**Role of fumarate ion in changing bacterial flagellar motor from clockwise rotation to counterclockwise rotation**

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Bacterial flagellar motor (BFM) is one of the largest molecular motor and is used by bacteria to navigate their environment in search of better resource. BFM is a membrane bound rotary motor driven by Proton motive force (pmf) across the membrane. Pmf is made of two components i.e., ΔpH and ΔΨ (electrical potential across the membrane). Recent studies (Minamino, Imae et al. 2003, Nakamura, Kami-ike et al. 2009) indicate there is weak correlation between pmf and torque output of the BFM. In this study we show the output of BFM is varied by presence of negatively charged fumarate ion in the buffer. We have varied [fumarate ion] and [H+] in the buffer and studied bacterial flagellar motility using swimming assay and tethered cell assay. We find the motility of cells are lost if the fumarate concentration is increased to 20 mM in pH 5 and at pH 8 the motility is lost with 10 mM fumarate. This loss of motility is reversible and instantaneous. Using the tethered cell assay, we show the BFM move from Clockwise rotation at pH 5 to completely Counter Clockwise with increasing concentration of fumarate. These results suggest that fumarate ions play a direct role in BFM motility and needs further study to clarify the mechanism.