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Firmicutes D/

Dethiobacteria class. nov.

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De.thi'o.bac.ter.i.a. N.L. masc. n. *Dethiobacter*, type genus of the type order of the class *Dethiobacterales*; N.L. neut. pl. n. suff. *-ia*, ending to denote a class; N.L. neut. pl. n. *Dethiobacteria*, class of the order *Dethiobacterales*.

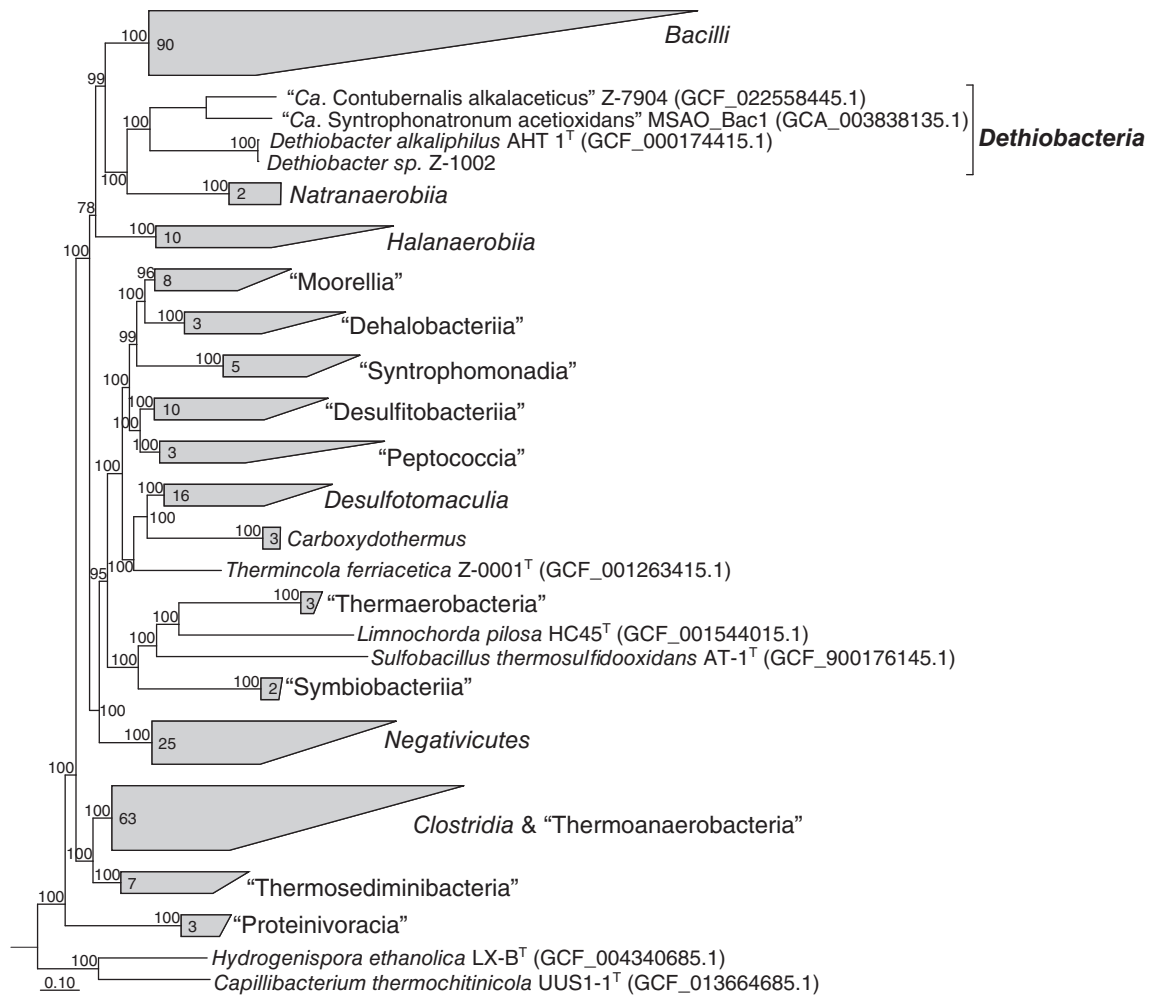
The class *Dethiobacteria* forms a deep-branching phylogenetic lineage in the phylum "*Firmicutes D*" (according to the GDTB classification) and includes obligately anaerobic haloalkaliphilic bacteria with respiratory metabolism from soda lakes. It consists of a single order *Dethiobacterales*, family *Dethiobacteraceae*, and genus *Dethiobacter*.

The class incorporates obligately anaerobic, moderately salt-tolerant, and obligately alkaliphilic bacteria isolated from soda lakes, which grow chemolithoautotrophically (fixing CO₂ by the Wood–Ljungdahl pathway) either by disproportionation of elemental sulfur or by anaerobic respiration with sulfur, thiosulfate, or Fe(III) as acceptors and H₂ or formate as the electron donors (Sorokin et al., 2008; Poser et al., 2013; Melton et al., 2017). Two isolates are currently known in pure culture: the type strain AHT1^T forming the type species isolated from a soda lake in Mongolia and a closely related unclassified strain Z-1002 enriched from soda

lake Magadi in Kenya (Zavarzina et al., 2018). Furthermore, two candidate genera of syntrophic acetate-oxidizing anaerobes from hypersaline soda lakes, *Ca. Synthrophonatronum* acetoxidans (Sorokin et al., 2014, 2016; Timmers et al., 2018) and *Ca. Contubernalis* alkaliaceticus (Zhilina et al., 2005), are also members of the class *Dethiobacteria*. They form a separate family and most probably (according to the phylogenomic calculations) represent a second order-level lineage. Currently, however, the only order in the class *Dethiobacteria* containing pure culture isolates is *Dethiobacterales* consisting of the family *Dethiobacteraceae*, the genus *Dethiobacter* and the type species *D. alkaliophilus* (Sorokin et al., 2008, 2014). The class status in the phylum "*Firmicutes D*" was established by phylogenomic analysis and was based on the GTDB classification (Figure 1). According to our current phylogenomic analysis, the phylum "*Firmicutes D*" confidently incorporates two classes: *Dethiobacteria* and *Natranaerobiia* (Sorokin et al., 2021). The issue about inclusion of the representatives of the *Alkalicella*, *Anaerobranca*, and *Proteinivorax* genera (class "Proteinivoracia" according to the GDTB classification) in "*Firmicutes D*" needs to be further established as genomic data continues to accumulate.

Type order: **Dethiobacterales.**

FIGURE 1. Phylogenomic placement of *Dethiobacteria* among other *Firmicutes* classes based on a concatenated amino acid sequence alignment of the 120 bacterial single-copy, conserved protein markers (Parks et al., 2018). The tree was built using the PhyML 3.0 program (Guindon et al., 2010) and the approximate likelihood-ratio test for branches (Anisimova and Gascuel, 2006). Bootstrap values above 90% are shown at the nodes. The numbers inside the collapsed clusters indicate the number of sequences used for the analysis. Names in quotation marks are not validly published and are quoted from the Genome Taxonomy Database Release 07-RS207. Bar, 0.10 changes per position.



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