What is the practical gain to applied active matter concepts to microbes?

Harold Auradou (Directeur de Recherche CNRS INSIS)

One of the most exciting recent developments in physics is the rapid expansion of the branch devoted to active matter, which – unlike classical solids and liquids – refers to material which are not at equilibrium. There are many examples of active matter in nature, ranging from crowds of human people, flocks of birds, or suspension of bacteria… While most of the past studies dealt with the emergence of collective motion, the challenge is now to understand how active matter flow.

The question addressed in this talk concern the role of the swimming activity of bacteria on their transport in a complex geometry. To do so, we have developed a “rock on chip” experimental device that allows for the visualization of the trajectories of the bacteria inside the pore structure. Their analyses revealed that the coupling between their motility and the flow has two fold positive impacts. First, it increases for a vast majority of bacteria their residence time in the porosity favoring the attachment on grains and the formation of colony.

Finally, some are observed to cross the environment faster than identical but none motile bacteria.

This phenomena eases the rapid transfer of bacteria over long distance. The two together ensure that the volume explored by the bacteria is maximized.
We will finally discuss the practical implications of our findings for filtration and straining of living organisms.