the immoderately expanded body (frog-belly) which is caused by an accumulation of gases in the limp intestines which are then filled to bursting. Many such children have succumbed to gradually progressing emaciation and weakness.

[32]

Probably it will not be possible to save all children in the future that have been stricken with this disease as many are wanting in sufficient vitality to resist all external influences.

With adults intestinal consumption makes itself known by everlasting diarrhoea, a result of the numerous ulcers in the intestines which have been caused by the tubercle-bacilli.

Tuberculosis of the brain and of the cerebral membranes also attack children especially. Before this no attempts have been made to try whether it is now possible to cure the *tuberculous inflammation of the cerebral membranes* which has previously been unconditionally fatal. The decision will certainly soon be made.

We will give a fuller description of the symptoms of this disease to thus enable timely summons of medical interference. This disease will be known to many as "acute hydrocephalus."

As a rule children of 2-7 years of age are attacked by this fearful disease. The antecedents are extremely peculiar and manifold. Even two or three weeks before the outbreak of the real sickness, emaciation takes place from which the face is strangely enough entirely exempt, so that children, when dressed show no signs of a change. Attentive mothers and nurses, however, regularly notice the same and especially the appearance of the ribs causes no little anxiety. With this a slight pallor of the face is associated and a peculiar lustre of the eyes. The children lose their former feeling of gayety and activity. They sleep more than usual, withdraw from their favorite game, they become grumbly and shy toward their surroundings and cry for the slightest reason. It also is very peculiar that they avoid trying their former little tricks, such as climbing up on chairs, opening of door bolts that are almost out of their reach, they even will not try to look through a latticed window and asked to do so, decidedly refuse. Boys, that would not stand anything from their associates, that fought and wrestled as long as their strength permitted it, sneak away cowardly and crying from such attacks. Other children again become extraordinarily tender-hearted and affectionate, they hug their parents continually and can hardly console themselves when they leave them.

[33]

In the case of older children that have already learnt something, teachers notice unusual inattention and indifference, committing to memory comes harder than usual and what is finally learnt is recited in an awkward and stammering way. The children sleep unusually much and often by day; on the other hand their sleep at night is less sound and is interrupted by horrid dreams, frequent turning over in the bed and frequent clamorous outcries.

[34]

The appetite is lessened, and often a craving is noticed for stimulating food of which, however, little is eaten. Thirst is not increased. Urinal secretion is somewhat diminished and the urine is characterized by a brick-colored precipitate. The stool is rather costive, especially with larger children; but diarrhoea may attend this disease. The latter is principally the case with small children that are in the stage of first teething.

Headache is rarely felt and hardly ever complained of even by larger children; dizziness and unsteady walking is frequently observed. The children quite often complain of stomach-ache, which is very much increased by pressure on the abdomen.

Fever is not generally attendant, but the same may be present.

The symptoms just described, separately or collectively, gradually increase; the children finally take to their bed and now the *real cerebral affection* develops.

Now the principal symptoms are: vomiting, constipation, slow pulse, irregular abrupt breathing, increased temperature of the skin, contracted abdomen, headache, great excitement alternating with drowsiness, beginning decrease of reason, and deranged ability of moving the limbs.

[35]

As regards *vomiting*, this is almost a continuous symptom and generally appears in the earlier stages. But the duration of vomiting is very different. Some children vomit only for one or more days and not all they have eaten, while others vomit continuously from the beginning of the disease till they are relieved by death, and no food can be found that is not thrown up shortly after its being eaten. In this connection it is a peculiar fact that vomiting will not recur if it has once ceased for twenty-four hours.

Very important for the recognition of the disease is the manner of vomiting. For a child suffering from a spoiled stomach will be troubled with nausea, belching, choking and cold sweat long before it is forced to vomit, while children with acute hydrocephalus will throw up without any previous symptoms of that kind, just as though they filled the mouth with water and spit it out again. Vomiting is facilitated when children are raised or placed on their side. It ceases for the time the stomach is empty, but as soon as fluid or even solid food is taken in it will be cast out at once without causing any particular distress or inconvenience to the child. Gall is very rarely mixed with the vomit.

A second and nearly as constant a symptom is *constipation* from which nearly three-fourths of the diseased children suffer. As a rule cathartics have no effect and are generally thrown out through the mouth. This constipation will not last till the end, for a few pappy stools appear later on whether purgatives are administered or not. Violent diarrhoea resulting from intestinal tuberculosis may be discontinued at the beginning of acute hydrocephalus. But the later stools will again be thin and of cadaverous odor. [36]

During the latter stages of the disease children will often *fail to pass urine* for twenty-four hours, so that the physician is obliged to draw it off with a catheter.

The appetite does not disappear entirely as a rule. There may not be any desire for food, but generally little difficulty is experienced in inducing children to take milk or broth, which is all the more surprising as vomiting regularly follows.

The *fever* is generally not very intense. The temperature of the head, especially the forehead, is considerably increased in all cases and remains so until death ensues, while the feet have great tendency to getting cold.

The *pulse* is characteristic in many cases. In the beginning of the disease the pulse is quickened only to slacken after a few days. The number of beats may be reduced to 40-60 a minute (normal 90-100), however it does not commonly remain at a certain figure, but varies, often inside of an hour, so that at one time 40, then 60 and again 80 beats may be counted inside of twenty-four hours. [37]

The pulse again increases 1-3 days before death and then to such a rate that it is almost impossible to count it. It may reach 180 and 200 beats a minute. As soon as this rate of the pulse follows one of the reductions described above a speedy death may be predicted.

Of great importance are the variations in respiration. In the beginning stages of the disease breathing is normal except in such case where tuberculosis has made great progress in the lungs and in the case of high fever. Then of course breathing becomes more rapid. Acute hydrocephalus influences respiration in such a way that it slackens and becomes irregular. In one minute children may breath fifteen times, in another thirty, then again 20 times; at one time breathing may be very slight with almost invisible expansion of the chest and without any noise whatever, then again it may consist of deep sighs; these are also characteristic of this particular disease. Sometimes breathing is completely discontinued for ten seconds and more.

If the pulse attains that extreme rate shortly before death the rate of breathing will also be increased. [38]

As regards the *skin*, the same is generally damp from the beginning of the disease; severe sweats are observed on the head; with progressing disease the skin becomes dry, brittle, comes off in flake-like scales and only when the death-predicting increase of the pulse sets in, there appears a profuse sweat, the cold sweat of death.

Headache is also a prominent and pretty nearly constant symptom. As has been mentioned before, it does not as a rule attend the precursory symptoms. It generally begins with vomiting and soon becomes so violent that older children constantly cry aloud and lament, while the smaller ones put their little hands up to their head, pull their hair and ears and restlessly roll about on the pillow.

These expressions of pain last as long as children retain consciousness, a particular part of the head is not commonly pointed out, but asked about it the majority point to the forehead. With small children automatic movements are noticed that also seem to refer to headache, and which consist in rapidly placing the hand on the head and then drawing it back.

The larger children complain of *pains in the bowels*, especially in the region of the stomach, which remarkably often, though not regularly, become more intense by pressing and may become so violent that the children cry out aloud with pain, when the stomach or other portion of the abdomen is but slightly touched. But these pains do not last as long as the headache, they often stop suddenly, at times return. [39]

The shape of the *abdomen* is extraordinarily characteristic. In the beginning nothing remarkable can be noticed, but after the symptoms of acute hydrocephalus, vomiting, constipation, etc., have lasted for some time, the abdomen gradually decreases in size, becomes wrinkled and collapses until it finally assumes a scaphoid shape and by slight pressure the large iliac artery can be felt on the spinal column.

This contraction of the abdomen is attendant in every case of tuberculous meningitis.

If the large *fontanel* on the head is not yet closed, the same will gradually bulge out as the disease progresses.

The *mental activity* suffers premature derangements, such as have been fully mentioned in the description of the precursory symptoms. The most striking is the confused, staring look, the peevish and surly behavior, and again in other cases the extreme indifference toward otherwise well-liked persons and things. Later on actual delirium sets in, but generally of a quiet nature. [40]

A very common symptom is a loud, plaintive outcry, that is repeated at longer or shorter intervals. Children often cry out at partly regular intervals during a whole night; these cries are always accompanied by a loud sigh. These symptoms of excitement being extremely tormenting and depressing for the sympathizing relatives, fortunately last no longer than 6-8 days at the most, and are succeeded by a deep *stupor*.

If the children have once become *unconscious*, they do not recover again as a rule but remain so until death; delirium and stupor may alternate with each other in certain cases, but the former process is by far the most frequent.

Convulsions appear only in the later stages. At first the interval between the attacks are long, often as many as three or four days intervene. Commonly however they come much oftener and may in some cases last for hours. All extremities are affected by these convulsions, the eyes become red, are rolled in every direction and turning way up are fixed so that nothing but the whites is visible. After several minutes, often after two or three hours, these general convulsions subside, the children, now very pale, drop into a deep sleep and their general condition appears much reduced. [41]

Different muscular groups especially those of the face are subject to *local cramps*. The upper lip may become distorted, convulsive smiles have been observed, also peculiar sucking motions. The children point their lips and flatten them again, sometimes for hours in succession.

In the latter stages a squinting of one or both eyes may be noticed but this may again disappear.

