NOTES

Emendation of *Thiobacillus perometabolis* London and Rittenberg 1967

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An emended description of *Thiobacillus perometabolis* type strain THI 023 (= ATCC 23370) is presented. *T. perometabolis* grows in autotrophic media containing reduced inorganic sulfur compounds and in heterotrophic media containing single carbon sources, contrary to the original description.

In 1967, *Thiobacillus perometabolis* ATCC 23370^T (type strain) was isolated by London and Rittenberg, who described this organism on the basis of one strain (i.e., the monotype) (4). The name *Thiobacillus perometabolis* appeared on the Approved Lists of Bacterial Names (6).

London and Rittenberg did not observe autotrophic growth of *T. perometabolis* at the expense of reduced inorganic sulfur compounds or heterotrophic growth at the expense of single carbon sources (4). However, we have observed growth of strain THI 023^T (= ATCC 23370^T) in autotrophic medium supplemented with thiosulfate, elemental sulfur, or tetrathionate and also in heterotrophic medium supplemented with alanine, glutamate, malate, citrate, succinate, or aspartate. Therefore, *T. perometabolis* was deemed to be a facultatively chemolithotrophic organism (2, 3). The mode for energy yielding is of great significance in the classification and identification of *Thiobacillus* species (1, 7), and the original description of *T. perometabolis* can lead to misidentifications of such bacteria.

In this paper we emend the description of *T. perometabolis* with regard to nutritional requirements and add new characters determined in a previous study (2, 3).

Description of *Thiobacillus perometabolis* London and Rittenberg 1967 emend. Katayama-Fujimura and Kuraishi. The description of this organism is based on the characteristics of type strain THI 023.

(i) **Cell morphology.** Rod-shaped cells (average dimensions, 0.4 to 0.5 μm wide by 1.1 to 1.7 μm long) with rounded ends. Cells occur singly or in pairs. Motile by means of a single polar flagellum. Nonsporeforming. Gram negative. Not acid-alcohol-fast.

(ii) **Colonial appearance.** Colonies on yeast extract-thiosulfate medium are circular, entire,

convex, smooth, creamy white, opaque, and about 1 to 3 mm in diameter after 1 week of incubation. Colonies on thiosulfate-mineral salts agar are circular, entire, convex, smooth, creamy white, and opaque, developing a brown center with age; these colonies are about 0.5 mm in diameter after 10 days of incubation.

(iii) **Biochemical and physiological properties.** *T. perometabolis* is obligately aerobic, and anaerobic growth is not observed in the presence of potassium nitrate.

This organism is a facultative chemolithotroph and grows slowly in heterotrophic media containing 20 to 40 mM substrate, such as alanine, glutamate, malate, citrate, succinate, or aspartate, after a long lag phase (about 2 weeks). The lag phase is shortened by adding thiosulfate to the media. Furthermore, this organism grows in mixotrophic media supplemented with α -ketoglutarate, serine, or histidine. Weak growth, as determined by colony formation on plates and by optical density in liquid media, is observed with mixotrophic media containing glucose or gluconate. This organism grows in liquid inorganic salts media supplemented with thiosulfate, elemental sulfur, or tetrathionate; this growth is accompanied by a decrease in the pH of the media. Thiocyanate does not support growth.

Potassium nitrate, ammonium chloride, and urea are utilized as nitrogen sources. Glutamate and aspartate are utilized as both nitrogen and carbon sources.

Growth occurs at 15 to 42°C; optimum growth occurs between 35 and 37°C.

Growth occurs at pH 5.0 to 7.0, and optimum growth occurs at pH 5.5 to 6.0 in thiosulfate-yeast extract medium.

Gelatin is not liquefied.

Guanine-plus-cytosine content: 65.0 mol%.

Ubiquinone system: ubiquinone 8.

This organism has hexadecanoic acid, hexadecenoic acid plus cyclopropane acid of C₁₇, and octadecenoic acid plus cyclopropane acid of C₁₉ as its major non-hydroxylated cellular fatty acids and 3-hydroxydecanoic acid and 3-hydroxydodecanoic acid as its hydroxylated fatty acids.

Isolated from soil (4).

The type strain of *T. perometabolis* is THI 023. This strain has been deposited with the American Type Culture Collection under accession number ATCC 23370 and with the Institute of Applied Microbiology, University of Tokyo, Tokyo, Japan, under accession number IAM 12132.

Another strain, strain THI 024 (= ATCC 27793), which was originally isolated by Myers and Millar (5), is regarded as a separate species, *Thiobacillus rapidicrescens* (2).

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