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Hydrodynamic model of bacterial tumbling near a non-slip surface[1] JIAN SHENG, MEHDI MOLAEI, Texas Tech University — To swim forward, wild type *Escherichia coli* bacteria rotate their helical flagella CCW to form a bundle; to tumble, one or more flagella rotate CW to initiate flagella unbundling and polymorphic transformation that leads to a significant change in cell orientation in comparison to original swimming direction. These random change of direction increases bacterial dispersion and also is long speculated to be a mechanism for perichtricous bacteria to escape from a surface. Our recent experimental results show that the tumbling frequency is substantially suppressed near a solid surface by 50%, and the bacterium tends to start a new run in the direction parallel to the surface. This suppression occurs at two cell length (including flagella) away from the surface whereby steric hindrance plays less significant role. Here we propose an analytical model based on hydrodynamic interaction between flagella and the solid surface. We utilize Slender Body Theory combined with the image system of the singularities for the Stoke-flow to quantify the flow around the bacterial flagella in the presence of a no-slip surface. The model includes two non-identical rigid helical flagella representing a bundle and single flagellum. We have showed that in the bulk, a repulsive force among flagella initiates the unbundling and consequently tumbling; however, in presence of a solid surface, the force is strongly mitigated that stabilize the bundle and suppress the tumbling.

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