Grinding of the teeth is another very peculiar symptom which is well-known and feared by experienced nurses. The *arms* are subject to various motions, at times sweeping automaton like, then again convulsive contractions, sometimes trembling of the muscles, at others a throbbing of the tendons. Many patients put their hands to their sexual organs and make motions tending to onanism.

The *legs* are not subject to cramps as much as the arms; they are mostly bent and drawn up in a half paralyzed condition.

The *muscles of the neck and back* are very much contracted and most children, when raised or laid on their side, bend the head far back.

In most children an extreme sensibility at being touched is observed. They may be handled with the greatest possible care and lifted most tenderly, a slight pressure on the head, body or hands in changing their position will be violently resisted with obvious expressions of pain. In the latter stages this extreme sensibility gives way to *insensibility*. [42]

Then the children may be pinched and poked, they may be turned and moved from one side to the other without any consideration, they will not resist and only give expression to the remaining sensibility by a low whimper. The lack of sensibility may be especially marked in the eyes; these can be touched with the fingers, without causing a closing of the lids.

The sense of *hearing* seems to continue its functions until very late. Children show that they hear as long as they are not completely unconscious; even when addressed in a low tone of voice they react somewhat. The sense of *smell and taste* also are lost toward the very end of the disease.

Paralytic affections appear during the final stages. It has been observed in some cases that the arm and limb are paralyzed on one side only. Often one upper eyelid is paralyzed and hangs down on one side of the face and the muscles of the tongue may be affected.

Generally the patient dies after violent general convulsions that last for hours. Exceptionally only the paralytic symptoms increase gradually and cause death without any agony or struggle, simply a discontinuance of the functions constituting life. [43]

The duration of the disease varies from 2-4 weeks from the beginning of the characteristic symptoms. Generally the day when the children take to the bed is fixed as the beginning of the disease.

The former methods of treatment have been a signal and absolute failure in every case. Every child that has once been attacked with this disease has heretofore died. Until now Koch has not been able to make any experiments with acute hydrocephalus, so that it remains an open question whether it is now possible to cure this disease.

Besides tuberculosis of the cerebral membranes with which children are afflicted, *tuberculosis of the brain* may occur, although this disease is very rare. Tuberculosis of the brain appears in the shape of small tumors in all parts of the brain. After longer duration of tuberculosis of the brain, tubercular meningitis appears.

The process of this disease may be varied. In some cases the development of cerebral tuberculosis is manifested by the sudden appearance of high fever temperatures or violent headache; to this may be added, slackening of the pulse, vomiting, stiff neck and isolated cases of palsy; sometimes an attack of convulsions is the first manifestation. [44]

In other cases the beginning can not be accurately determined, as the beginning symptoms of the

disease are so slight as to escape notice. Impaired process of nutrition, languor and headache are symptoms from which the existence of some serious affliction may be inferred without being able to determine its nature in the earlier stages.

Again in other cases the disease may proceed through all its stages without any cerebral appearances whatever. This is especially true of small tubercles and of diseases of infants. However, we more frequently observe in children than in adults convulsions of varied intensity and distribution.

Nutrition is more and more impaired as the disease progresses, in isolated cases only, a temporary improvement may be observed.

The *end* of cerebral tuberculosis has been *death* before this. Ten days to two weeks, even three weeks may pass from the first appearance of tubercular meningitis to the completion of the process of the disease, attended by feverish motions characteristic of this condition and by cerebral symptoms, first with the character of excitement, later on with that of palsy.

The treatment of cerebral tuberculosis has been entirely insufficient before this. Let us hope that [45] it will be possible to effect a cure by means of Koch's new method.

Tuberculosis of the Kidneys is met with from the earliest childhood till old age. Most frequently the male sex is afflicted during manhood.

In most cases tuberculosis also exists in other organs, especially in the urinary and sexual apparatus. The existence of pulmonary or intestinal tuberculosis is not essential.

The symptoms of renal tuberculosis are of such general and indefinite character, that it is often impossible to fully determine the disease. Now, however, it will be more easily possible on account of Koch's discovery.

The *urine* may, but need not contain pus and blood. Sometimes small lumps are found in the urine.

Pains are only sometimes felt in the renal regions; *fever* may be occasionally attendant.

The disease lasts for months and years; though before now it has inevitably resulted in death, though it has in exceptional cases taken ten years or more.

The internal treatment of renal tuberculosis was ineffectual, surgical treatment has been attended with greater success. This consisted in removing the diseased kidney. Now good results [46] will possibly be attained by the application of Koch's method to cure and resource to surgery will be taken in exceptional cases only.

Tuberculosis of the suprarenal capsules is of very rare occurrence. It leads to a peculiar change in the color of the skin; the same turns dark brown or bronze color. Sooner or later death results.

Perhaps the application of Koch's method will, besides curing the disease, give us information regarding the functions of the suprarenal capsules about which nothing whatever is as yet known.

A large space in the realm of disease is claimed by *tuberculous affections of the bones and joints*. These afflictions appear particularly in childhood though manhood is by no means exempt. They may appear in all portions of the body, although a marked preference is shown for certain parts. Although the tubercle-bacilli are infinitely small, they possess the power to cause suppuration of the bones and joints and to produce acute inflammation of these parts.

Most frequently tubercular affections of the bones are found in the hip-joints, the knee and the spinal column.

Tuberculous inflammation of the hip-joint is principally a disease occurring in childhood; though [47] it rarely appears before the third year. It is most frequent from the fifth to the tenth year.

Inflammation of the hip-joint develops very slowly in children, it generally takes months before the slightest beginning symptoms reach a threatening appearance. The first sign is *lameness*; among laymen tuberculous inflammation of the hip-joints is known as "voluntary limping."

By limping we understand that mode of walking in which one leg is spared and by this the trunk is supported only a short time by one extremity and all the longer by the other. In every painful affection of the lower extremity limping results as the weight of the body increases the pain. The lameness in the case of diseased hip-joint has something peculiar about it, inasmuch as not only a part of the extremity but the whole of it is dragged. For this very reason parents of children afflicted with inflammation of the hip-joint use the expression "the child draws" or "drags the leg".

In the beginning even the examining physician finds no symptoms of disease in the joint. No swelling, no abnormal position, no restriction of the freedom of motion, no pain from pressure or while moving, in short nothing can be found that would otherwise indicate the beginning of an inflammation of the joints.

Yet *lameness only* is sufficient data from which we may infer the probable beginning of hip-joint inflammation. It is much better to overestimate the significance of this symptom than to miss the proper time for calling in the aid of a physician by placing too little confidence on it. [48]

The second symptom, *pain*, rarely attends the beginning of lameness, generally it comes several weeks later and in the case of very slow development of tubercularly inflamed hip-joint several months later. In very small children the attendance of pain is manifested by the fact that they will not play and they often wake up in the night and begin to cry.

Children from the fourth and fifth year upward definitely point out the hip as the seat of pain, sometimes, however, the knee-joint on the diseased side is designated with great determination. This pain in the knee has often been the cause of mistakes.

Later on painfulness of the hip-joint is experienced from pressure and at about the same time the movements are impeded.

Then the leg takes a peculiar position. The thigh is slightly bent and rolls outward. For convenience the child drops the half of the pelvis corresponding to the diseased hip-joint, and naturally raises the other half. From this apparently a curvature of the spinal column results in the lumbar region. Apparently only, for when the child is laid down and the morbid position of the thigh is restored the curvature of the lumbar column disappears. [49]

During the further progress of the disease the pain is increased, and the sensibility may become so acute that the slightest movement of the limb, even a shaking of the bed in which the patient lies will cause the most intense pain. In the previous stage walking could only be done for short distances and then awkwardly, now it is entirely impossible. Children are obliged to lie in bed night and day, and under these altered conditions there is a change of the position of the extremity. The increased sensibility induces the child to seek the medium position, the leg is bent more than in the position mentioned above, it is halfway straightened.

To this is added, that the child can not lie well on the sensitive and swollen hip; with right side hip-joint inflammation it turns on the left. As the diseased and bent thigh does not then rest on the mattress the same is placed on the healthy limb for support and for protection from movements, in the same manner as we lay one leg on the other in a healthy condition when we sleep on our side.

The actual danger to life in tuberculous hip-joint inflammation begins with the time when the child takes to his bed. The fatal end comes almost without exception after suppuration has commenced, very rarely before that time. Total suppuration of the hip-joint is an almost absolutely fatal process. If this suppuration sets in suddenly, it may result in an early death with attendance of acute fever. In other cases several weeks may elapse from beginning suppuration till death. [50]

A complete cure of tuberculous hip-joint inflammation may come about spontaneously. But often the knee remains bent and unserviceable for walking, so that crutches or machines must be used.

Even before this the beginning stages were treated with fair prospects of success, and it is a lamentable fact that in many cases the import of these seemingly trivial symptoms has been underestimated.

Rest is of the greatest importance during the very first stages of the disease in which the attending symptoms are of so indefinite a character that it is almost impossible to know whether hip-joint inflammation will develop or not; the child must not be allowed to walk. Aside from this the application of brine-, malt- and sea-water baths is advised. An abundance of nourishing food is of just as great importance. All this will also retain its significance in the future.

