

Locomotion of microorganisms in weakly viscoelastic liquids

The locomotion of organisms in Newtonian fluids at low-Reynolds numbers displays very different features from that at large Reynolds numbers; indeed, in this regime the viscous forces are dominant over the inertial ones and propulsion is possible only with non-time-reversible swimming strokes. In many situations of biological interest, however, small organisms are propelling themselves through non-Newtonian fluids such as mucus or biofilms, which display highly viscoelastic properties. Fluid viscoelasticity affects in a complex way both the micro-organisms' swimming velocity and dissipated power, possibly affecting their collective behavior. In our work, we employ the so called "squirmers" model to study the motion of spherical ciliated organisms in a viscoelastic fluid. We derive analytical formulas for the squirmer swimming velocity and dissipated power that show a complex interplay between the fluid constitutive behavior and the propulsion mechanism.