BREVIBACTERIUM HELVOLUM
(ZIMMERMANN) COMB. NOV.

A.G. Lochhead

Bacteriology Division, Science Service,
Department of Agriculture, Ottawa, Canada

In 1890, Zimmermann (7) described an organism isolated from Chemnitz tap water to which he gave the name Bacillus helvolus. The organism was reported to be a nonsporulating, Gram-positive rod, occurring usually in pairs, as well as in fours or longer chains. The cells were about 0.5 microns in width and usually 1.5 to 2.5 microns in length though at times they reached a length of 4.5 microns. The rods were stated to rotate on their long axis. On agar, gelatin and potato the organism grew well, with cultures of a bright yellow color, gelatin being slowly liquefied, while broth became turbid with a yellowish-white sediment. The organism grew best at room temperature.

In view of the inability of the species to produce spores, Lehmann and Neumann (6) proposed a new combination, naming the organism Bacterium helvolum. These authors also added certain characters to the original description from a study of a culture isolated from air that agreed with Zimmermann's culture. Lehmann and Neumann furthermore reported their strain to be able to coagulate milk and produce hydrogen sulfide, but incapable of producing indole or of forming gas from glucose. Though confirming Zimmermann's description in other respects, they stated that their culture was nonmotile.

In 1918, the name Corynebacterium helvolum was first used as a new combination for Zimmermann's organism by Kisskalt and Berend (5). The paper in question, which has been widely quoted, provides no comparative experimental data, but states briefly that the authors have recognized Bacterium helvolum, among others, as a diphtheroid.

A further combination for Zimmermann's organism appeared in the first edition of Bergey's Manual of Determinative Bacteriology, 1923, in which the binomial, Flavobacterium helvolum, was first used. The description of the species, which was carried through unaltered to the fifth edition of the Manual, 1939, indicated the organism to be Gram-negative, obviously erroneously, since Zimmermann (7) as well as Lehmann and Neumann (6) had stated it to be Gram-positive.

In a study of saprophytic mycobacteria and corynebacteria isolated from soil, Jensen (4) described a species-group which he designated as Corynebacterium helvolum (Zimmermann) Kisskalt and Berend, with the following names considered as synonyms: Bacillus helvolus Zimmermann, Bacterium helvolum (Zimmermann) Lehmann and Neumann, and Flavobacterium helvolum (Zimmermann) Bergey et al. Jensen's species, which represented the most common soil corynebacterium found, showed the wide range of morphological variations characteristic of the "soil diphtheroids" and though various strains showed certain physiological and cultural differences, such as a color range from cream through greyish yellow to chrome-yellow, Jensen regarded them to be most appropriately grouped as one species. It is not clear why Jensen considered his soil type to be identical with Zimmermann's organism, since he does not appear to have had the latter available for comparison, nor is there anything in the descriptions provided by Zimmermann, Lehmann and Neumann, or Bergey, et al. to indicate the pleomorphism noted in Jensen's species.

In 1928, Conn (2) described, under the name Bacterium globiforme, an organism occurring abundantly in soil which showed pronounced pleomorphism in that it changed from a distinct rod in young cultures to a coccus form on further incubation. The characteristics of the species indicated by Conn suggest a relationship of Bacterium globiforme to the soil corynebacteria later described by Jensen (4). Conn's organism, however, does not appear to have been used for comparison nor to have been considered in relation to its possible identity with any of the species of Corynebacterium named by Jensen.

More recently Conn and Dimmick (3) provided further characterization of Bacterium globiforme which strengthened the belief that their organism was closely related to Jensen's soil corynebacteria and in particular to his Corynebacterium helvolum which was included in the studies reported. The group of organisms typified by Bacterium globiforme was admitted by Conn and Dimmick to be closely related to the genus Corynebacterium. However, these authors considered such soil types to have characteristics sufficiently different from those of the type species as to warrant generic distinction and proposed for their inclusion a new genus, Arthrobacter, with Arthrobacter globiforme as the type species.

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Apparently solely on the basis of its chromogenesis, Jensen's Corynebacterium helvolum was regarded as a species distinct from A. globiforme.

