DENISON (C.)

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THE ANTITOXIN TREATMENT OF TUBERCULOSIS

OR THE DIRECT (TUBERCULIN PREPARATIONS) VERSUS THE INDIRECT (ANIMAL SERUM) METHOD OF IMMUNIZATION AGAINST TUBERCULOSIS.

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THE ANTITOXIN TREATMENT OF TUBERCULOSIS.

OR THE DIRECT (TUBERCULIN PREPARATIONS) VERSUS THE INDIRECT (ANIMAL SERUM) METHOD OF IMMUNIZATION AGAINST TUBERCULOSIS.

BY CHARLES DENISON, A.M., M.D.

Since Koch's discovery of tuberculin some seven years ago, we no longer wonder that the majority of medical men were turned away from the employment of this remedy by its ill-advised use, and the resulting gross effects, as shown by Virchow, the great pathologist.

From the absurd advertisement of a Swiss barber "tuberculin injections given here," and the equally preposterous belief which at first prevailed that a means to destroy tuberculosis had been discovered, as easy of use as a household remedy, we have come to learn that if cure it will, it must be by a concentration of skilled effort, and a technique involving as much discrimination in diagnosis and care as does the differentiation of a complicated eye refraction, the microscopic determination of blood changes due to disease, the endoscopic study of internal organs, or any other delicate field of professional work.

The great mistake of the celebrated discoverer of tuberculin (which in a measure is applicable, also to his later discovery tuberculin T. R.) was that there was no due recognition of the failures of physicians in the diagnosis of tuberculosis. In other words medical men failed to recognize the great variation of the disease to be treated by so powerful a remedy. We can now see how unfortunate it was for Koch to

allow his tuberculin to be indiscriminately used since no determination was reached as to what cases should be excluded, but rather a trap was set to catch the very class of cases which should never have had the remedy in its original crude form. I refer to the precaution announced in the first instructions that preference should be given to hospital cases where patients were to be kept in bed during the "reactions," in apparent neglect if not ignorance of the necessity of elimination, and the ever present need of recognizing other associated causative agencies, chief of which is that of climate. The concealed and therefore more serious tubercular lesions would be brought to light by the searching specific, and cheesy or tubercular pneumonias which would necessarily have to undergo the expected process of "necrosis" would in some way (?) have to be taken care of. Indeed the indiscriminate use of tuberculin was an absurd and indefensible proposition under the conditions specified. I abandoned Koch's proposed method within a month of its commencement, and thereafter refused to give the treatment unless patients were well enough to come to my office and could take exercise enough to eliminate the tubercular bacilli or their toxins when thrown off or set loose by the special agency used.[1]

So tuberculin is said to be a failure and the perennial essayist, in assumed wisdom, which seems almost ludicrous to one who knows the truth, exclaims, "Hic jacit" tuberculin the chief of specifics for consumption! As to the original product, should any professional brother desire to investigate the proofs, I can select for him a dozen or more persons, who were once actively tubercular, and who from seven to four years ago were treated hypodermatically with relatively large quantities of the crude tuberculin and who are now apparently well and free from any sign of tuberculosis.

As a result of these years of investigation of tuberculosis by such eminent men as Klebs, Trudeau, Von

[1] "Exercise and Foods for Pulmonary Invalids," pp. 13 and 14.

Ruck and Whittaker, there is no doubt in my mind that the healing specific, the immunizing agency, lies somewhere in the bodies of the tubercle bacilli. Koch practically acknowledges this when he uses the whole of the germ to make his new tuberculin T. R., a product in reality the clear portion of an *emulsion* of the bodies of the bacilli.

While among veterinarians the crude tuberculin has been generally used and acknowledged as the best diagnostic means ever found for the detection of tuberculosis in cattle (a diagnosis that I have thus far utilized with satisfactory result in twenty-one human beings), yet the successful application of the remedy in the arrest of human tuberculosis has been made but by very few. Those who have had the courage, intuition and skill to succeed in this line are well represented by Dr. James T. Whittaker of Cincinnati, who answered the objections to the use of tuberculin in an excellent paper on "General Impressions from Six Years use of the Old Tuberculin," read before the British Medical Association at Montreal, Sept. 2, 1897. He concludes in these words, "aside from the objections urged by ignorant and prejudiced people, not worthy of notice, four apparently valid arguments accumulated, in the course of time, against the use of tuberculin in man.

