

Pfeiffer and Kolle extended the method to the typhoid bacillus so as to distinguish the true typhoid organism from typhoid-like forms, which are frequently found in water, and they also so elaborated the method as to show that the reaction was specific.

In the course of their researches they found that it was not always necessary to introduce the mixture of immune serum and bacteria into the peritoneal cavity of a guinea-pig, for a certain amount of change took place if the serum and the culture were mixed in a test tube with bouillon. If the culture was not of the same germ which had produced the immune serum, no change occurred; if it was, the bacteria fell to the bottom of the tube in a flocculent precipitate. A microscopic examination showed that they had lost their motility, and had become entangled so as to form clumps.

Gruber and Durham, of Vienna, discovered this test-tube reaction almost simultaneously with Pfeiffer, and they gave to the substance in the serum which causes the clumping the name agglutinin. Pfeiffer, on the other hand, calls it paralyisin.

Widal was the first to see the clinical significance of these facts, and to examine the effects of the blood serum of patients suffering from typhoid upon cultures of the typhoid bacillus. He was able to find an agglutinating action present when he used the serum alone, or the fresh blood, or a watery solution of the dried blood.

Dr. Wyatt Johnston, of Montreal, has made a practical application of Widal's method in allowing a drop of blood from a suspected typhoid case to dry upon a slip of paper, and then later, in the laboratory, moistening the drop with sterile water, and mixing a portion of it with a fresh bouillon culture of typhoid in a hanging drop. This is watched under the microscope, and, if the case is typhoid, in the course of from half an hour to an hour agglutination of the bacilli occurs. The advantage of Dr. Johnston's method is that it is eminently practical, and enables a bacteriologist in a central laboratory to make diagnoses for a large area of country in the same manner as has been done in diphtheria and tuberculosis.

I have used Dr. Johnston's method in my own laboratory, and am well satisfied with the results obtained so far.

After mixing the culture and the watery extract of the blood of a typhoid patient, as a rule no change is observed for a few minutes, the bacilli moving rapidly backwards and forwards through the field with their characteristic motion. Then one notices individuals sticking together in pairs or in threes moving clumsily, and in a short time others join the clumps, the movement becoming always slower, until finally all the bacilli are tangled together in large clumps containing ten or more individuals, and all movement stops.