De Assis in 1939 (a,b) described strain 648, which was related in cultural properties to *Shigella alkalescens*, although it failed to ferment dulcitol. Antibiotically it was entirely different from the ordinary *S. alkalescens*. At that time this form was called alkalescens II, a designation that was adopted by Neter (1944). Approximately 20 strains of this type were isolated from cases of dysentery in Rio de Janeiro and Sao Paulo (De Assis et al., 1946; De Assis, 1947b). Two of the strains slowly utilized lactose (De Assis et al., 1946). In a recent publication, De Assis (1947b) designated these strains as *Shigella tieté*.

Among the strains employed by Braun and Unat (1942a,b, 1943a,b) in their investigation of the inagglutinability of certain shigellae, a strain Clark was mentioned which, when received in this laboratory, proved to be culturally and serologically indistinguishable from *S. tieté*. The isolation of strains of this type at two points as distant as Brazil and Turkey suggested that *S. tieté* is more than a local Brazilian variant. For this reason, and because the confusion regarding this type reflects what may occur in the classification of shigellae in general, we feel justified in reporting our experiences with *S. tieté*.

The strain Clark was obtained through the courtesy of Professor Braun both as “Od” and “Ol” variant. Dr. de Assis kindly sent us four of his strains including the lactose-fermenting cultures, “Gen” and “Cav.” We are also indebted to Drs. Ewing, Francis, Neter, and Mollari for strains used in this work.

*S. tieté* is a gram-negative rod that is nonmotile in fluid media and semisolid agar at 20 C and 37 C. It does not liquefy gelatin nor attack urea. It is anaerogen, indole-positive, and it reduces trimethylamine oxide (Wood and Baird, 1943; Weil and Black, 1944). It forms acid rapidly from glucose, mannitol, maltose, and arabinose, and may or may not slowly utilize salicin. Dulcitol and rhamnose are not fermented. Lactose was not acidified by two of the strains of Dr. de Assis, but was slowly fermented by strains “Gen” and “Cav” as well as by Braun’s strain Clark. On agar plates, the strains form both clear and opaque colonies, as observed in *S. alkalescens* (see figure 1 and references in Weil, 1947). All strains formed round smooth colonies. They grow evenly throughout fluid media, and suspensions are salt-stable.

The clear variant is agglutinable. The opaque variant is inagglutinable when tested in the living state, but after boiling for 1 hour the bacteria are completely agglutinable. The clear variant usually breeds true. The opaque form has a tendency to split off clear variants. The inclination to do so varies greatly in the progeny of individual colonies picked and repeatedly replated.

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1 Pronounced: tee-ay-tay.
When tested by slide agglutination with absorbed sera or in tubes with unabsorbed sera for *Shigella dysenteriae*, *Shigella ambigua*, the 15 types of Flexner (I to XIV and *Shigella etouae*), *Shigella sonnei*, *S. alkalescens*, and the 5 types of the Large Sachs group, no agglutination was obtained. Also no significant reactions were obtained with living or boiled bacteria with sera for *Shigella wakefield*, strains 1831 and 2370 of Wheeler, Neter's 9731 (alkalescens type IV), and a few hitherto undescribed single strains, including the culturally similar strain A113, which Dr. J. B. Nelson isolated in India as no. 1477–C857. Boiled bacteria reacted to approximately 10 per cent of the homologous titer with sera for *Shigella rio* (Weil et al., 1948), Boyd's strain 1296/7, and Ewing's 2–193. In all three cases absorptive analysis showed that minor and independent anti-

![Image](http://jb.asm.org/)

**FIG. 1.** Twenty-four-hour Culture on Agar Showing the "Clear" and the "Opaque" Variants of a Strain of *Shigella tieté*. Magnification Approximately 2 X

genic relations are involved. As to *S. rio*, there was no evidence that absorption with one of the *S. tieté* strains influenced significantly the phase B antigen.

When rabbits were immunized with *S. tieté* strains, sera were obtained that gave identical reactions when tested against the different *Shigella* types listed in the previous paragraph. They could be exhausted by each of the *S. tieté* strains. It made no difference whether live or boiled cultures were used. Absorption of the sera made with living microorganisms by bacteria boiled for 1 or 2 hours also completely exhausted the sera.

Significant cross reactions were observed with strains of Ewing's 2–193 and with Boyd's 1296/7. Absorption with these strains showed that the homologous reaction is not significantly impaired and the antibodies reactive with the two strains are not identical. Strain 9731 of Neter also showed some cross reaction. Absorptive analysis showed that this antigen is related to the one present in Boyd's 1296/7.
DISCUSSION

Our data are in complete agreement with those of De Assis. *S. tieté* appears to be a distinct new member of the genus *Shigella*. It shares with other shigellae (see references in Weil, 1947) the property of a heat-labile component or structure that inhibits agglutination in the living state. Variants are formed (and possibly also may occur in natural surroundings) in which this "envelope" is lacking. The agglutinable and inagglutinable variants can be distinguished by differences in the opacity of their colonies, which is another character that *S. tieté* shares with *S. alkalessens*.

It appears that otherwise indistinguishable strains of *S. tieté* may differ in their ability to ferment lactose slowly. In a recent review (Weil, 1947), occasion was taken to emphasize the variability of the cultural properties of *Shigella* types. Thus, *Shigella paradysenteriae* types IV and VI comprise strains that may or may not utilize mannitol, and Flexner type VI also comprises strains that may or may not form slight amounts of gas (references in Weil, 1943, 1947). From the general agreement on these cases it appears that the viewpoint that antigenic relationships are of greater importance than cultural properties for defining *Shigella* types is gaining wider acceptance. This attitude will probably facilitate the correlation of classification and immunological host relations (Weil, 1947).

In the case of *S. tieté* the range of variation extends to a property that in the past appeared to be of particular importance in classification, namely, to the utilization of lactose. However, *S. tieté* is not the only *Shigella* type in which lactose fermentation varies. The antigenic characteristics of the *Shigella* (2-193) that was first found by Ewing, and which is identical with Neter's alkalessens III (Neter, 1944; De Assis, 1947a), are found in strains that do and and that do not form acid from lactose (Carpenter, 1943; Carpenter and Stuart, 1946). Under the predominance of cultural considerations, Ewing's 2-193 has been successively classified as a *S. alkalessens*, as *S. dispar* (Carpenter and Stuart, 1946), and as *S. flexneri* (Francis, 1946). Similar uncertainties have been avoided in the description of salmonellae by adopting the practice of designating new types by some geographical epithet. It may be advisable to follow a similar procedure in the designation of new shigellae. Accordingly, a Brazilian *Shigella* has recently been described by Weil et al. (1948) as *Shigella rio*, and this consideration induced De Assis to abandon his former designation of *S. alkalessens* II in favor of *S. tieté*.

SUMMARY

Data on the cultural and antigenic properties of *Shigella tieté* are given.

The reasons for favoring the designation of new shigellae by geographical epithets are discussed.

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