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3D effects on diffusion coupled motility of Helicobacter pylori[1]
SURAJ KUMAR KAMARAPU, HENRY C FU, University of Utah — The bacterium *H. pylori* swims through the gastric mucus gel by diffusing ammonia from its body, de-gelling the surrounding medium to make a pocket of Newtonian fluid around itself. Confinement by this pocket impacts bacterial swimming and flows, while the flows simultaneously affect the pocket geometry via advection. Previously, a simple two-dimensional model of confinement effects predicted slight increase in swimming speeds. Here, we treat a realistic three-dimensional swimming bacterial geometry, and include the effects of its 3D swimming flows on the advection-diffusion of ammonia. *H. pylori* is modelled as a swimmer with a spherical head and a flagellum using the method of regularized Stokeslets. We model the mucus gel as a random spatial distribution of regularized Stokelets placed outside the Newtonian fluid pocket. To handle the large number of Stokeslets we implement a Fast Multipole Method. Advection-diffusion of ammonia is treated numerically in the frame of flagellum allowing us to solve a steady problem. We iteratively find a pocket geometry that leads to swimming flows that self-consistently produce the pocket geometry through the advection-diffusion of ammonia. We find that the bacterium swims at a slower speed than the unconfined speed at all Peclet numbers.

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