Formerly recourse to surgery has been taken during the later stages of the disease in which suppuration of the internal parts of the joint has commenced and large parts of the diseased bones may have become mortified. An incision is made into the joint, the same is exposed and all diseased portions are carefully removed. In the future this operation must probably also be performed, although with the difference that the prospects of success are now much more certain than formerly when relapses only too often followed the operation. [51]

Tuberculous inflammation of the knee-joint is, as said before, very frequent with children and is rather lingering in the beginning. Here also a slight dragging or limping of the diseased leg can be noticed. The child when asked about the limping, or of its own accord, complains of pain in the joint after walking or when the part is pressed; at first nothing abnormal can be seen on the knee by the layman.

On closer examination, however, by comparing the two knees it will be found that the grooves on each side of the patella, which give the healthy knee-joint the beautifully modeled shape, have nearly or quite disappeared; nothing more can be noticed.

The hinderance in motion may be so insignificant, that the children may slightly limp about for weeks and months and complain but little. Generally the physician is not called until the limb begins to hurt and swell after continued exertion.

The swelling which in the beginning is hardly noticeable is now more plainly visible, the knee-joint is evenly rounded and quite sensitive to pressure. [52]

If the disease is not now properly treated, its further course will be as follows: the patient may perhaps linger for several months; then comes a period when he must keep to his bed uninterruptedly because moving results in too much pain; generally the limb becomes more and more bent.

Now particularly painful points appear on the joint, especially on the inner or outer side or in the bend of the knee; on one of these points a soft portion distinctly develops, the skin becomes reddened and finally suppurates from the internal parts outward and breaks after a few months; thin purulent matter mixed with flakes is discharged. The pains now cease, and the condition is improved; but this improvement does not last; soon another abscess is formed and thus it continues.

Meanwhile perhaps two or three years may have elapsed; the general condition becomes greatly reduced. The child, formerly strong and healthy, has now become lean, the discharges of matter have often been attended by acute febrile attacks; the patient becomes exhausted, loses his appetite and digestion becomes more impaired from week to week. Even now a spontaneous change for the better is possible, though this happens very rarely; more frequently the disease progresses and leads to death from exhaustion resulting from severe suppuration and continual attacks of fever. [53]

Restoration to health is indicated by decreased suppurative discharges; the openings of the fistulae contract, the general condition is improved, the appetite is restored, etc. Finally the fistulae heal, the joint becomes fixed at an angle or bent or otherwise crippled, but painfulness disappears and the patient escapes with his life and a stiff leg. This is the most favorable result known to have been obtained in severe cases. The joint may become a solid bony immovable mass or may admit of slight movements. The whole process may last from two to four years.

The former treatment of tuberculous inflammation of the knee-joint was either of a general or a local nature. The general treatment was designed to strengthen and nourish, and will continue to be applied in the future.

The local treatment consisted in the application of salves, brushing with tincture of iodine, spanish fly plasters, wet and dry bandages. As with inflamed hip-joint absolute rest by lying in bed is of the greatest importance.

If after a certain period of rest and application of the above-named remedies no improvement in the state of health could be noticed, the diseased joint was laid in plaster or confined with splints. [54]

If even then, after such treatment for months, no improvement could be noticed but rather that the general state of health was reduced, nothing remained to be done excepting an operation, by which all the diseased parts of the knee-joint were removed, or amputation, that is, the taking off of the diseased limb. The latter method was generally adopted in the case of feeble and emaciated individuals and those who had passed the age of early manhood, as with these the removal of the diseased parts did not, as a rule, result in an improvement of the general condition, which was especially intended.

Now tuberculous inflammation of the knee-joint will be treated by Koch's method and in extreme cases only will operation be necessary. At all rates, an absolute cure will be easily effected.

Aside from the hip- and knee-joint the *spinal column* is most frequently attacked by tuberculosis. Here also it is the youthful age, from the third year upward, that has to suffer most from this serious disease. Adults are rarely attacked by it and with them it generally appears in connection with general tuberculosis.

The tubercle-bacilli penetrate into the substance of the vertebrae, destroy the same and transform it into purulent matter. As a result the destroyed vertebrae sink or rather settle down and cause a curvature of the spine, in other words a humpback. [55]

In the beginning the symptoms of diseased spine are very indefinite and misleading. The patient rarely complains of pain at first, and it is only noticed that the sick child easily tires of standing or walking and tends to hold on to chairs and similar objects with his hands to relieve the spinal column of the weight. From such uncertain data it is of course impossible to recognize the disease.

Only then when the softened vertebrae give way under the weight of the body, that is when the humpback begins to develop, can tuberculous inflammation of the spine be surmised with any degree of certainty.

As a rule two other characteristic phenomena appear which are dependent on the pain in the affected spinal column. The child, while standing, places his hand on the thighs and thus directly supports part of the weight of the trunk with the lower extremities; at the same time he avoids bending the spinal column forward. This anxious care for the diseased vertebrae is especially noticeable when the child attempts to pick up an object from the floor. While the healthy child

bends freely forward, the sick one crouches down and while bending the knee and hip keeps the spinal column as straight and stiff as possible. Frequently a small spot on the spinal column is found to be extremely sensitive to pressure in this stage; but such a subjective symptom must be considered with caution especially with children.

[56]

This humpback, which is a result of tuberculous inflammation of the spine, must not be confounded with the humpback caused by rickets. With the latter the curvature is more uniform as a rule, and in the start at least, disappears while in a horizontal position. Besides the humpback resulting from rickets appears between the first and fourth years of age, while tuberculous inflammation of the spine rarely begins before the fourth year. And finally rickets never causes suppuration while this is always the case with inflammation of the spine.

The progress of suppuration is downward as a rule and does not admit of examination until it gets near to the surface of the body; before this the feverish conditions toward evening are the only signs that indicate beginning suppuration. Ardent fever is not attendant during this time; the temperature does not exceed 38 or 38.6° C. and even such trifling increase of temperature may be wanting.

As soon as the skin is reached by the originally deepseated centres of suppuration, it gradually becomes red and later on also suppurated. If the skin is broken and the matter discharged, great care must be taken to keep the wound clean, as otherwise the suppurative cavities may suddenly become ichorous and lead to rapid death. In other cases this extreme result is not caused and fistulae are formed from which the ichor constantly flows. Small bits of mortified and broken off bones may be thrown out with the matter.

[57]

As a result of the sinking and settling of the vertebrae the spinal chord may suffer from pressure and contusion as it is contained in a channel formed by the vertebrae. Aside from certain pain it may result in paralysis of certain parts.

Formerly the diagnosis of tuberculous inflammation of the spine in its beginning stages was very uncertain. A great number of afflicted are at present cured by surgical treatment; in former times this was not possible, as the majority of patients died in whose case the disease had progressed to suppuration. But the curvature of the spine could not be removed by any former treatment and can not be by Koch's new method. Vertebrae once destroyed can in no way be restored to their normal condition.

Nevertheless the number of patients whose life is spared will be a still greater one and the number of complete cures will also be increased in a short time. Formerly tuberculous inflammation of the spine was treated as follows: the abscesses were opened and antiseptics carefully applied: mechanical apparatus and corsets were used to aid in a natural cure. These apparatus will surely be of inestimable value at the application of Koch's method.

As has been stated before tuberculosis may attack all other bones and joints and there cause the most serious derangement. Formerly these tuberculous afflictions were treated surgically or by means of iodoform, which has produced pretty good results in certain cases.

[58]

However it will certainly be possible to produce still better results with Koch's method of treatment, especially in the restoration of the functions of the afflicted parts. Here, as in all tuberculous affections, it is particularly essential to subject the respective case to treatment in as early a stage as possible and before incurable destruction of the tissues of the bones and joints have been caused.

A certain disease of the skin called *lupus* (ringworm) must be counted in with the number of diseases generated by the tubercle-bacillus.

Lupus may begin in two different ways. Either in the form of a purple spot, which is raised above the level of the skin and which has no definite limits but blends with the healthy parts; or as a slightly raised, moderately firm, darkred grain, sharply limited and about the size of a pinhead or millet seed.

If the disease has begun in the shape of spots, the afflicted portions of the skin gradually swell during the process of the disease. Several isolated knots appear around which the disease spreads more and more.

While the disease thus takes possession of greater area and develops new centers, a uniform scaling off of all knots begins.

[59]

After prolonged existence, sometimes after short duration, decay and casting off of the epidermis in its entire thickness supercedes the scaling process, and suppuration transforms the ringworm into an ulcer covered by a dirty-brown rind and disagreeably colored serum.

The ulcers of lupus are of various, generally irregular shape, the rims not hard, the ground flat and covered with purulent matter and decayed tissue; they are commonly surrounded by a faint reddish areola. These ulcers gradually become epulotic and form irregular, generally slightly protruding white scars in which new tubercles may appear.

Lupus appears most frequently in the face and especially frequent on the nose. Sometimes its

appearance is indicated only by an inflammation and swelling of the mucous membranes of the nose and at the same time a reddening of the epidermis. The nostrils are stopped up by a thin rind which, if torn off, is replaced by a thicker one below which an ulcer is formed that spreads with greater rapidity on the mucous membranes of the nose than on the external epidermis of the same.

