A NOTE ON THE TAXONOMY OF
LACTOBACILLUS BIFIDUS

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During recent years increasing attention has been drawn to Lactobacillus bifidus, especially in investigations of its nutrition. It seems, however, that some confusion still occurs as to the taxonomy of this bacterium.

According to Weiss and Rettger (1), L. bifidus is characterized by its strict anaerobic behaviour in freshly isolated cultures, and its very variable cell shape. Weiss and Rettger (2) later called attention to a possible subspecies, L. parabifidus, which they considered more permanently anaerobic than L. bifidus, and capable of fermenting pentoses. These considerations of Weiss and Rettger have been accepted in the current edition of Bergey's Manual (3).

Later authors have paid attention to the "straight rod variants" of L. bifidus, which may develop from branched cultures. The change in morphology is accompanied by development of the ability to grow aerobically. Norris et al. (4) have concluded that an inclusion of such aerobic straight rod cultures under the conception "L. bifidus" must be incorrect. Accordingly, they proposed that the species pattern should be limited to the obligate anaerobic branched type only, and that the name L. parabifidus should be employed for the aerobic (or microaerophilic), frequently straight rod cultures. Norris et al. considered the "straight rod type" to be a variant of the anaerobic branched type. Hence the proposal of these authors was exactly the reverse of the considerations of Weiss and Rettger (1, 2).

From the definition of the variant conception outlined by Smith, Gordon, and Clark (5) ("A variant is an organism showing some variation in some character from the pattern of the stable parent species") it follows that the proposal of Norris et al. (4) is obscure. L. bifidus (Norris et al.) is distinguished from L. parabifidus (Norris et al.) on the basis of differences in morphology and in sensitivity to oxygen. So far as these characteristics are concerned L. bifidus provides no stable species pattern. L. parabifidus, again, may

not be a variant of its variable parent culture (L. bifidus). For the same reason L. parabifidus (Weiss and Rettger) can hardly be considered a subspecies of L. bifidus (Weiss and Rettger).

Recently the present author (6) cited evidence to show that primary cultures may possess the characters of L. parabifidus (Weiss and Rettger) and L. bifidus (Norris et al.). On subcultivation *in vitro*, the cultures showed a gradual change in their characters, especially cell morphology. The change was from a slightly branched anaerobic type to a microaerophilic type showing manifold branchings and mycelial filaments. Ultimately, straight rods developed from the filaments. The "straight rod" cultures were often aerobic. Both the latter types--highly branched forms or regular straight rods--most closely correspond to L. bifidus (Weiss and Rettger) and L. parabifidus (Norris et al.).

These findings show that the polymorphic appearance and the variation in sensitivity to oxygen may be distinctive characters of L. bifidus, and accordingly, that aerobic or microaerophilic types showing variation in morphology cannot be considered variants or subspecies of the ordinary anaerobic and branched type of L. bifidus.

Recently Rose and György (7) have reported that there occur two nutritionally different types of L. bifidus: a type which requires a specific factor present in human milk as an essential nutrient, and another type which does not require this factor for growth. These authors consider it probable that the former type, which they have named L. bifidus var. pennsylvanicus, is the parent organism, which may mutate into the latter, non-milk-requiring "regular" form of L. bifidus. Accordingly, the characteristic property of L. bifidus var. pennsylvanicus can be lost by variation, and then strains of L. bifidus var. pennsylvanicus may not vary from typical L. bifidus strains. It has not been reported that ordinary L. bifidus strains change, spontaneously or on training, into the milk-requiring type, and thus it can be concluded that L. bifidus in this respect provides a "stable parent species". L. bifidus var. pennsylvanicus, therefore can be considered a true variant of L. bifidus.

On the basis of the facts presented above it can be concluded that Lactobacillus bifidus (Tissier) Holland (L. bifidus Weiss and Rettger; cf. Bergey's Manual (3)) is to be considered as species pattern. The description given in the

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1948 Bergey's Manual, however, ought to be amended in certain paragraphs, especially the characteristic variation in morphology and in sensitivity to oxygen must be emphasized. It would then read:

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Small, slender rods....., very variable in appearance. Slightly branched and club forms are characteristic of freshly isolated cultures. On subcultivation highly branched filaments or regular straight rods may develop.

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Strict anaerobe in primary culture becoming microaerophilic. Straight rod cultures often show surface growth in stabs.

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Distinctive characters: Bifurcations and club-shaped forms, particularly in primary culture. On subcultivation highly branched filaments may develop, which are readily changed into regular straight rods.

SUMMARY

The taxonomy of Lactobacillus bifidus is briefly discussed. Evidence is cited to show that the variation in morphology and in sensitivity to oxygen, regularly found in this bacterium, does not permit creation of distinct variants or subspecies. It is proposed that the current description of L. bifidus (L. bifidus (Tissier) Holland in Bergey's Manual) should be amended in certain paragraphs.

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