"1. That the reaction occurred in the absence of tuberculosis. This objection has been met by the demonstration of concealed deposits.

"2. That the reaction occurs in other diseases, syphilis, lepra, actinomycosis, etc. This objection has been met by the demonstration of tuberculosis coincident with or complicating these maladies.

"3. That the reaction will occur in the most quiescent cases even where the bacilli are not only concealed but encapsulated and deposits are partly calcified. This is no objection at all, but a most striking confirmation.

"4. That the use of it is dangerous; that it not only awakens the disease from latent sources but dissemi-

nates it over the body and this leads to an infection and increases the danger of infection of others. This conclusion rests on a false premise and confounds the *post* with the *propter hoc.*" I have quoted so much because this verdict, like everything Dr. Whittaker writes, is a clearer statement than I could make; but I can heartily endorse it, for during the same long period there has been no time during which I have not had from half a dozen to twenty tubercular patients undergoing this form of immunization by means of some form or derivative of tuberculin.

It has been my desire, if possible, to find such a derivative from or modification of tuberculin, uniform, standard, and freed from all undesirable qualities, as will be acknowledged by the medical world to be a true specific for tuberculosis. I mean just as much an antitoxin for this chronic and perplexingly variable infection, as, in its way, is the antitoxin for diphtheria for that acute and unique disease. You may assert that, with the necessity for a congenial soil for tubercular infection before the disease can find lodgement, and with all the varying complications of susceptibility. of natural resistance, of climate, of age and associated conditions—different in every one of a thousand cases—that the thing is impossible, I believe it *is* possible and that all these varying conditions are simply elements to be duly weighed and accounted for in our battle against this insidious disease.

There are a dozen, more or less, of tuberculin preparations, extracts or serums, which I have to mention.

1. The crude or original tuberculin of Koch, which is the glycerin extract of the dead bacilli, as I understand, filtered through porcelain.

2 Then comes Klebs' first modification, a purified article called tuberculocidin, in which the crude tuberculin is deprived of much of its toxins and reactionary power.

3. Following this is the name antiphthisin which Klebs gave to practically the same product manufactured in this country.

4. Tuberculinum purificatum, which name Dr. Karl von Ruck of Asheville, has given to his manufacture of practically the same preparation.[2]

5. A purified tuberculin made by Dr. Whitman of Los Angeles, Cal., from the culture fluid in which the bacilli have been grown, not yet standard in strength but which I have found to be moderately efficient.

6. Oxytuberculin,[3] the lately much talked about remedy of Dr. Hirschfelder of California, in which a small per cent. (said to be 5) of tuberculin is, under great and protracted heat, saturated with peroxid of hydrogen. The effect of this, if any, besides that of the contained tuberculin, the discoverer claims, is the conversion of the toxin into an antitoxin. This increase of curative effect but slightly shown by my own limited use of the remedy, as I have had only a four-weeks trial of it in a single case. So far, however, the result is not unfavorable. If this creation of an antitoxin outside of an animal body is verified, it is indeed a wonderful discovery; then it is to be hoped that the bulky dose prescribed for injection will be reduced to 1 c.c. or thereabouts. It is not impossible that the excessive oxydation has simply destroyed the toxins, and so left a large amount of a healing property, not yet fully understood but common to so large a bulk of tuberculin.

7. Koch's new tuberculin T.R., descriptions of which you have lately seen in the medical press.

8. Dr. Karl von Ruck's watery extract of the bodies

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[2] We understand this is made as follows:

"Take the entire ripe culture of tubercle bacilli and transfer to vacuum apparatus, and concentrate to 1-10 of the bulk at 55 degrees C. This takes about a month; remove from vacuum and filter through paper for removal of bacilli, and next through porcelain. Now precipitate with acid solution of sodic-iodid of bismuth and filter. Next neutralize the acid solution for reprecipitation of bismuth salts and filter. Next precipitate with absolute alcohol adding enough to bring the entire bulk to 90 per cent. alcohol; let stand and when precipitate has formed, filter. Collect, precipitate and wash it with more alcohol (absolute) dry, weigh and make 1 per cent. watery solution and filter. It (purified tuberculin) differs from antiphthisin in that it is made and concentrated with the tubercle bacilli in the fluid and it is filtered through porcelain as well as paper. It differs from tuberculocidin, in that it is prepared and concentrated at a low temperature (50 degrees C.) instead of at (100 degrees C.) boiling temperature, and filtered through porcelain.

