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Hydrodynamic interactions of Chlamydomonas with a solid surface[1] ABEL-JOHN BUCHNER, KOEN MULLER, DANIEL TAM, Technical University of Delft — Motile unicellular organisms swim through complex environments and often interact with solid surfaces. Their swimming is influenced by the proximity to solid substrates, through hydrodynamic and steric interactions. These interactions directly influence the cell population density distribution and the residence time in the vicinity of the surface, in turn modulating the probability of cell-surface adhesion and subsequent surface colonisation. The extent to which hydrodynamic forces influence cell-wall interactions remains unclear and previous experimental studies have often been limited to two-dimensional flow cells, which confine the trajectories of the swimming cells. Here, we investigate the interaction of free-swimming cells with surfaces in an otherwise unconstrained three-dimensional flow chamber. Our tracking experiments focus on the model "puller" organism Chlamydomonas reinhardtii. Swimming cells are recorded simultaneously by four separate cameras and triangulated in three-dimensions. Kinematic statistics are calculated from approximately 30,000 swimming tracks. Our results provide evidence of the existence of a long-range hydrodynamic interaction, which induces orbiting behaviour in the near-surface region.

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