In a recent comparative study by the writer of organisms of the "soil diphtheroid" type which might be considered for inclusion in the genus Arthrobacter, proposed for the seventh edition of Bergey's Manual, a culture of Conn's Arthrobacter globiforme as well as one of Jensen's Corynebacterium helvolum were included*. Though Jensen's strain was yellow when received, it had later become nonchromogenic, showing a cream colored growth on agar indistinguishable from that of A. globiforme. Comparative tests, morphological and physiological, showed the cultures to resemble each other so closely that it was impossible to designate any distinguishing feature in which they differed. The findings therefore point to the identity of Jensen's C. helvolum with A. globiforme (Conn) Conn and Dimmick. Though Conn and Dimmick (3) were inclined to consider the yellow pigmentation of Jensen's organism sufficient for species separation, Jensen (4) included in the species strains with a range of pigmentation from cream to yellow, and this fact, considered in conjunction with the loss of color in the strain examined by the writer, leads us to regard the chromogenic strains as variants of A. globiforme. The reason for Jensen's assumption of the identity of this species with Zimmermann's organism is not clear, and doubt of this identity was expressed by Conn and Dimmick.

If the identity of Jensen's organism with A. globiforme is admitted, it is clear that the name C. helvolum as employed by him cannot be regarded as synonymous with that used to designate Zimmermann's species. The morphology of the latter organism, both as described by Zimmermann and also by Lehmann and Neumann, is that of a simple rod without any suggestion of snapping division, branching, or the pleomorphism of the "soil diphtheroids". The earlier descriptions thus differ from that given in the 6th edition of Bergey's Manual in which the organism was removed from Flavobacterium and placed in the genus Corynebacterium, with the description radically altered to conform with that given by Jensen. Though it is to be assumed that Kisskalt and Berend (5)

*The cultures were kindly supplied by Dr. Conn, in 1941 and 1948 respectively.

based their selection of the name Corynebacterium helvolum on the study of a culture of Zimmermann's species there is little to indicate the reason for their change in generic name.

Since Zimmermann's organism is the one for which the specific epithet helvolum is valid, it is reasonable that the description should follow Zimmermann's or that of Lehmann and Neumann who were confident that they were working with the same organism. Though it is uncertain whether Zimmermann's culture is still available the descriptions referred to provide a basis for classification and reidentification.

In a paper read before the VI International Congress for Microbiology, Breed (1) established a new genus, Brevibacterium Breed, to include short, unbranched, Gram-positive, nonspore-forming, rod-shaped bacteria, reproducing by simple cell division, with B. linens (Weigmann) Breed as type species. This new genus will be recognized in the seventh edition of Bergey's Manual, and, with the genus Kurthia Trevisan, which includes larger, peritrichous, Gram-positive rods that grow into filaments, will constitute the new family Brevibacteriaceae. The matter of the most appropriate allocation of Zimmermann's organism was discussed with Dr. Breed, Chairman, Bergey's Manual, who agreed that it is properly placed in the genus Brevibacterium. The bibliographical record of this species is as follows:

Brevibacterium helvolum (Zimmermann, 1890) comb. nov.

Bacillus helvolus Zimmerman, 1890,

Bacterium helvolum Lehmann and Neumann, 1896,

Corynebacterium helvolum Kisskalt and Berend, 1918,

not Corynebacterium helvolum Jensen, 1934,

Flavobacterium helvolum Bergey et al., 1923.

REFERENCES

1. Breed, R.S. The Brevibacteriaceae fam. nov. of order Eubacteriales. Riassunti d. Comunicaz., VI Cong. Internaz. di Microbiol. 1:13-14. 1953.
2. Conn, H. J. A type of bacteria abundant in productive soils, but apparently lacking in certain soils of low productivity. New York State Agric. Exp. Sta. Tech. Bull. 138. 1928.

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3. _____ and I. Dimmick. Soil bacteria similar in morphology to Mycobacterium and Corynebacterium. Jour. Bact. 54:291-303. 1947.
4. Jensen, H.L. Studies on saprophytic mycobacteria and corynebacteria. Proc. Linn. Soc. N.S. Wales. 59: 19-61. 1934.
5. Kiskalt, K., and E. Berend. Untersuchungen über die Gruppe der Diphtheroiden (Corynebakterien). Centr. Bakt. Parasitenk. Abt. 1, Orig. 91:444-447. 1918.
6. Lehmann, K.B., and R.O. Neumann. Bakteriologische Diagnostik. 1 Aufl. 2:254. 1896.
7. Zimmermann, O. E. R. Bakterien unserer Trink- und Nutzwasser. Chemnitz. 1:52-53. 1890.
8. Bergey, D.H. et al. Bergey's Manual of Determinative Bacteriology. p. 114. 1st Ed. 1923.