[3] Transactions California State Medical Society, 1897.

of the dead bacilli, which is a like powerful remedy in immunizing strength to the new tuberculin (T. R.) and I judge will compare favorably, with the same.

This extract is liable to give reactions in susceptible persons, for it is highly charged with immunizing power.[4] I have tried the procedure recommended by von Ruck and found it in the main quite satisfactory, namely to commence with the purified tuberculin and work up from 1-10 c.c. to 2 c.c. and then every second or third day give 1-10 c.c. of this stronger undiluted extract, possibly working up to 3-10 to 5-10 c.c. as a terminating dose, the intervals between treatments being lengthened toward the close of the course.

I will explain why I have not used Koch's new tuberculin (T. R.) While the fact previously cited, that the bodies of the bacilli contain the immunizing or healing principle, may be proven by the claimed improved effect of the new over the old tuberculin, yet the admitted fact remains that it is practically an emulsion which Dr. Fisch says is essential according to Koch's intentions and that its curative power would be lessened by filtering through porcelain. Drs. Trudeau and Baldwin (*Medical News*, Aug. 28, 1897) claim to have found the fragments and the whole bacilli in it by microscopic examination. While this would not deter me from using it in an understood case, where the infection was already so great that thousands of bacilli were known to be thrown off daily in the sputum, yet I do not like the technique of its administration nor the idea of my diagnosis being "hedged" against by such a range of dose, equivalent to 1 to 500,000, as Koch (from his experience with the average medical man) has deemed it best to establish. The finally accepted remedy should, I

[4] In making this extract virulent cultures are used and the proteids (it is claimed 80 to 90 per cent. of them) are extracted with ether from the filtered bacilli. After repeated dryings on porcelain plates, the filtrates (bacilli) are repeatedly powdered and macerated over permanent water baths and the resulting proteids are passed through porcelain in a perfect watery solution which is then made to a standard strength watery extract, which when used, can be still further diluted if desired.

think, be not so liable to deteriorate; it should be stable, uniform, made entirely safe by careful filtration, and the range of dose need not exceed 1 to 1,000 or less.

I am aware that Trudeau has claimed that antiphthisin is only a very weak tuberculin, but in my considerable experience with it and the tuberculinum purificatum during the past four years, in comparison with the use of crude tuberculin during the previous three years, I have been satisfied that it was safer, that there was less resulting general reaction as well as local reaction in affected areas. The distinctive tuberculosis temperature is apparently more easily controlled by its use.[5]

The tuberculin products thus far considered, with the possible (?) exception of oxytuberculin, are supposed to work by their toxin creating or stimulating the production of an antitoxin in the blood of an affected person. We now mention an additional class where the antitoxin has already been produced in an animal's blood, preferably one already immune, and then through its serum made available in the treatment of tuberculosis. I believe it is possible to do this, as is the case with diphtheria. Whether it is preferable to making the affected system create the antitoxin, I will not attempt here to discuss. It is a difficult and important point to decide. I have seen some persons (previously under the tuberculin treatment) who seemed after some months to be losing their thereby acquired immunity, and whose systems seemed to respond to a renewal of the treatment, as though that particular stimulant to antitoxin activity was just the influence needed. Whether an artificially created antitoxin introduced from without the human body will have an equal or a better effect I have yet to learn.

However, from the many investigations thus far

[5] For cases in illustration of these favorable effects reference is made to my previous paper on these subjects. "Tuberculin and the Living Cell." Transactions of the Am. Climatological Asso., 1892, and "Antiphthisin," Medical Record, July 20, 1895.

