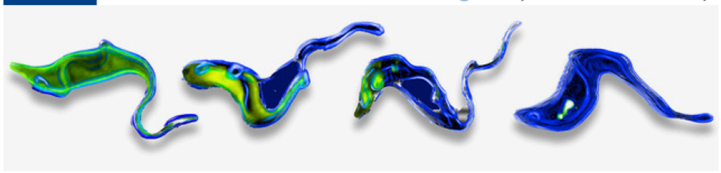

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Bacteria Propulsion and Interactions in Thin Biofilms

Bacteria are able to migrate collectively over wet surfaces and form stable and highly motile aggregates, which are often referred to as biofilms. Collective locomotion of bacteria within aggregates is called swarming [1], and is affected by interactions between bacteria, their shape and the strength of propulsion, and the density of bacteria packing within a biofilm [2,3]. To better understand the collective behavior of bacteria, numerical simulations of a large number of swimmers are performed. The swimmers are represented by the so-called squirmer model, in which bacteria propulsion is imposed by a prescribed slip velocity field at the surface of the swimmer [4]. This model allows the simulation of swimmers with different propulsion properties, including various motility types (e.g., pusher, puller) and propulsion strengths. We find that local interactions between swimmers mediated by the fluid environment determine their swarming behavior and the formation of clusters. In particular, swarming generally takes place at moderate volume fractions of swimmers, while at high swimmer densities, large non-motile clusters prevail. These results advance our understanding of bacterial film formation and the connection between the collective swarming behavior and the internal properties of individual swimmers.

References

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