

put forward only after the researches of Behring and Roux, involving as it does the knowledge of antitoxines, a theory not previously enunciated.

Starting with Koch's tuberculine (original), gradually increasing doses are injected into a horse till it is rendered immune to further injections of a corresponding amount. The blood from the jugular vein is then allowed to flow into a sterile flask, where it coagulates, and the sterile serum thus obtained is used as an antitoxine.

Maragliano, in Italy, has evolved a similar process, and many recoveries have been reported, especially in America, from the physicians using Paquin's serum, prepared in St. Louis. It is extremely difficult to estimate the amount of antitoxine actually dissolved and present in the serum so obtained.

Koch proceeded on the principle that immunization would be secured when the body should be invaded by great masses of bacilli (as in general miliary tuberculosis, when at a certain stage the bacilli disappear), and these bacilli should come in direct contact with the tissues. The necessity of separating the bacilli from the cells in which they are found had been pointed out some time previously, and this Koch aimed to accomplish by extracting the bacilli with deci-normal sol. N.A.O.H. The fluid obtained in this way was designated T. A. (Tuberkulin Alkalisches), but was not free from bacilli, for in a field of the microscope 5-10 might be seen lying dead, separately, not in heaps. When administered it produced a reaction quite similar to that of the old tuberculin of '90; relapses were, however, less frequent. Finally it was abandoned. Failing to extract the bacilli from their covering of fatty acid, Koch resolved to crush them in a mortar, dissolve the mass in distilled water, and treat it with a powerful centrifuge.

In this way the fluid was divided into two layers.

KOCH'S T. R. (*Tuberculum Residuum*). 1. An upper layer containing *T.B.C = T. O. (Tuberkulin Oberst).

2. A lower layer consisting of a colloid sediment with a few bacilli = T. R. (Tuberkulin Rest).

The T. R. was then again dried, pulverised, and treated as before in a centrifuge (giving 4,000 revolutions a minute) for $\frac{1}{2}$ hr. The process was repeated again and again till the last bacillus was destroyed and the whole fluid become perfectly transparent. Trudeau, however, has found living bacilli in T. R. and doubts whether one can ever be sure that they are absent. Koch evidently believes that one or more living bacilli are incapable of harm to a tuberculous organism.

The immunizing action of T. R. is very great, but this is entirely apart from any febrile reaction, while in the old tuberculin the two were associated. If one be immunized with T. R. he is proof against treatment with T. A. or T. O. For the preparation of T.R. the most recent and virulent cultures must be used.

HIRSCHFELDEN'S TUBERCULINE (*Oxytuberculine*).—I have dwelt upon the principal tuberculins and serums which up to the present have attracted the attention of the medical profession, as a prelude to the detail-

* For the sake of brevity the tubercle bacillus will hereafter be referred to as T.B.C., a pseudonym which is constantly employed in Mt. Sinai Hospital.