made with serums, we are enabled to assume that an efficient antitoxin to tuberculosis can be produced in the serum of an animal's blood, but it is yet undetermined how much of this effect is purely antitoxic and what proportion of it is transmitted tuberculin. The question of transmission would seem to be relative, the size of the animal treated, and the character and amount of the toxin administered, together with the time before and again after treatment with reference to the taking of serum, all being important considerations. This, too, is a difficult question to decide, for the toxin, if transmitted, may be wholly or only partially neutralized by the antitoxin created in the animal's blood. E. Müller (*Jahrbuch f. Kinderheilkunde*, Vol. xliv) claims, from a study of the blood of children treated with the anitoxin of diphtheria, that the time of the excretion of the antitoxin varies in different individuals, even of the same age and body weight, and that there is no direct connection between the size of the dose of the antitoxin and the duration of the power of immunity, *i. e.*, the time the antitoxin remains in the blood. He shows the protective power of the blood on successive days of a number of individuals, sufficient antitoxin to confer immunity seldom remaining after three weeks. Should we not bear in mind that this study was for diphtheria, comparatively active in its toxicity, and admit for a more chronic disease, as tuberculosis, a similar variability in its antitoxic and immunity laws commensurate with its chronicity?[6]

Of late the proper technique of serum production

[6] Over four years ago, learning from experiments on healthy puppies that they would stand for their size, very large doses of Koch's tuberculin, I conceived the idea that the toxin in this extract might be thus neutralized and a beneficial change in the tuberculin treatment result. I went to the expense of having a healthy pup treated in the course of seventy-two hours, with about 1 c.c. tuberculin to the pound weight. Twenty-four hours afterward the pup was killed and all his serum taken. This was nicely done for me by the New York Biologic and Vacinal Institute. Though no harm resulted from the use of this serum, it was not a brilliant success, for I got the rash, which serums so often cause, and what I thought was a lack of the distinctive healing sounds I had expected to find in the affected lung, and so went no further with it.

is being gradually determined and we have now several antitubercular serums which have gained for themselves a curative reputation.

In Italy Maragliano's serum, made at first from a goat's blood (as I understand it), is now obtained from the immunized horse. Maragliano's results with the goat's serum speak very well indeed for his product and the proportion of successes were about the same, but no better, so far as I could determine, than ours in this country with antiphthisin or purified tuberculin. Furthermore the absence of definite knowledge of the manufacture, strength and dosage of his serum, precluded my own trial of it. This is the "cure" which has lately been lauded to the skies by the sensational newspaper claims of a New York daily.

10. The antitubercle serum of Paul Paquin, though one of the first made in this country and tried by many physicians, I have no personal knowledge of except from results (mostly favorable) observed in a number of patients coming under my observation after they had been treated with it. These results were not distinguishable from those of crude tuberculin, and I can not say that there was not the transmitted effect previously referred to.

11. Professor Crandall, also of St. Louis, immunized a horse I believe with tuberculin (?) taking some two years for the process before the serum was used. I gave it a faithful trial. The results were not bad, nor were they as good as with the purified tuberculin. I could not determine that there was any "transmitted" effect of tuberculin, but I got the serum rash in two out of five cases treated.

12. The H. K. Mulford Company, of Philadelphia, have been faithfully perfecting a serum. To produce this they chose asses as the animals most immune to tuberculosis. When in Philadelphia last June, I examined these animals at their bacteriologic laboratory and was one of the first to try their perfected serum. Its effect was better than that of any serum previously tried; seemed to raise the patient into an

exalted state, hopeful of recovery, with physical signs and ability to do, perceptibly improved. This was strongly shown in two young men of the five cases treated, who were hopelessly advanced in tuberculosis, both of whom had large excavations in the lungs. One of these afterward went home to die, and the other has improved by living among the foot-hills and having an injection of this ass's serum once or twice a week. The objection to this serum is its lack of sustained effect and the serum rash, which occurred in one or two cases.

13. We now come to consider the last and I think the best of the antitubercular serums, the antiphthisic serum (T. R.) made by the John T. Milliken Company of St. Louis, according to the formula of Dr. Carl Fisch. In his address, read before the Mississippi Valley Medical Association, at Louisville last October, Dr. Fisch presented the tabulated results of an elaborate animal experiment, or test of this new serum. The serum is peculiar in that the selected horses from which it is taken have been strongly immunized, charged with Koch's new tuberculin (T. R.), the process usually taking four months and the serum being drawn fourteen to twenty-eight days after the last injection. When it is considered that for a last dose 50 c.c. of tuberculin T. R. was given the horse, which I am informed has now been increased to 100 c.c., we can get some idea of the enormous load of tuberculin these animals are carrying in the blood by remembering that according to Koch, the initial dose of tuberculin T. R. should be 1–500 of a milligram.

