Structuration of the dynamics of bacteria dispersions

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M1-M2 subjects for 2016

Abstract: The bacteria E coli *smooth runner* swims at constant speed (15um/s) over a long period time in water and as such represent an excellent candidate as model active colloid while being biologically relevant [1].
The aim of this internship is to characterize the bacteria dynamics in a dense forest of micrometer pillars. In particular, how does the bacteria interact with micrometer pillars, is it scattered by the pillars like a ball in a flipper or does it orbit like an electron around the nucleus of an atom (see Figure)? Can we modify this interaction using depletion [2]? Provided that the forest of pillar is quite dense can the bacteria stay trapped between a few pillars? ...
This model experiments allow us to tackle the issue of transport of bacteria in crowded environments which is typically the case for bacteria in soils and inside our body.

Experimental techniques: bacteria culture, video microscopy experiments, microfluidics, image analysis in matlab

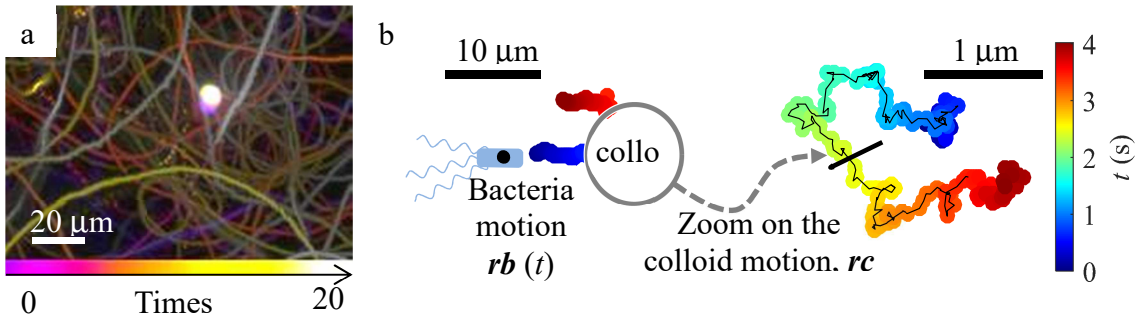

Figure: A 10 um passive colloid in a suspension of bacteria. a) Time superposition of Fluorescent microscopy images. The color codes for the time. The colloid is the bright spot in the middle of the image and the bacteria follow smooth trajectories. b) By tracking both the trajectory of the colloid and the bacteria, we observe that the bacteria seems to orbit around the colloid rather than being scattered.

This project can be followed by a PhD.

Supervision: Thomas Gibaud and Denis Bartolo

[1] Differential dynamic microscopy to characterize Brownian motion and bacteria motility. D. Germain, M. Leocmach, T. Gibaud. *Am. J. Phys.* **84**, 202 (2016)
[2] Phase separation and rotor self-assembly in active particle suspensions. J. Schwarz-Linek, C. Valeriani, A. Cacciuto, M. E. Cates, D. Marenduzzo, A. N. Morozova and W. C. K. Poon. *PNAS* **109,** 4052 (2012)