Sometimes the whole process on the nose is so rapid, that very often the physician is not called to the patient, before a large part of the wing of the nose or of the nasal epidermis is destroyed and deep ulcers have developed under the rind. New tubercles of lupus are commonly noticed to spring up on the margins of these ulcers; the cartilage as a rule resists the progress of the disease for a longer period and may be unhurt, while the skin on the wing of the nose may be completely destroyed. [60]

Frequently the process is extended to the mucous lining of the hard palate and to the gums. Lupus generally appears on the lips in the same manner as in the nose. The upper lip especially appears very much swollen and covered with ulcers after a prolonged existence of the affection. Sometimes even the aperture of the mouth itself is reduced in size by the development of ulcers and scars on the surrounding parts.

If the process extends to the lower eyelid, the connective tissue as a rule becomes much swollen and reddened. The malady especially attacks the inner angle of the eye, destroys the entrance of the lachrymal duct, and from there the lupous tubercles appear on the connective tissue. Gradually tubercular formations develop on the cornea and sight becomes impaired.

On other parts of the face lupus generally appears in the form of small knots, about the size of millet seeds, which remain for a time then multiply and spread. The epidermis swells between these knots and irregular ulcers develop on a hard swollen and glossy ground, and are covered by dark brown rinds. [61]

Tubercles appear anew on the margins of the ulcers and in the spaces between them, isolated whitish spots of sunken or raised scab tissue are observed on which very frequently lupous tubercles again develop.

Lupus appears on the throat, neck, back, breast, and the extremities, most frequently in serpentine form i. e. swellings of the skin develop, being arranged in curves, they progress in the same manner, these are transformed into just so many ulcers. Between these whitish scarred spots are noticeable on which small red lupous tubercles again appear.

Lupus is more frequently found on the extremities than on the trunk. The surface of the skin is found to be tense and glossy on a firm base which is affected by lupus.

Deep ulcerous formations of lupus are sometimes observed on the fingers and toes, particularly on the finger-joints, these may at times penetrate into the inner parts of the joints, secreting whitish pus and covered with a thick rind.

As regards the difference between lupus and syphilitic diseases it has been found that lupus commonly develops before puberty while syphilis appears in the mature age. [62]

The ulcers of lupus are often round like those of syphilis with sharply defined margins, but at the same time they are flat accompanied by little or no pain; rim and base of the same are loose, red, rank, and bleed easily. On the other hand syphilitic ulcers are very painful and rim and base are covered with greasy matter.

Lupus appears only in the form of knots, which are deeply inbedded, from size of a pinhead to that of a lentil, but never as large knots in the beginning. Syphilis produces large and palpable knots from the start.

Loss of the bony part of the nose or destruction of the hard palate are observed, but rarely and after protracted existence of lupus, and often in the case of syphilis.

The indicated peculiarities however refer only to typical cases of lupus and of syphilis. In other cases it was almost impossible to show a difference.

As regards the course of lupus, the same begins, as has been stated before, in earliest childhood, sometimes only in the form of scaly spots and knots. Less often lupus develops after complete development of manhood. It is more frequent with women than with men. Sometimes some of the knots remain isolated and disappear again after a time; in other cases additions appear in the course of time, which may affect larger portions of the body and lead to more or less dangerous ulcers. As a rule the course of lupus, even of great extent, is not malignant and at the most the alliance with *traumatic erysipelas* and possibly the appearance of *pulmonary consumption* may succeed the affliction. In cases of not too rare occurrence it has been observed that lupus has developed into *cancer*, which has always resulted fatally. [63]

The *treatment* of lupus has principally been a *local* one. Caustics were applied to destroy lupous tubercles by direct action, and furthermore recourse has been taken to the so-called mechanical treatment, in which the ringworm was scraped out.

Our experiences relating to the mechanical treatment of lupus have taught us the following.

Lupus can not be cured without destroying and removing the diseased and affected tissue. That method which effects the most radical destruction, protects most from relapses. Therefore the best method of treating lupus is to cut out the diseased skin. But with the superficial spreading peculiar to many cases of lupus this method can only be applied within certain limits. Then again the secondary growths after an operation may be of serious consequences. [64]

Unfortunately it has not been possible before this to remove all diseased portions, no matter what method was applied, because often tiny lupous tubercles spring up which are almost invisible to the naked eye. These tubercles will again be the starting point for another spreading of lupus.

We will see that Koch's new method to cure has the advantage both to make visible all tubercles, even those that have escaped our notice and also to effect a cure in the shortest time even in old chronic cases that have before this been considered incurable. It is especially possible in this form of tuberculosis to follow the specific action of the new remedy, as we will learn later on.

Tuberculosis of the testicles is not so very rare, it is found in about 2½ per cent. of all men afflicted with pulmonary consumption. It is more rarely met with in children than in men.

The conditions under which tuberculosis of the testicles and epididymis develops are various inflammatory processes with existing disposition. It is mostly gonorrhoea or some other inflammation of the urethra, or injured testicle. It occurs less frequently without any apparent cause.

According to the starting point of tuberculosis the symptoms are varied. If it starts in the testicle, this appears normal or larger in size, but never reaches extraordinary dimensions. The surface of the testicle is at first smooth in the case of increased tension, later only does it become irregular, bumpy and of unequal consistency. [65]

If the starting point is in the epididymis, hard, rounded lumps are formed generally in the head or tail of the epididymis, rarely in the body. These increase in size and cause a swelling often of extraordinary dimensions, the surface of which appears hard, irregular, bumpy and in certain parts yielding and elastic. If the process is extended to the testicle, this also increases in size. Then both together form an oval swollen mass and can not be distinguished from each other.

Striking changes appear only later and consist in the softening of the lumps and in the development of abscesses.

Very soon the lobuli are affected. The same are then thickened in the septa, are hard and form an irregular, bumpy swelling surrounded by more or less thickened tissue.

Very soon tuberculous changes are caused in the prostate gland, an organ situated near the intestine and the functions of which are to dilute the semen. A hardening is often the first sign, this is followed by increase in size and then softening. [66]

With the affection of the prostate gland, that of the urethra also begins, which passes through the middle of the prostate gland. This disease often appears in the form of a yellowish secretion, which is more and more increased and becomes ichorous with the decay of the urethra and the prostate gland. This secretion must be distinguished from that which as a venereal affection caused the whole process. The tubercular derangements do not only extend forward but also upward. The bladder, the ureters and the kidneys are affected and show extreme derangements with altered urinal secretions and excretions.

Of other symptoms of tuberculosis of the testicles pain deserves especial mention. The same is slight in the beginning, but often becomes insufferable.

The symptoms here related often increase very slowly. Essential changes are caused during the chronic course of tuberculosis of the testicles if suppuration sets in. The skin is perforated and fistulae are formed. If there is no halt in the process, general tuberculosis results and this has until now always caused death.

According to the time in which the general derangements come about, a chronic and acute tuberculosis of the testicles has been distinguished. The former is the more frequent, the latter of rare occurrence. [67]

The sexual functions may remain unchanged if only one testicle is diseased, but are generally ruined if both epididymes are affected, because the secretion of the semen is then interrupted by the stopping up of the vas deferens. In some cases the sexual function may be interrupted for a time only and may then be resumed.

The treatment before this has been surgical, in which the diseased parts were carefully removed, and where this was impossible, even castration (removal of the testicle) was performed. Without doubt Koch's method will cause great changes in the method of treatment here also.

Finally we must include in our reflection the well-known disease of children, *scrofula*. Although the same is not a form of tuberculosis in the sense of the diseases just considered, still tuberculosis and scrofula have the most intimate relations. Scrofula is only too often a precursory

stage of tuberculosis.

The manifold scrofulous affections, such as inflamed eyes, diseased ears, skin diseases, catarrh of the nose, pharynx or bronchials, inflammation of the joints and suppuration are not caused through the cooperation of tubercle-bacilli. But here the same find an excellent soil for growth and propagation, and they use the same to the full extent and so give the impetus for the development of tuberculosis. [68]

Scrofula is one of the most frequent diseases, it is spread over the whole world. It occurs more seldom in the tropics than in the north. Furthermore it is more frequent in a cold and damp climate than in a dry one. Elevation has no influence on the development of this disease. Scrofulous individuals are found in the mountains as well as in the plains.

Scrofula principally attacks children; it occurs most frequently in the time from the second to the fifteenth year. Rarely earlier developed scrofula drags beyond the age of puberty or more advanced manhood. Sex has no particular influence on the development of scrofula.

In many cases this particular disease is *inherited*. The following causes are considered in the inheritance of scrofula: great age, close relationship and infirmity of the parents; but the germ of scrofula is planted in the child by parents that are themselves afflicted with tuberculosis or scrofula. This is most frequently observed in children that have descended from parents, who were scrofulous in their youth and remained so, or that became tuberculous later on and at the time of generation were afflicted by advanced scrofula or tuberculosis, or that were suffering from oft-treated but never entirely cured syphilis. Some scientists claim to have observed the inheritance of scrofula by children, whose parents at the time of generation were afflicted with tuberculosis or were suffering from general debility resulting from hunger and want. [69]

In the majority of cases scrofula is acquired, as a rule the development of this disease is favored by indigence and poor hygienic conditions according to the coinciding experience of all scientists; *nutrition*, especially in the first year of life, has the greatest influence on the origin of scrofula.

