

Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

Hydrodynamic interactions between flagella PIETER JANSSEN, MICHAEL GRAHAM, UW-Madison — Many bacteria, such as *E. coli*, use several rotating flagella to propel themselves at low-Reynolds numbers. If the flagella are all rotating counter-clockwise, they bundle up, and the cell moves at great speed. However, if one flagellum starts to rotate clockwise, it disentangles from the bundle, and the cell starts to rotate randomly. After a while, the rotation of all flagella becomes counter-clockwise again, and the cell starts moving again, now in a different direction. The bundling and disentangling is poorly understood from a fluid mechanics point of view. We investigate the hydrodynamic interactions between flagella that may lead to the bundling. Flagella are modeled as series of spheres connected through hinges with bending and twisting resistance. Hydrodynamic interaction between the spheres is incorporated through standard expressions. The cell body is described with a boundary-integral method. Synchronization between the flagella is shown, and we investigate the effect of stiffness, pitch and length of the flagella, and of the hook connecting the flagellum to the cell. Furthermore, we show the effect on the orientation, rotation and speed of the cell body under the influence of multiple flagella.

Michael Graham
UW-Madison

Date submitted: 31 Jul 2009

Electronic form version 1.4