Abstract Submitted
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Accumulation of swimming bacteria near an interface[1] JAY TANG, GUANGLAI LI, Brown University — Microbes inhabit planet earth over billions of years and have adapted to diverse physical environment of water, soil, and particularly at or near interfaces. We focused our attention on the locomotion of Caulobacter crescentus, a singly flagellated bacterium, at the interface of water/solid or water/air. We measured the distribution of a forward swimming strain of C. crescentus near a surface using a three-dimensional tracking technique based on dark field microscopy and found that the swimming bacteria accumulate heavily within a micrometer from the surface. We attribute this accumulation to frequent collisions of the swimming cells with the surface, causing them to align parallel to the surface as they continually move forward. The extent of accumulation at the steady state is accounted for by balancing alignment caused by these collisions with rotational Brownian motion of the micrometer-sized bacteria. We performed a simulation based on this model, which reproduced the measured results. Additional simulations demonstrate the dependence of accumulation on swimming speed and cell size, showing that longer and faster cells accumulate more near a surface than shorter and slower ones do. The overarching goal of our study is to describe interfacial microbial behavior through detailed analysis of their motion.

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