Hydrodynamic interactions induces sinking in microswimmers

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Résumé

In the wild, isolated groups of living organisms can organize themselves spontaneously and lead to collective movement. An object of interest is to determine the set of rules encoded at the individual level that give rise to this large-scale coherent organization. This phenomenon can be observed at several scales, from the movement of birds and ants to colonies of single-celled microorganisms.
In this study, we use Chlamydomonas Reinhardtii, a motile unicellular green alga that can form bioconvection cells characterized by the appearance of areas of variable concentration in its colloidal culture. In order to study the pattern formation, we looked at the hydrodynamic interactions between two alga, using new mathematical models developed from existing literature and verifying our hypotheses through numerical simulation. These simulations are made with the Stokesian Dynamics method, using a three sphere, three forces model for a microswimmer. The results show that the swimming ability of these microswimmers is strongly affected by the distance between them. The closer they are, the slower they swim and the more gravity can pull them down, and under a certain distance, they sink.

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