

its behavior towards staining agents. This so-called characteristic is not warranted by the statements of the original investigators. It is true that Eberth makes this an important means of recognition, and states that the bacillus is not colored by Bismark-brown and hæmotoxyl'n and only slightly by the other ordinary stains; but what is the verdict of others on this point? In the paper in which he calls attention to the fact that he had photographed the short bacillus before Eberth had published his discovery, Koch says: "Eberth states that these short bacilli have but slight tendency to take stains. The photograph here given shows to the contrary, that in taking stains these bacilli are but slightly inferior to other bacteria." Fischel stained easily with hæmotoxyl'n. Coats<sup>39</sup> had no difficulty in staining with Bismark-brown. Gaffky states that the best color is methylen-blue, but that the bacilli are stained very well (*sehr gut*) with methyl-violet, gentian-violet, Bismark-brown, and fuchsin, and less well by hæmotoxyl'n. Meyer<sup>40</sup> had the same difficulty in staining reported by Eberth; but Friedlander<sup>41</sup> found that the bacilli in the sections stained intensely (*intensiv*).

The conclusion which necessarily follows is that either the action of the organism towards stains is variable and dependent upon conditions, or the majority of the above-mentioned investigators were working with germs which were not identical with those of Eberth.

Since the above lecture was given, a very valuable paper on the "Variability and Varieties of the Typhoid Bacillus," by the distinguished bacteriologist, Babes,<sup>42</sup> has appeared. This paper in part confirms and in part complements the work reported in the lecture. The chief points made in the paper may be stated as follows:

(1) The bacillus varies in size and appearance according to the culture medium on which, or the temperature at which, it is grown.

(2) Many of the saprophytic bacilli stain as feebly in Gram's method as the typhoid germ.

(3) The growth on potato is not always invisible, and many other organisms do form an invisible mould; therefore this test is not characteristic.

(4) The flagella discovered by Löffler are not characteristic.

(5) There is nothing characteristic in the effects upon the lower animals. The "typhoid-like" bacilli are more highly pathogenic than the typhoid germ.

(6) He has found in a case of dysentery, in the body of a mouse dead from an unknown cause, and in water, germs which give all the so-called characteristic reactions.

(7) He has found in twelve *post mortems* of typhoid subjects germs, all of which respond to the characteristic tests, but which differ from one another.

(8) In all of these cases, with one exception, he finds what he calls the typical typhoid bacillus along with atypical ones. This "typical" germ is not identical with that obtained from the Berlin Hygienic Institute, and among its properties are two which other bacteriologists would deem sufficient to exclude it from any possible connection with the typhoid germ. These are: (1) it evolves a putrefactive odor\*, and (2) old cultures on potato are brown.

(9) Although he has been unable to convert any of the varieties into the typical germ, he has seen the differences grow less marked. (We are not told what means he has used to influence the properties of the germs.)

(10) A very important statement is made by Babes, but upon this he lays no stress. It is that he has found some of the varieties outside the body (in drinking-water), but the typical germ has been found only in the bodies of those dead of typhoid fever. The facts given in the lecture will probably explain this statement.

(11) Animals inoculated with the atypical germs die more certainly (*i.e.*, a larger proportion of them die) and more rapidly than those inoculated with the typical germ. Exactly the same changes are found after death.

How Babes can conclude, after all this valuable work, that his typical germ is the sole cause of the disease, I cannot understand. It is true that he indirectly implies that other germs might cause the disease, because he constantly speaks of his typical germ as "the typical germ of our cases."

In again concluding, I wish to say that it seems very evident to me that the belief that typhoid fever is due at all times to one and the

\*Neither A nor B give off any putrefactive odor, even after the pieces of spleen, described in the lecture, were kept in the incubator for two months.