

Supplementary Text:

Evolution of the natural transformation protein, ComEC, in bacteria

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Manual operations for the visualization of the species phylogeny: In the visualization of bacterial phylogeny (Figure 2), taxa that contained a single representative species were eliminated from the phylogeny to enhance the visualization of major branches. The eliminated single lineages included *Caldisericum exile* AZM16cD1 of the Caldiserica (1), *Fimbriimonas ginsengisoli* Gsoil 348 of the Armatimonadetes (2), *Kiritimatiella glycovorans* L21-Fru-AB of the Kiritimatiellaeota (3), *Candidatus Cloacimonas acidaminovorans* str. Evry of the WWE1 candidate division (4), *Fibrobacter succinogenes* subsp. succinogenes S85 of the Fibrobacteres (5), *Gemmatimonas aurantiaca* T-27 of the Gemmatimonadetes (6), *Desulfurispirillum indicum* S5 of the Chrysiogenetes (7), and *Candidatus Babela massiliensis* 673862, which has been identified as the single representative of the TM6 phylum (8). Additionally, *Thermodesulfobium narugense* DSM 14796 was removed as it was distant from the rest of the Firmicutes despite being labeled as one in the NCBI Taxonomy database. Work by other groups has demonstrated the distant relationship between *T. narugense* and any known bacteria (9). The same was applied for *Coprothermobacter proteolyticus* DSM 5265, which was also labeled as a Firmicutes based on NCBI taxonomy, but it has been shown to not be a member (10). Some taxa were merged with others to reduce the phylogenetic complexity. The Tenericutes were included with Firmicutes and the Acidithiobacillia with the Deltaproteobacteria. The strain *bacterium* L21-Spi-D4 was included as a member of the Bacteroidetes based on its genome paper (11). The Desulfurellaceae and Epsilonproteobacteria were included in the recently classified Campylobacterota (12, 13). Lastly, *Thermobaculum terrenum* ATCC BAA-798, not currently assigned a phylum in the NCBI Taxonomy database, was included as a member of the class Chloroflexi (phylum: Firmicutes) as it has been proposed to be a member (14).

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