NOTES

Leuconostoc mesenteroides subsp. *cremoris* (Knudsen and Sørensen) comb. nov. and *Leuconostoc mesenteroides* subsp. *dextranicum* (Beijerinck) comb. nov.

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Leuconostoc mesenteroides (Tsenkovskii) van Tieghem 1878, *Leuconostoc dextranicum* (Beijerinck) Hucker and Pederson 1930, and *Leuconostoc cremoris* (Knudsen and Sørensen) Garvie 1960 belong to a single deoxyribonucleic acid homology group. These three organisms have similar lactate dehydrogenases and glucose-6-phosphate dehydrogenases. Because of these common properties, these organisms are here regarded as subspecies within a single species, *Leuconostoc mesenteroides*. The names of the subspecies are *Leuconostoc mesenteroides* subsp. *mesenteroides*, *Leuconostoc mesenteroides* subsp. *dextranicum* (Beijerinck) comb. nov., and *Leuconostoc mesenteroides* subsp. *cremoris* (Knudsen and Sørensen) comb. nov. The type strains of these subspecies are ATCC 8293, NCDO 529, and NCDO 543, respectively.

The concept that a single species, *Leuconostoc mesenteroides*, should include as subspecies the bacteria previously classified as *L. mesenteroides*, *Leuconostoc dextranicum*, and *Leuconostoc cremoris*, has been suggested previously (2, 7). These species form a single deoxyribonucleic acid (DNA) homology group despite large differences in physiological properties (1). DNA-DNA homologies have been estimated by the membrane filter technique (2) and by the hydroxyapatite method (7). Both of these studies used the type strains. *L. mesenteroides* NCDO 523^T (type strain) had $110 \pm 9.3\%$ DNA homology with *L. dextranicum* NCDO 529^T and $66 \pm 10.3\%$ with *L. cremoris* NCDO 543^T (2). The homology values were 90 and 78%, respectively, when hydroxyapatite was used (7).

The immunological relationships among the lactate dehydrogenases and among the glucose-6-phosphate dehydrogenases of the leuconostocs have been determined (4, 6). On this basis, it was found that *L. mesenteroides* (most strains), *L. dextranicum*, and *L. cremoris* constituted a single group distinct from *Leuconostoc lactis*, *Leuconostoc paramesenteroides*, and *Leuconostoc oenos*, thus supporting the division of the genus based on DNA homology.

Recently, other authors have argued that a DNA homology group forms a bacterial species and have divided the *Lactobacillus acidophilus* group into several species based on DNA homology groups (8, 10). The same species concept has been used for other genera (5, 11, 12).

As phenotypically similar strains are placed in different species on the basis of low DNA homology and different compositions of enzyme proteins, conversely, phenotypically different strain NCDO 523, is in the group of strains that shows high DNA-DNA homology with the type form single genospecies.

Hontebeyrie and Gasser (7) have suggested that *L. mesenteroides* may require subdividing. However, the type strain of *L. mesenteroides*, strain NCDO 523, is in the group of strains that shows high DNA-DNA homology with the type strains of *L. dextranicum* and *L. cremoris*. On the basis of priority, the name *L. mesenteroides* must remain with this group even if new species are defined subsequently.

At present, there is no explanation for why bacteria showing wide phenotypic differences have high DNA homology. DNA homology techniques measure chromosomal DNA, and it appears that much of the information carried in the *L. cremoris* chromosome is suppressed. Plasmids may be involved, but their role, if any, must await clarification until there is an understanding of the function of plasmids in bacteria living under natural conditions. The differences between the proposed subspecies are stable and many. It appears unlikely that these differences are all individually encoded in plasmids.

The decision to propose subspecies status for *L. dextranicum* and *L. cremoris* was made because the distinctions among the three proposed subspecies are large. *L. cremoris* is an important

dairy starter organism. The differences between *L. cremoris* and the other two species, *L. mesenteroides* and *L. dextranicum*, are important to the dairy industry. The names of the proposed subspecies are *Leuconostoc mesenteroides* subsp. *dextranicum* (Beijerinck) comb. nov. and *L. mesenteroides* subsp. *cremoris* (Knudsen and Sørensen) comb. nov.; according to rule 46 of the *International Code of Nomenclature of Bacteria* (9), the valid publication of these subspecies names automatically creates the subspecies *L. mesenteroides* subsp. *mesenteroides*. The type strains of these subspecies are NCDO 529, NCDO 543, and ATCC 8293, respectively. The properties of these type strains have been described recently (2, 3).

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