In *infancy* the most frequent cause of scrofula is the premature giving of *farinaceous* food besides the mother's milk, or the feeding of children with so-called pap, especially when this is done in the *first month of their life*.

In later months the excessive eating of bread, potatoes or vegetables instead of milk has an injurious effect.

Furthermore the development of scrofula is favored by the breathing of *foul damp air* such as is frequently found in newly built or damp houses and also by *deficient care of the skin*.

Scrofula thrives in the narrow tenement dwellings in which is found a close, overheated, foul air pregnant with smoke, kitchen fumes and mustiness from the damp walls.

Frequently the development of scrofula has been observed to succeed measles, diphtheria, scarlatina or whooping-cough. [70]

The opponents of vaccination also designate vaccination as a frequent cause of scrofula. It is supposed that a poison is transferred into the system with the lymph which is enabled to generate the phenomena of scrofula. However the supposition has not as yet been proven.

Of course the fact cannot be denied, that cases of developing scrofula have been at times observed as succeeding vaccination. But the circumstances are the same as in the case of the contagious diseases mentioned above. No one will probably maintain that in those cases in which the development of scrofula had been succeeding those diseases, that this has resulted from a poison generated by the preceding disease.

The attempt to designate symptoms by which to recognize a scrofulous constitution has at all times been made. Many physicians have for a long time distinguished a *torpid* and an *erethistic* scrofulous constitution.

With a *torpid* constitution the body is pale, spongy and bloated, the nose and lips are thick, the abdomen swelled, there is plenty of fat and but weak muscles. Such children are indolent, at times peevish and indifferent, they do not sleep quietly, have no appetite or may be voracious and suffer from derangements of digestion. An examination of all organs indicates no change. The children are easily afflicted with eruptions of the skin, with inflammation of the eyes and ears, and catarrh of the mucous membranes, which are characterized by great obstinacy. The derangements in nutrition here described are caused by the lymphatic glands though a swelling of the same can not be found. [71]

In the case of *erethistic* scrofula the children are found to be of slight and lean structure, with fine hair and long eyelashes; they are active, easily excited, gifted and extremely sensitive to physical pain. The face is pale and becomes easily flushed by physical or emotional excitements. They are easily subject to palpitation and short breath; and are attacked by high fevers from the slightest reason. The lymphatic glands, especially the deepseated ones, are as a rule more or less swelled.

In most cases, however, the characteristics of these two forms are blended.

The phenomena of scrofula are manifold and extend over the entire body.

The *skin* is frequently the seat of scrofulous affections. These are particularly found on the head and face and are characterized by great obstinacy and tendency to return.

Most frequently herpes appear, the parts especially affected are the scalp, face, auricular passages, eyelids and the nose with its surrounding parts. [72]

Pustules are sometimes developed under the skin and may appear in great numbers. These pustules may either break through the skin or shrink into a caseous mass.

Of all *mucous membranes* that of the *nose* becomes most frequently diseased; in a great number of cases this happens in the form of a chronic catarrh; the mucous membrane of the nose is reddened and swollen and a profuse, thick, purulent, ichorous and easily drying fluid is secreted. Often the external parts of the nose are swollen as a result of the catarrh and the nostrils are stopped up with thick yellowish-green rinds. Inflammation of the skin is caused by the flowing out of the purulent and ichorous liquid secreted.

In many other cases the disease appears in the form of scrofulous ulcers on the mucous membranes of the nose; in such cases it is found that the nose is stopped up with numerous yellowish brown crusts; after removing the same the mucous membrane appears swollen and moderately reddened, on several places ulcers, the size of lentils, are found which are covered with a yellowish gray coating. At the slightest touch bleeding of the nose is caused; often also the external parts are reddened and swollen. In such cases erysipelas frequently develops, starting from the nose and spreading over the whole face. Frequently a repetition of erysipelas occurs. [73]

The scrofulous catarrh just described is generally of a very protracted nature and is marked by many relapses. Sometimes the fluid secretion of the nose is of very bad odor.

The mucous membrane of the *throat* becomes diseased at the same time as that of the nose. The same is found to be moderately reddened and swollen; the lymphatic glands especially those on the posterior wall of the throat are increased to swellings the size as large as peas. The *tonsils* also become inflamed frequently and become enlarged through the repeated rather chronic inflammation.

Inflammations of the ear are a common occurrence with scrofula. These originate most frequently by means of the eustachian tube, which connects the ear with the back part of the mouth as a result of the catarrh of the nose and throat. In a majority of cases the inflammations of the ears lead to perforation of the tympanum and may even result in fatal cerebral meningitis.

The *eye* is as frequently affected by scrofula. Swelling of the lids and inflammation of the glands are the lighter forms. Pustules on the connective tissue of the eye and on the cornea, accompanied by photophobia, cramp in the lids and flowing of tears are those severe forms that are so frequently observed in scrofula, and that often leave opaque and incurable spots on the cornea of the eye. [74]

Swelling of the *glands* has at all times been a characteristic phenomenon of scrofula. A swelling is merely the result of diseases of the mucous membrane of the throat or nose, of herpes of the scalp or face, of inflammations of the ears, eyes, periosteum, bones, etc. In the beginning the swelling of the glands is painless and results in flat swellings of about the size of filberts, which may be moved back and forth; such glandular swellings may exist for years, without showing the slightest alterations.

With renewed attacks they enlarge and may become of considerable size. At times single glands become inflamed, hurt when pressed and develop abscesses which perforate the skin after it has become inflamed and reddened.

These abscesses may heal within a few days. In the majority of cases, however, they remain for a longer period, months and even years and result in the well-known tumid, hard and immovable scars.

Inflammation of the periosteum and of the bones is one of the instances of scrofula. Most frequently *spina ventosa* is found; the same consists of a gradual, painless swelling of the diseased bones, most frequently on the fingers and toes, so that they become bottle-shaped. The skin covering these swellings is pale and tense. The swelling may gradually disappear or begin to suppurate. Besides this hip- and knee-joint inflammation are observed, also inflammations of the ankle, elbow-joint, spine, etc.; especially in the case of diseased bones it is extremely difficult to fix a dividing line between scrofula and tuberculosis. [75]

The frequency of anaemia with scrofula is only a *result* of the disease and not a symptom. As a result of scrofula nutrition and assimilation become impaired, mostly in the cases of extreme suppuration.

Scrofula is a chronic disease. In many cases it is completely cured, the lighter cases after several months and the more malignant after several years. Extreme scrofula may often remain until

puberty and may be completely healed.

Fatal results are due to scrofulously diseased bones, joints or glands, and it can not be denied that a large number of children succumb in this manner. Fatal results may also be due to additional diseases, such as pneumonia, pleurisy, intestinal catarrh, etc.

It has been frequently observed that *tuberculosis* succeeds scrofula. It is a well-known fact that scrofula furnishes the largest contingent for tuberculosis.

As a precautionary measure against scrofula a careful regulation of the diet is recommended. [76]
During the first nine months of life children should be fed with human milk exclusively if possible. If scrofula is hereditary in a family, or if the mother exhibits symptoms of the disease, she should not be allowed to nurse the child but a strong and healthy nurse should be engaged. Recourse to artificial nourishment must only then be taken, when nursing the child is absolutely impossible. For this purpose exceptionally pure cow's-milk ought to be selected. All substitutes, that appear under various names, such as infant's food, condensed milk, etc., contribute much toward the development of scrofula.

Children 1-2 years of age are to be fed with milk, meat and eggs. Only strong children, that show no sign of scrofula may be fed once or twice a day with small quantities of rice, tapioca, sago, green vegetables, pulse, etc., beside the food above mentioned.

To prevent scrofula it is essential not to give the food of adults to children during the first years of life; avoid exclusively solid food and prepare the same in a pappy form as much as possible. Of course a proper regulation of meal-time and a careful avoidance of overfeeding is by all means to be observed.

It is of no less importance for a successful treatment of scrofula to provide surroundings of as [77]
favorable conditions as possible.

First of all *pure air* containing plenty of *oxygen*. Therefore the *sea-coast* is recommended as a proper place for scrofulous children. The children ought to stay there until the signs of scrofula have disappeared and the entire nutrition has been improved. The results obtained in the sanitary stations (vacation colonies) along the sea-shore for scrofulous children have received much favorable comment.

Mountain air has a similarly favorable effect especially when *salt water baths* are used at the same time; even the plain, pure *country air* proves beneficial to scrofulous children. *Very dry* locations and dwellings ought to be selected. The children should remain *out of doors* as much as possible.

Of great importance for scrofulous children, furthermore, is a suitable course in *gymnastics and rubbing-down with cold water*. To begin with the water may be 72° but should gradually be reduced to the natural temperature of well water.

Just how far Koch's new method will take the place of former remedies used for scrofula can not be told at present as experiments in this direction are wanting. Nevertheless it will be possible to prevent the dangerous transition of scrofula into tuberculosis and thus save the lives of a great many persons.

Anyone who has informed himself through the foregoing as to the great number of diseases and [78]
forms of disease that are directly or indirectly connected with tuberculosis, will now be able to estimate the farreaching import of Koch's discovery. It will now be clear to him that pulmonary consumption constitutes only a part, although a great part of tuberculosis and that there are a great many diseases besides that can now be surely cured, it is hoped, with the aid of Koch's method. But this much should be remembered by everyone that this remedy also acts best and surest during the *beginning* of a disease. We hope that no one will allow valuable time to slip unimproved; it may easily happen that it is too late for successful treatment. Everyone will be able to recognize the symptoms of diseases, which Koch has taught to cure, from the foregoing complete description, and it is better to apply the remedy once too often than miss the proper time for application.

