O190 Acetispirales, a new order of homoacetogenic deltaproteobacteria from insect guts

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Reductive acetogenesis from H_2 and CO_2 is an important process in termite guts. Unlike in other environments, it is not catalyzed by homoacetogenic *Firmicutes* but instead by a termite-specific lineage of spirochetes. Recent studies documented that the enzymes required for the Wood-Ljungdahl pathway are also present in the genome of '*Candidatus* Adiutrix intracellularis', an endosymbiont of termite gut flagellates that represents a deep-branching clade of *Deltaproteobacteria*, the Rs-K70 group. Although this group is widely distributed in intestinal tracts of termites and cockroaches, its members have not been cultured. We isolated the first representative of this group from cockroach guts. *Acetispira formosa* grows by reduction of CO_2 with hydrogen or formate and by the homoacetogenic fermentation of glucose and *N*-acetylglucosamine. Comparative analysis of the genomes of *A. formosa* and '*Ca.* Adiutrix intracellularis' and the draft genome of an uncultured strain from a higher termite reconstructed by metagenomic analysis revealed that the same set of genes is involved in reductive acetogenesis in all three organisms. The hydrogen-dependent CO_2 reductase, a key enzyme of the pathway, which was most likely acquired via lateral gene transfer, appears to be of clostridial origin. However, none of the genomes encode an energy-converting hydrogenase or an Rnf complex. Instead, they encode an 11-subunit complex that has been implicated in energy conservation of methyl-reducing methanogens, which suggests that energy metabolism in *Acetispirales* differs from that in homoacetogenic *Firmicutes*.