Between one and two hundred guinea pigs were used in Dr. Fisch's interesting test.

1. The T. R. serum was shown not to increase but rather to lessen the temperature of a healthy guinea pig for the first three to nine hours.

2. Guinea pigs previously immunized with T. R. serum withstood without harm fatal doses of virulent tubercle bacilli virus, while the control animals died in twenty-one to twenty-four days.

3. The least quantity of T. R. serum needed, previous to the poisoning of the guinea pig, to sufficiently immunize him was determined: 2½ c.c. in five injections during the previous month being sufficient to keep alive and healthy a 600 gram weight guinea pig.

4. The T. R. serum and virus were injected mixed and the proportion of the former sufficient to neutralize a fatal dose of the latter was thus determined *i.e.*, from ¼ to 1 c.c. of the serum.

5. Separate injections of the serum proved that (even commencing the tenth day after guinea pigs had received the fatal injections of the poison) they lived while the controls died in from twenty to twenty-eight days, as well as three controls treated with Paquin's serum, after the fatal toxin had been administered to them four days.

6. The serum treatment was shown to have a lowering effect on the abnormal temperature of these poisoned guinea pigs, *i.e.*, from the second to the sixth day a total average decrease each of 2 degrees F.

7. The amount of T. R. serum which would inhibit the poisonous effect of tubercle bacilli and also which would inhibit the reaction to tuberculin was determined; all of which constitutes an experiment calculated to fill us with hope for the trial of this new serum on human beings. Dr. Fisch claims that if there are reactions to T. R. serum which he does not ordinarily find in the affected human being, that they are not the same as from the crude or old tuberculin. To me it does not seem to be so harmful if there are some slight reactions according to the dose given and the susceptibility of the patient, just as we would expect from this remedy; for even if the tuberculin T. R. has not all been neutralized or changed to an antitoxin in the animal's blood, we have a stable, soluble, preservable in standard strength remedy, chiefly in antitoxic form, one which can be relied upon for immunization against tuberculosis, and safe compared with Koch's new tuberculin. How permanent its effect will be has to be left for the lapse of sufficient

time to determine. The half dozen cases I have to report on, are not claimed to establish a cure, especially as I have never allowed myself to abandon other and important means of relief simply because I happened to be giving any of these forms of tuberculin. We need all the help that the proper individualizing of a patient will suggest, and we will contentedly bear the charge, sure to be made, that the always admitted essential aids, the preferable climate with good feeding, systemized exercise (including proper inhaling), and hopeful conditions or environments have done it all.

Case 1.—S. H. F., aged 48; machinist. From Indiana, one month in Colorado when first seen by me July 28 last. His lung disease is said to have commenced with a chill and fever May 1. He is not improving, I think because of tubercular pleurisy at base of right lung, the apex of which is excavated, and top of the other lung slightly affected. A case of laryngeal tuberculosis as well, with nasal complications, bilious temperament and torpid liver. Not a favorable case by any means, when one considers that the daily ounce of purulent expectoration contained fifty-five tubercle bacilli "to the field" on September 15, when the antiphthisic serum T. R. was first administered. The injections were given every alternate day below the shoulder blade commencing with ½ c. c. and gradually increased until a decided reaction limit was found at 1½ c.c. Reaction temperatures inclined to be prolonged of 1½ to 3 degrees F., were found after 1½ up to 1 7-10 c.c. doses, and I learned that I had a more powerful serum to contend with than I had ever used before. A return to 1 c.c. for the dose gave better results with no temperature rise above 99 for quite a while. Meanwhile up to October 30, he had received 25 c.c. in twenty-one injections, the sputum had greatly diminished in quantity and showed "ten to field" in about two weeks and "one to field" in six weeks. The pleurisy had subsided, partly at least, controlled by wearing a restraining bandage devised to specially limit the movement of the affected area. The effect was good and all the physical signs improved. Unfortunately this patient had to go back to his Indiana home, October 30, but he is still having the remedy administered there and reports improvement continued, with a gain in weight of twelve pounds since the commencement of the treatment.