Koch's first communications relating to the subject have just been published and will be given unabridged in the following pages. As these communications are written for physicians we will add such explanatory notes as are deemed essential for general intelligence.



DR. KOCH IN HIS LABORATORY

THE FIRST COMMUNICATION

Relating to a Method to Cure

TUBERCULOSIS,

BY

Prof. R. KOCH, Berlin.

In a lecture, delivered by me several months ago, at the International Medical Congress, I referred to a remedy, which makes animal subjects impervious to the inoculation of Tubercle-bacilli, and in the case of diseased animals, checks the progress of the tuberculous disease. In the meantime experiments have been made with human subjects, about which I will report in the following.

Originally I intended to complete my investigations and especially gain sufficient experience concerning the practical application of the remedy and its production on a larger scale before I published anything concerning it. In spite of all precautions too much has already been published about it, and that distorted and exaggerated, so that I was obliged, in a way, to prevent false conceptions, to give even now a synopsis of the method as far as it has progressed at the time being. Under present circumstances it must necessarily be short and leave unanswered many important questions.

The experiments have been, and are still being made under my direction by Dr. A. Libbertz and Stabsarzt Dr. E. Pfuhl. The necessary subjects and material have been provided by Prof. Brieger from his Polyclinic, Dr. W. Levy in his Private Surgical Clinic, Geheimrath Fraentzel and Oberstabsarzt R. Koehler in the Charite-Hospital, and Geheimrath Herr v. Bergmann in the Surgical University Clinic. To all these gentlemen and their assistants I here tender my heartfelt thanks for their untiring interest which they manifested for this subject and also for the disinterested help and aid which they have offered at all times and without which it would have been impossible for me to make such progress in a few months in this difficult and responsible investigation.

As my work is far from being completed, I can not as yet make any statements relating to the origin and preparation of this remedy and reserve these for some future time.^[1]

The curative is composed of a clear brown fluid, which in itself is not perishable, even without special precautionary measures. For use this fluid must be more or less diluted and these dilutions are perishable when made with distilled water; Bacterian vegetation soon develops in them and they become turbid and are no longer fit for use. To prevent this the dilutions must be sterilized through heat and be kept under cotton batting or be prepared with a 5 per cent. phenol solution which is much simpler. Through repeated heating as also through the mixture with the phenol the efficiency of the diluted solution appears to be curtailed after a time and for that reason I have always used solutions as fresh as possible.

The remedy does not act through the stomach; to effect a reliable action it must be applied subcutaneously. For our experiments we have exclusively used a syringe decided upon by myself for bacteriological purposes, which is supplied with a small india-rubber ball and which has no stamp. Such a syringe can be easily kept positively aseptic by rinsing with absolutely pure alcohol and on this we base the fact that not a single abscess has sprung from over a thousand injections.

[c1]

[c2]

[c3]

After trying various parts of the body as places for application we selected the skin of the back between the shoulderblades and in the lumbar region, because at these places the injection was almost painless and caused the least and in most cases no local reaction.

Even at the beginning of our experiments we found that in one particularly important point the human subject was affected by the curative in a way decidedly differing from that of the animal subject generally used, the guinea pig. Therefore another confirmation of the rule for experimentors upon which hardly enough stress can be laid, not to rely upon a like effect upon the human being from the experiments on the animal without further confirmatory inquiry. [c4]

Man proved himself much more sensitive to the effects of the remedy than the guinea pig. Up to two cubic centimeters and even more of the undiluted fluid could be injected under the skin of a healthy guinea pig without causing any particularly disparaging effect. In the case of a fullgrown man on the other hand, 25 ccm. are sufficient to produce intense results. In proportion to weight of body therefore $\frac{1}{1500}$ of the amount which has no noticeable effect on the guinea pig has a decidedly strong effect on the man.

From an injection that I have made on my upper arm I have experienced the symptoms which arise in man after an injection of 25 ccm., in short they were the following: Three or four hours after the injection a raking pain in the joints, languor, inclination to cough, oppressed breathing, which rapidly increased; in the fifth hour I experienced intense chills which lasted nearly an hour, at the same time nausea, vomiting, increase of the temperature of the body to 39.6° C. After about 12 hours all these affectations ceased. The temperature sank and reached the normal height the next day. Heaviness of the limbs and languor lasted for a few more days, and for the same length of time the place of injection remained red and painful. [c5]

The lower limit of effect of the curative for a healthy man is about .01 ccm. (= 1 cubic centimeter diluted with a 100 parts) as numerous trials have shown. The majority reacted on this dose with only light pain in the joints and passing languor. With a few a slight rise in temperature set in, to 38° C. or a trifle higher.

Although there is a marked difference as regards the dose of the curative (according to relative weight of body) between the animal subject and man, an evident resemblance is shown in several other qualities.

The most important of these qualities is *the specific action of this remedy on tuberculous processes of whatever kind they may be*. I will not relate the effects on the animal subject in this connection, as it would lead too far, but will at once turn to the peculiar effects on tuberculous human beings.

As we have seen, a healthy man reacts but little or not at all on .01 ccm. The same is true of diseased persons, provided they are not tuberculous. But the relations are entirely different with those afflicted with tuberculosis; a marked general and also a local reaction resulted from an injection of the same dose of the remedy (.01 ccm.)^[2]. [c6]

The general reaction consists of an attack of fever, which, beginning mostly with chills, raises the temperature to over 39°, often up to 40° and even 41°. Other noticeable symptoms are pains in the joints, a tendency to cough, great languor, and often nausea and vomiting. Several times we observed a faint icteric coloring and in some cases the appearance on neck and breast of an exanthema resembling measles. As a rule the attack begins 4-5 hours after the injection and lasts 12-15 hours. In exceptional cases it may begin much later, but then it is not nearly so intense. The patients experience remarkably little weakness from the attack and feel relatively well as soon as it is over, generally better than they did before it came on.

The local reaction can best be observed on those patients whose tuberculous affection is plainly visible, for instance those afflicted with lupus. In them changes take place that prove the specific antitubercular action of the remedy in a most surprising way. The diseased portions of the skin in the face, etc. begin to swell and turn red even before the attack of chills set in, although the injection is made under the skin of the back, a point decidedly remote from the affected parts. The swelling and reddening increases during the fever and can attain a very marked degree so that the lupus-tissue turns reddish brown and necrotic. In the case of more sharply defined lupus centres the more swollen and dark red parts were edged by a white seam nearly a centimeter wide and this again was surrounded by a wide bright red border. The swelling of the diseased parts gradually decreases after the cessation of fever and may have entirely disappeared after 2 or 3 days. A serum exudes from these lupus-centres and, drying, forms a crust on them which changes into scabs that fall off in 2-3 weeks and sometimes leave a smooth red scar after a single injection. Generally several injections are necessary to effect a complete removal of the lupus tissue, but of this I will speak further on. It is very important to note that the changes during this process are exclusively limited to the portions of the skin affected by lupus; even the faintest and smallest bits of diseased tissue go through the entire process and become visible on account of their swelling and reddening, while the actual scab-tissue in which the various stages of lupus have been completed remains unchanged. [c7]

The observation of the treatment of lupus with the remedy is so instructive and must be so convincing as regards the specific nature of the remedy that every one wishing to occupy himself [c8]

with the study of this remedy should if possible make his first experiments with lupus.

Less marked, but still apparent to the eye and touch are the local reactions in tuberculosis of the lymphatic glands, of the bones and joints, etc., in which case swelling and increased painfulness, and in the more superficial parts also a reddening can be observed.

The reaction in the inner organs, especially the lungs is removed from our observation unless we consider the increased coughing and expectoration of the patients after the first injection a local reaction. At the same time we must assume that these parts undergo changes directly observed in the case of lupus.

The different forms of reaction described have appeared without exception in previous trials on the dose of .01 ccm. when any form of tuberculosis prevailed in the system, and therefore I trust that I am justified in assuming, that in the future this remedy will constitute an indispensable diagnostic auxiliary. We will be enabled to diagnose in doubtful cases of phthisis even then, when it is impossible to obtain reliable information concerning the nature of the ailment, by the presence of bacilli or elastic fibres in the sputum or by a physical examination. Glandular affectations, hidden tuberculosis of the bones, doubtful tuberculosis of the skin and the like will easily and reliably prove to be such. In case of apparently completed processes of tuberculosis of the lungs or joints it will be possible to show whether the process of the disease is in reality a complete one or establish the existence of centres from which later on the disease may spread like a fire from a live coal in the ashes.

[c9]

But much more important are the specific qualities of the remedy than the aids it offers for the diagnosis.

