

KMnO<sub>4</sub> (1 c.c. = 2 mg. Ca); add the filter paper to flask and titrate to find end point. Tenth normal oxalic acid (made from powdered oxalic acid dried over a mixture of hydrated and dehydrated oxalic acid) is used to standize the permanganate (as well as the NaOH for P analysis).

*P Analysis.*—Take aliquot containing 5–10 mg. P in a 200 c.c. pyrex flask; dilute to 100 c.c; add 10 c.c. HNO<sub>3</sub> and 1 drop brom-phenol blue; neutralize with ammonia; add 20 c.c. acid ammonium molybdate solution (usual formula); heat to 65°; shake 5 minutes; filter (the filtrate should turn methyl violet green). Wash until there is no titratable acidity in wash water; transfer paper and precipitate back to flask; run in 0.1 N NaOH until precipitate dissolves; boil 5 minutes; add ½ c.c. phenolphthalein and titrate to colorless with 0.1 N HCl. 1 c.c. alkali corresponds to 0.1194 mg. P.

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##### **The agglutination reaction in the diagnosis of tuberculosis.**

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Many attempts have been made in the past to make use of the agglutination reaction in the diagnosis of tuberculosis. The test has been found unsatisfactory largely because of the fact that the tubercle bacilli grow in adherent masses from which it has been difficult to prepare the homogeneous suspensions necessary for carrying out the test.

In the year 1918 Larson, Hartzell and Diehl<sup>1</sup> described a method of emulsifying and disrupting bacteria by subjecting them to the influence of carbon dioxide under high pressure, after which the pressure was suddenly released, causing a disruption of the organisms as a result of the rapid escape of the gas with which they were filled.

Tubercle bacilli grown on glycerine broth or glycerine agar are suspended in distilled water and placed in the apparatus where

<sup>1</sup> *Jour. Inf. Diseases*, 1918, xxii, 271–279.

they are subjected to CO<sub>2</sub> pressure for two or more hours. The process may be repeated as often as desired although one treatment, as a rule, is sufficient to effect emulsification. By repeating the process several times a large percentage of the organisms may be disrupted. After the CO<sub>2</sub> treatment the emulsion is diluted to the desired standard with salt solution. In this way a perfectly homogeneous suspension of tubercle bacilli, which gives no sediment after standing several days without agitation, may be obtained. The addition of 0.2 per cent. trikresol enables the suspension to be kept in the laboratory indefinitely.

We have performed the agglutination reaction on three hundred cases, one hundred of which were known to have tuberculosis, and two hundred "normal" cases. With one exception all of the tubercular cases gave agglutination. Of the "normals" all but five gave a negative reaction. Of the cases five which gave the positive reaction four were suspected of having syphilis but only one of these had ever given a positive Wassermann. The tests were carried out by the macroscopic method. The serums were diluted 20, 40, 80, 160, 320 and 640 times respectively, placed in the incubator for two hours, and in the ice-box over night.

In this series of dilutions a proagglutinoid zone was noted in a majority of the positive cases, in that agglutination was rarely present in the tube containing serum in dilution of 1-20. Agglutination was very marked, often complete precipitation, in dilutions 40, 80, and 160 and somewhat irregular in the higher dilutions. It is important that the serums used be free from hemoglobin since we have found that hemoglobin causes a false agglutination of the tubercle bacillus. From these results we believe the agglutination test will prove of value in the diagnosis of tuberculosis.

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### **Correlations among the constituents of potato tubers.**

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It has long been known that both the total dry matter and the starch content of potato tubers are proportional to the specific