The physics of the unconventional motility strategy of euglenids

MARINO ARROYO, Univ Politecnica de Catalunya, GIOVANNI NOSELLI, ANTONIO DESIMONE, SISSA — Euglenids are a family of unicellular protists, which use flagella to move in a fluid. However, they are also capable of performing elegantly concerted large amplitude deformations of the cell shape, in what is known as metaboly. To perform metaboly, euglenids use an elaborate cortical complex capable of actively imposing spatially modulated shear deformations on the cell surface. This mode of cell deformation has been linked to motility, but biophysical studies have demonstrated that it leads to very small swimming velocities as compared to flagellar locomotion. Furthermore, why would these cells possess two elaborate apparatus for the same function remains unclear. In this work, we combine experimental observations of euglena gracilis cells with theoretical models to shed light into the function of metaboly. The theoretical models account for the force generation and shape evolution at the cell envelop, together with the mechanical interaction of the cell with its environment. We characterize the efficiency of the two modes of locomotion of this cells in terms of the physical nature of their environment.

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