While describing the changes, that are caused by hypodermic injections of the remedy, on the parts of the skin affected by lupus, attention was called to the fact that the lupose tissue does not return to its original condition after the swelling and reddening have ceased, but is more or less destroyed and disappears. On some places, as observation teaches, the process is such, that after a single injection the diseased tissues undergo mortification and are cast off as dead matter later on. On other places it seems that a diminution or rather a kind of melting of the tissue is caused, and to effect a complete disappearance a repeated application of the remedy is necessary. As the required histological investigation is wanting, it is impossible at the present time to state with certainty how this result is brought about. Only this much is known that it is not a destruction of the tubercle bacilli, but that only the tissue containing the tubercular bacilli is affected by the application of the remedy. In this, as the visible swelling and reddening show, greater circulatory derangements are caused and with these vital changes in the *assimilation* which result in a more or less rapid and thorough mortification of the tissue according to the manner in which the remedy is allowed to act.

[c10]

To make a short repetition, the remedy therefore does not destroy the tubercle bacilli, but the tuberculous tissue; on dead tissue, for instance, gangrenous cheesy matter, necrotic bones, etc., it does not act; nor on tissue that has undergone mortification through the action of the remedy itself. Living bacilli can still linger in such dead masses of tissue, which are either cast out with the necrotic tissue, or may possibly migrate under special conditions into the adjoining living tissue.

This quality of the remedy must be particularly observed, if its full specific action is to be obtained. Therefore we must first cause the mortification of the tuberculous tissue, and then effect its removal as soon as possible, for instance, by means of a surgical operation; but where this is impossible and the excretion by the organisms themselves is necessarily slow, we must attempt by continued application of the remedy to protect the endangered living tissue from the immigration of the parasites.

[c11]

As the remedy acts only on living tissue and causes mortification of tuberculous tissue, we can readily explain another exceedingly peculiar property of the remedy, namely, that it can be given in rapidly increased doses. This may apparently be explained as being based on inurement. But noting that in about three weeks the dose may be increased to 500 times the strength of the first one, it is unquestionably something more than habit, as we know of nothing analogous confirming such a rapid and farreaching adaptation to any powerful drug.

This fact can rather be explained thus: in the beginning there is an abundance of living tuberculous tissue and only a minute quantity of the effective substance is sufficient to cause a strong reaction; through each injection a certain quantity of this responsive tissue disappears, and then relatively larger doses are required to cause the same degree of reaction as before. Aside from this adaptation may assert itself within certain limits. As soon as the patient is treated with such increased doses, and that he reacts no more than one not afflicted with tuberculosis, we may assume that all the reactive tuberculous tissue is dead. It is then only necessary to continue the treatment at intervals and with gradually increased doses as long as any bacilli remain in the system, to protect the patient from a new infection.

[c12]

It remains to be learnt in the future whether this conception and the deductions based thereon are correct. For the present I have directed the manner of application of the remedy on this basis, which in our experiments resulted as follows:

To begin again with the simplest case, namely lupus, we injected the full dose of .01 ccm. in nearly all such patients to begin with, and allowed the reaction to take its full course, after 1-2 weeks we again injected .01 ccm. and so forth until the reaction became less and less and finally ceased. In the case of two patients with facial lupus three respectively four injections in this manner resulted in a clean, smooth scar in place of the affected parts; the remaining patients of this kind have also improved in a measure proportioned to the time of treatment. All the patients have suffered from their afflictions for years and have been treated by various methods without success.

Tuberculosis of the glands, bones and joints has been treated in a very similar manner, as in these cases larger doses were applied at longer intervals. The result was the same as with lupus, a rapid cure in the lighter and milder cases and a slowly progressing improvement in the severer ones.

With the majority of our patients, those suffering from pulmonary consumption, the conditions are somewhat different, patients with decided pulmonary tuberculosis are very much more responsive to this remedy, than those afflicted with surgical tubercles. We were forced to reduce the quantity of the first dose of .01 ccm. as prepared for the phthisicist, and we found that as a rule he reacted strongly on a dose of .002 and even .001 ccm., but that the quantity could be rapidly increased from this low initial dose to that which could be easily tolerated by the other patients. We generally proceeded in such a manner that the patient at first received an injection of .001 ccm. and if a rise in the temperature set in this dose was repeated once daily until the reaction ceased. Only then the dose was increased to .002 ccm. and applied till the reactions failed to appear. And so forth, always increasing the dose only .001 or at the most .002 up to .01 ccm. and higher. This mild procedure seemed to me imperative, especially with such patient as were in a weak and feeble condition. Proceeding in the manner just described we can easily attain the application of very light doses with but slight attacks of fever and hardly perceptible to the patient. Some of the stronger consumptives were treated with larger doses from the beginning, partly with a forced increase in the dosing when it seemed as though the favorable result was obtained in a correspondingly shorter time. The action of the remedy on the phthisicist generally seemed to be such that cough and expectoration increased somewhat after the first injection, then gradually diminished and in favorable cases disappeared entirely; the sputum lost its purulent nature and became slimy. The number of bacilli as a rule did not decrease until the sputum had attained a phlegmy appearance (only such patients were selected for these experiments in whose expectorations bacilli were contained). They entirely disappeared temporarily, but were again met with from time to time until the expectoration had completely stopped. At the same time the night-sweats left off, and the patients improved in appearance and gained in weight. All patients treated in the first stages of phthisis were freed from all symptoms of disease in the course of 4-6 weeks so that they could be considered as cured. Even patients with cavities not too large were considerably improved and nearly healed. But in the case of such consumptives, whose lungs contained many and large cavities no objective improvement could be marked, although the expectoration diminished and they appeared to feel much better. I am inclined to assume on the basis of these experiences, that the *earliest stages of phthisis can with certainty be cured by this remedy.*^[3] This may also hold good in cases that are not too far advanced. [c13] [c14]

In exceptional cases only will pulmonary consumptives, with large cavities, derive continued benefits through the application of the remedy, when other complications exist, for instance, the penetration of other suppurative micro-organisms, irremovable pathological changes in other organs, etc. Even such patients were in most cases temporarily improved. It must follow that even in them the original process of the disease, tuberculosis, is influenced in the same manner by this remedy as in other patients, but that it is impossible to remove the gangrenous masses of tissue and also the secondary suppurative processes. Naturally we are led to think that perhaps in some of these severe cases cures may be effected by means of a combination of this healing process together with surgical aid (after the manner of operating empyema) or some other curative means. I would not advise anyone however, to apply this remedy without discrimination in every case of tuberculosis. The simplest mode of application will certainly be required in treating the first stages of phthisis and simple surgical affections, but in all other forms of tuberculosis medical science should draw on all its resources and individualize carefully to supplement and sustain the action of the remedy. In many cases I have had the decided impression that the attendance to and nursing of the patient was of no little influence on the curative process, and therefore I would prefer the application of the remedy in suitably adapted institutions, where a close observation of the patient and the adequate attention to them is possible, to the ambulant or home treatment. No estimate can at present be made as to the extent in which a profitable combination can be made between this new method to cure and those modes of treatment that have thus far been considered beneficial, the application of mountain climate, the free air treatment, specific nourishment, etc.; but I trust, that these remedial factors will be of considerable use in conjunction with the new method in many cases, especially the severe and neglected as also in the convalescent stages.^[4] [c15] [c16]

The nucleus of this new curative method lies in the earliest possible application. The proper objects of treatment ought to be the first stages of phthisis, because here the remedy can fully

develop its curative qualifications. Therefore it is of vital importance, more so in the future, than it has been in the past, that practical physicians employ all possible means to diagnosticate phthisis in as early a stage as possible. Until lately the finding of tubercle bacilli existing in the sputum was rather considered as an interesting incidental evidence, which, although it insured the diagnosis, was of no further benefit to the patient and therefore was only too often omitted, as I have only lately discovered in numerous cases of phthisis which had passed through the hands of several physicians without having their sputum examined once. This must be different in the future. Any physician who fails to search for tubercle bacilli in the sputum, to establish phthisis in as early a stage as possible, commits gross negligence toward his patient, because his life may depend on this diagnosis and the specific treatment which has hurriedly been introduced on this basis. In doubtful cases the physician should gain certainty as to the existence or absence of tuberculosis through a trial injection. [c17]

Only then will the new mode of treatment truly become a panacea for suffering mankind when that period is reached, where all cases of tuberculosis are treated in as early a stage as possible, to prevent the development of neglected severer cases which have heretofore formed a continual unlimited source of new infection.

In conclusion I would remark, that I have intentionally omitted all numerical statistics and descriptions of individual cases in this communication, because the physicians to whose material the patients provided for our experiments belonged, have themselves undertaken the description of their respective cases and I did not wish to anticipate them in an objective representation of their observations.

[1] Physicians who wish to experiment with the remedy, can get the same of Dr. A. Libbertz (Berlin, N. W., Lueneburgerstrasse 28 II.), who has undertaken the production of the remedy with Dr. Pfuhl's and my assistance. But I must state that the present stock is very limited, and that larger quantities can only be disposed of at the end of several weeks. [c18]

[2] We gave children of 3-5 years of age one tenth of this dose, that is .001 and very weak children .0005 ccm. and obtained a strong though not alarming reaction.

[3] This statement is necessarily confined in so far as we have no conclusive experiences, and can not have at present, that show whether the cure is a permanent one, recidivations of course are not excluded for the present. But we may assume that these will be removed as easily and quickly as the first attack.

On the other hand it is possible from analogy with other infectious diseases that those who are once cured become permanently exempt. This must also be considered an open question for the present.