Case 2.—F. J. M., aged 24; draftsman. Came to Colorado in May, 1897, from Massachusetts. Lung trouble probably dated back to pneumonia five years ago, and a severe cold one year ago. Decrease in weight of twenty-four pounds from his

average to 108 pounds, both apices show an advanced fibro-tuberculosis, the third stage being more marked on the right than on the left side. By this evidence the diagnosis of a non-active fibro-tuberculosis both sides was made. Serum T. R. has been given for its general effect with the result that we now have a diminution of expectoration and some improvement. The proportion of the very few bacilli in sputum not yet much changed, improvement in physical signs but no gain in weight, though bad environments and confined occupation, leading to frequent colds, are disturbing elements which have to be accounted for in this case.

Case 3.—Sept. 20, 1897. Mrs. H. Age 27. Came from Connecticut. Weight at this date ninety-nine pounds. Had a hacking cough for eleven years, and two years ago sympathetic whooping cough and fever at times. Now some restrained action at base of right lung where once she had pleurisy, but the chief trouble is a chronic catarrhal fibro-tuberculosis, second stage, upper half of left lung, with softening spot threatening under left shoulder blade. Commenced the T. R. serum September 22, and on alternate days gradually reached 1 c.c. for a dose which has not been exceeded. Bacilli to the field, seventeen large with streptococci and staphylococci. November 2 and 18, seven and eight to the field, small and beaded and less "mixed" infection. November 28, the record contains this note—Has taken 27 c.c. antiphthisic serum and has now no reactions and physical signs have all improved. The temperature being below 99 degrees P.M. and weight now is 106 pounds.

Case 4.—J. A. R. Chemist, age 28, came from New Orleans, July 6, 1897. First seen by me September 18. A case of tubercular broncho-fibrosis of six years standing with hemorrhagic tendency, first stage; both upper halves of the lungs, chiefly right. Up to date taken the T. R. serum treatment ten weeks every other day since September 19. The spirometrical record has improved from 170 cubic inches to 200. He has improved in weight and in general as well as local signs. The record of his sputum examinations is as follows: September 18, 25.3 to the field; September 30, 20.3 to the field; October 18, 2.5 to the field. November 2 and 19, one to five and one to ten fields. December 3, 4 to field (been confining himself too closely indoors.)

Case 5.—J. E. L. Age 24. Newspaper reporter. Came from Pennsylvania. July 4. A case of laryngeal tuberculosis with broncho-fibrosis originating some two years ago but aggravated by overwork at night, one year ago. First stage, left side chiefly affected, but evidences of bronchial involvement top of both lungs. Has taken the serum treatment over six weeks (18 c.c.) with exercise, inhaling, etc.; doing well. Had left side pleurisy at one time which has disappeared. Expectoration much lessened in quantity, chest sounds improved, weight increased six pounds. No elevation of temperature now,

though there was a little during the first part of the treatment; voice which was quite hoarse has improved and strengthened. Bacilli to field October 13, seven, November 20, one to three fields. December 14 none.

Case 6.—W. S. Book-keeper. Age 31. Arrived from Wisconsin, October 28. A case of tubercular broncho-fibrosis with suspicious laryngeal complication, both lungs affected in first stage, also has fistula in ano. Acclimatization may have something to do with his improvement for it has certainly been remarkable. Before giving the serum injection his temperature each day was from 98.5 degrees to 100.5 degrees and by the time 1 c.c. dose was reached the next day's rise was slightly increased. Since then 99.2 degrees has not been exceeded. December 3, after 12 c.c. had been given, the record showed, weight increased 156 pounds, a gain of six pounds in one month. Fistula nearly stopped discharging, sputum lessened in quantity about five times, and the bacilli in it reduced from 23.2 to 2.8 to the field. The physical signs and general strength are also on the gain. In fact the outlook for this, as well as for the others of this group, is bright for a permanent arrest of the disease. There have been five or six others who have taken the same treatment for shorter periods, but not long enough for any definite results. One of them, however, shows great succeptibility and the diagnostic effect of the T.R. serum which is worthy of notice.

