Near-wall dynamics of microalgae

Master internship jointly proposed by Dražen Zanchi (ENS Paris) and Florence Elias (MSC Paris)
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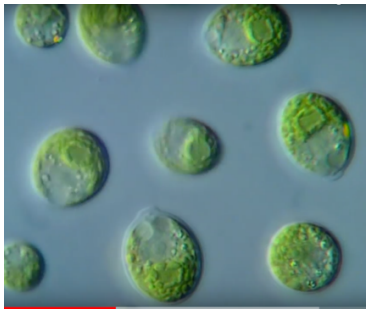
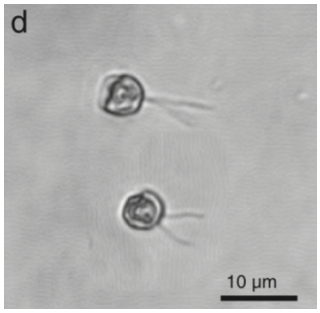
Comprehension of the dynamics of bacteria and microalgae near solid or soft substrates is one of major actual challenges of biophysics, both from fundamental and applied point of view (adhesion to plastic waste, to boats hulls, etc…) [1].
We propose to use a novel 3D real-time microscopic tracking technique based on slightly defocused image [2] in order to study the movement of motile microalgae near a flat surface.
Work packages:
1) Identification of characteristic modes of motion, active and passive, starting from the moment when the cell has "felt" the proximity of the surface.
2) Light-triggered reversible adhesion of alga *Chlamydomonas rheinardtii* was recently reported [3]. Our project is to study the near-surface motion of this alga upon time-modulated light stimulus.
3) On the other hand, the surface itself can be functionalized in a way that its interactions with cells are tunable by applying external stimuli (light, temperature), which is the basic idea of the present w.p.
4) Study of collective dynamics of *Phaeocystis globosa* [4] in a microfluidic well with particular geometries (e.g. with "pics").
Work packages 2) and 3) are possible thank to competences developed in our ENS group, concerning functionalized polymer-coated surfaces with interactions and solvation properties controlled by light or temperature. That way we can tune the adsorption/desorption/guiding of surface-engaged living cells [5].



Chlamydomonas rheinardtii.



Phaeocystis globose

[1] D. Linke, A. Goldman, Bacterial Adhesion: Chemistry, Biology and Physics (Springer, 2011).
[2] G. Boniello, C. Tribet, E. Marie, V. Croquette, D. Zanchi, Phys. Rev. E 97, 012609 (2018)
[3] Christian Titus Kreis, Marine Le Blay, Christine Linne, Marcin Michal Makowski and Oliver Bäumchen, Nature Physics, DOI: 10.1038/NPHYS4258
[4] V. Rousseau, F. Lantoine, F. Rodriguez, F. LeGall, M.-J. Chretiennot-Dinet & C. Lancelot, Journal of Sea Research 76 , 105-113, (2013).
[5] F. Dalier, G.V. Dubacheva, M. Coniel, D. Zanchi, A. Galtayries, M. Piel, E. Marie, C. Tribet, ACS Appl. Mater. Interfaces 10 (3), pp 2253–2258 (2018).