Rhodobacter capsulatus is an ideal bioenergetics model being a motile, Gram-negative, facultative photosynthetic bacterium which is able to utilize numerous carbon sources such as sugars, organic and amino-acids. The genome annotation of Rb. capsulatus indicates the presence of two acetate permeases (ActP1 and ActP2), whose functional/molecular mechanism is not yet understood in spite of the central importance of acetate for biotechnological production. Curiously, recent new insights into the mechanism of acetate transport by Rb. capsulatus are based on our knowledge of the cytosolic entry mechanism of the toxic oxyanion tellurite (HTeO$_3^-$/TeO$_3^{2-}$) [1,2]. Indeed, the strong toxicity of TeO$_3^{2-}$ is of general concern because the expanding use of tellurium in electronics and metallurgy, may give rise to high-local concentration close to waste dumps and metallurgical plants, with detrimental effects on the environment and human health [1,3]. It has been proposed that tellurite is transported inside the cells by means of an electro-neutral, $\Delta pH$ dependent, $H^+$/A-symport mechanism allowing the cells to precipitate the metalloid as reduced/inert Te(0) crystals [1]. Notably, in Rb. capsulatus cells, the acetate transport is decreased by non-toxic amounts of tellurite in a competing manner [2]. Recent data also indicated that Rb. capsulatus mutants carrying a non-functional actP2 gene show decreased transport of acetate and tellurite (60% and 80%, respectively) while the expression of ActP2 in Escherichia coli allows to acquire the biochemical features of Rb. capsulatus tellurite transport (shown here). Further, comparing in several Proteobacteria the presence and/or the sequences of actP1 and actP2 genes, an interesting correlation has emerged between the species without actP2 and the lack of tellurite uptake. This correlation allowed us to tentatively identify in ActP2 a “loop” of 15 AA, which is not present in ActP1, possibly linked with the capacity of ActP2 to bind/transfer the oxyanion tellurite.

References


doi:10.1016/j.bbabio.2014.05.283