A gentleman aged 26, referred to me by his physician in Pennsylvania, was seen on October 22, having arrived in Denver two days previously. His trouble seemed to have originated ten months previously, and he had visited North Carolina without benefit. A laryngeal and pharyngeal tuberculosis with lung involvement very slight at both apices, with principal centering point in left inter-scapular region, seemed to me at my first examination to be all that there was to explain the case. But the effect of the T. R. serum injections made manifest the incompleteness of my search as well as that of several physicians who had examined him previously, namely, that I could not reach the 1 c.c. dose the general and fever reactions were so great and prolonged. At two times, after 7-10 and 6-10 c.c. injections, he informed me he had stayed in bed all day, he felt so ill and feverish, the grippy signs being similar to occasional reactions I have seen from the the old tuberculin. I felt con-

fident there was a concealed cause somewhere. This the stethoscope finally revealed in the left infra-mammary region, where, over an area, not larger than a silver dollar, pleuritic friction with fine crackles were heard only at the end of forced inspiration, and without any pain. Under proper restraint, to promote adhesion and limit movement, I think this condition is gradually improving and that this case will also be a favorable one.

In closing I will add that this diagnostic power, a valuable evidence of the real efficiency of the new remedy, together with the infrequency of the resulting serum rash (though local reaction, infiltration, etc., at the point of needle puncture will sometimes be seen), is or ought to be a recommendation for this T. R. made serum; especially to those physicians who understand its import. That this preparation can be made standard and safe will also do much toward overcoming the natural prejudice which pertains to the use of either Koch's old or new tuberculin.

THE AUSCULTOSCOPE OR PHONENDOSCOPE VS. THE BINAURAL STETHOSCOPE.

BY CHARLES DENISON, A. M., M. D.
DENVER, COLO.

I am asked my opinion of these newfangled affairs. I have tested them enough to know that they can never supersede the stethoscope, if the latter is properly constructed.

The auscultoscope bell gathers the sound from too large an area, as large as would the bell for stethoscopic percussion which belongs to my stethoscope, diameter three inches. The sounds are thereby confused and not differentiated as they should be. To use the auscultoscope is too much like putting the whole side of your head against the chest wall. This confusion, with an admitted exaggreation of impulse sounds, as are the heart sounds, is a positive hinderance to any one who has been used to getting definite information out of a stethoscope. I do not believe it is any credit to a physician to be or appear to be satisfied with any such uncertain and mixed-up results.

If the area of impingement of the bell against the chest wall were one-half or one-third this size, and then this smallerbell were used in a nearly perfect transmitting instrument, such as the last make of my stethoscope by the Denver Surgical Instrument Company, then the exaggeration of sound would be in a degree corrected by definite transmission, which those little, long, soft-rubber tubes of the phonendoscope can never possess. Even then the sound will be perverted by the vibrations of the diaphragm of the phonendoscope. The kind of a sound needed is an accurate representation, clear and distinct, not some perversion which has to be dissected to get at the real thing. It calls in question the acoustic acuteness and diagnostic proficiency of many self-satisfied physicians to see the useless combination of little pipes and soft rubber tubes which, under the name of "stethoscope," they carry in their coat-tail pockets. I feel like urging them to put their cheap affairs to the same test I put my own stethoscope to several years ago, when comparing it with all those of English or any other make to be found at Down Brothers in London. It is this:

Place a watch on a glass counter or a table and cover it with the palm of the hand, while with the other hand you press the bell of the stethoscope firmly on the dorsal surface. If the two bells of the instruments being compared can not be equally imbedded in the flesh so as to alike exclude the outside air, then put the back of the hand on the watch and press the bells in the palm while you listen to the watch ticks. The best results under such conditions—clearness, distinctness and naturalness of sounds—determine the best instrument for cardiac and lung examinations. There is here plenty of reverberation and exaggeration of the watch ticks to make this a very delicate test, especially with weak-ticking watches. At the same time the conditions, as to passing sound through bone and flesh, are very similar to the detection of valvular sounds and murmurs. It is a fair and delicate test by which any physician may gauge the accuracy of his own instrument. Measured by this test, the auscultoscope or the phonendoscope (practically the same thing), even with their too large area of impingement unaccounted for, are not "in it' compared with my stethoscope with the medium-sized bell. Whether the principle of the auscultoscope can be incorporated in a modified instrument, having a smaller bell and perfect transmitting arms in a way that undue drum-like reverberation will be displaced by naturalness, remains to be seen.

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