[4] It was impossible to collect data referring to cerebral-laryngeal- and miliary-tuberculosis, as we did not have sufficient material.

[c19]

Explanatory Notes.

Koch states that he can not at the present make any statement about the origin and preparation of the remedy, as his labors are not yet completed.

We may assume that it is very probably a substance that corresponds in a way to the lymph used for vaccination. As vaccine lymph represents variolous poison greatly reduced in strength, as the remedy for hydrophobia is composed of a substance which is weakened hydrophobic poison, so Koch probably obtains his remedy for tuberculosis by artificially reducing the tuberculous poison by means of various processes.

A number of years ago it has been tried with syphilis in a similar way to obtain a substance that would not only cure syphilis but would also guard against infection from it. At that time however the experiment was not successful.

From several intimations I am inclined to believe that Koch was successful in finding a way in which a substance may be produced for contagious diseases, a substance that cures these diseases and also protects from infection. It is not impossible, since Jenner found the vaccine virus, Pasteur the hydrophobic lymph and now Koch the tubercle lymph.

To be sure there is this difference for the present between the substances named, that the vaccine virus only protects healthy person from infection by small pox but it does not cure those sick, while the hydrophobic lymph and tubercle lymph cure the afflicted. However Koch seems to believe that his tubercle lymph has a certain power of producing immunity. [c20]

According to Koch, his remedy, consisting of a brownish liquid, is easily perishable as soon as it is diluted with water; he recommends the preparation of the dilution of the remedy with a 5 per cent. phenol solution. Phenol is equivalent to carbolic acid. The dilution of the remedy for use must be considerable, as only small quantities of the same are used.

Koch tells us that his remedy does not act through the stomach, that is taken in through the mouth. On one hand it may be that this is due to the extremely small quantities necessary for an

effect, on the other hand and principally all the substances probably act only when they are directly applied and brought in contact with the circulation of the blood.

For a long time small syringes with fine needle points were used to inject strong acting drugs under the skin. This is done in a measure to have a guarantee of a sure effect which is not had by giving through the mouth. For instance, it is known that emetics given through the mouth often remain without results; if however the emetic apomorphine is injected anywhere under the skin, vomiting surely follows within a very short time. It is well known that morphine is injected under the skin in preference to taking it through the mouth as its action as a pain killer is much prompter. [c21]

Koch's liquid can also be injected under the skin with the aid of a so-called Pravaz syringe. Koch uses a somewhat differently formed syringe. The result remains the same, no matter what kind of syringe is used.

At the same time it makes but little difference, on what part of the body the injection is made, as the fluid injected under the skin is distributed at once over the entire system. Koch chose the skin of the back between the shoulderblades and the loins because here the injection could be made without causing pain or inflammation.

The production of the liquid must be attended with great difficulties as Koch plainly remarks that his stock at present is very limited and he can only furnish larger quantities at the end of several weeks. The price of a small bottle to be 25-30 Marks about 6-8 Dollars.

The human being is much more sensitive to Koch's remedy than the guinea pig, which is commonly used for experiments of this kind. It seems that no experiments have as yet been made with other animals. [c22]

Koch has tried the remedy on himself and has passed through all the symptoms of a poisoning. He certainly injected into his arm a considerable quantity of the liquid; twenty-five times as much as he injected in his patients.

But here also there is a difference. In sick people much smaller quantities act than in the healthy. One cubic centimeter of the liquid has hardly any effect on a healthy person, but quite a marked one on those afflicted with tuberculosis.

In the case of the latter one cubic centimeter produces about the same symptoms as twenty-five times the quantity would in a healthy person. The same must also be considered as symptoms of poisoning; but they are only of short duration and are accompanied with magnificent success.

Of all diseases based on tuberculosis only ringworm or lupus is perceivable by the eye, as it is a disease of the skin, all other tuberculous diseases take their course in the internal parts of the body, and therefore are not perceptible to the eye. The symptoms that follow an injection of Koch's liquid can be best observed in the case of lupus.

Koch therefore selected for his first illustration patients afflicted with lupus that is ringworm. Even a few hours after the injection the first perceptible changes begin to show in the diseased parts. These begin to swell and redden; in other words an inflammation is caused, through which the diseased tissue is obviously brought to mortification. Soon the inflammation stops. The gangrenous tissue changes into crusts or scabs which drop off in a short time and the patient is cured of his ringworm. [c23]

Koch places particular importance on the fact that the inflammation is restricted to the diseased parts only, and that it does not attack sound and healthy parts. Even the smallest otherwise invisible knots are made perceptible through the inflammation.

We have similar illustrations for this specific action of Koch's remedy for lupus (ringworm). So for instance a syphilitic ulcer on the thigh may be cured in a few days with iodide of potassium. In a similar manner a morbidly enlarged spleen may be reduced to the normal size by taking quinine.

The observation is very interesting indeed, as it may be shown whether a person is tuberculous in any organ or not by the injection of .01 ccm. In case he is tuberculous the poisoning symptoms appear in a marked degree; if he is not, hardly any effect is noticeable.

Although we have had excellent methods for a long time to detect pulmonary consumption, although Koch added the discovery of the tubercle bacilli, it occasionally happens that the disease can not be recognized in its beginning stages, because its progress is too slight. Now the reaction following an injection is to be the deciding medium. Also with other tuberculous affections physicians will welcome this diagnostic auxiliary, for in the beginning of the same it often happens that no certain diagnosis could be made and valuable time was lost. [c24]

We must call particular attention to the further statements of Koch, that through his remedy the tubercle bacilli are *not* killed. With this it is admitted that the remedy will not be able to effect cures, without any more ado, yes, even the tubercle bacilli may continue to infect parts of the body even in spite of the action of the remedy.

Therefore the application of Koch's remedy only, is not sufficient to effect a cure. Provision must

be made to remove the gangrenous tissue from the body as rapidly as possible, because it contains the still living tubercle bacilli. As a rule surgical aid is necessary to remove the mortified tissue. Where this is impossible Koch advises the continued application of the remedy to protect the endangered living tissue from the re-immigration of the tubercle bacilli. Koch thereby believes that he can protect the tissue, perhaps in the manner as vaccination protects from small pox. [c25]

The rapid increase in the quantity of the remedy applied in the course of time is something that has no parallel. Koch gives an explanation, but leaves it to the future to be confirmed. We have no previous instance in case that his explanation should prove correct. Reasoning from analogous application of our remedy, we are led to assume that *smaller* quantities of the substance would suffice to cause mortification of the remaining tuberculous tissue. Koch on the other hand uses larger and larger doses to reach a result. He admits inurement to the remedy within certain limits only.

Koch has made a difference between pulmonary consumptives and those suffering from tuberculosis of the bones and joints, etc. He was able to inject larger quantities in the latter than the former, for the quantity injected in the case of pulmonary consumptives was .001 ccm.; in other tuberculous cases .01 ccm.

Koch selected pulmonary consumptives for his experiments, whose sputum contained tubercle bacilli, so as to make no error in the diagnosis, and to ascertain by killing the bacilli contained in the sputum, whether the diseased tend toward restoration. As the remedy does not kill the bacilli, so a diminution of the bacilli can only be obtained in that manner, that the tissue of the lungs undergoes certain changes, which cause its properties to be such, that the bacilli are no longer able to exist or propagate in them. Then a so-called immunity results which we know of in other similar diseases. We know that anyone who has had the measles or scarlet fever rarely is again attacked by the same, as a rule he is permanently proof against them. [c26]

In the same way as vaccination protects from small pox, an injection of Koch's remedy acts against pulmonary consumption. Koch makes a cautious statement:

"On the other hand it is possible, from analogy with other infectious diseases that those who are once cured become permanently exempt."

Koch reaches this result, that beginning phthisis can with certainty be cured with his remedy. On the other hand, advanced consumptives, in whose lungs large cavities already exist, may possibly be improved but can not be cured. However he provokes the idea, that perhaps his method of treatment together with a surgical operation, that removes all gangrenous matter from the lungs, may yet have beneficial results in the end. The idea is not entirely new to treat lung diseases with the aid of surgery; unfortunately the operations have heretofore been thought too risky. Perhaps we will now have a new branch in operative technic, surgery of the lungs. Koch advises to conduct this lung surgery after the manner of operating empyema. This is an operation performed in the case of suppurative pleurisy to remove the pus from the pleural cavity. This operation has been successfully carried out for a long time. [c27]

Koch makes it of especial importance, that while treating consumption with the new remedy, the general attendance and nursing is not to be neglected. Koch also calls attention to what has been said before, that the general hygienic factors, good hospital treatment, mountain climate, etc., will never be dispensed with, on the contrary will be indispensable to the furtherance of cure.

In conclusion Koch again remarks that brilliant results are only promised in the early stages of pulmonary consumption (phthisis). Physician and patient must move all levers as to the existence or non-existence of tuberculous diseases.

Then those daily pictures of extreme wretchedness from consumption will be a thing of the past. Then the danger of contagion will be lessened resulting from the decrease of the number of tuberculous persons and of the tubercle-bacilli, and perhaps it will soon be possible to name the day on which with the last tubercle-bacillus the ravaging pest, tuberculosis, will be extirpated.

*** END OF THE PROJECT GUTENBERG EBOOK PROF. KOCH'S METHOD TO CURE
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