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Accumulation of microswimmers near surface due to steric confinement and rotational Brownian motion GUANGLAI LI, JAY TANG, Brown University — Microscopic swimmers display some intriguing features dictated by Brownian motion, low Reynolds number fluid mechanics, and boundary confinement. We re-examine the reported accumulation of swimming bacteria or bull spermatozoa near the boundaries of a fluid chamber, and propose a kinematic model to explain how collision with surface, confinement and rotational Brownian motion give rise to the accumulation of micro-swimmers near a surface. In this model, an elongated microswimmer invariably travels parallel to the surface after hitting it from any incident angle. It then takes off and swims away from the surface after some time due to rotational Brownian motion. Based on this analysis, we obtain through computer simulation steady state density distributions that reproduce the ones measured for the small bacteria E coli and Caulobacter crescentus, as well as for the much larger bull spermatozoa swimming near surfaces. These results suggest strongly that Brownian dynamics and surface confinement are the dominant factors for the accumulation of microswimmers near a surface.

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