Temperature Effects on Swarming Flagellated Bacteria in Microfluidic Environments

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Certain flagellated bacteria exhibit a mode of surface motion known as swarming. It has been reported that this motion is affected by temperature. In order to study this motility we employ phase contrast microscopy. Swarming bacteria are driven by flagella which are powered by biomolecular motors which switch in a clockwise/counter-clockwise sense. The switching frequency and the motor rotation frequency are both temperature sensitive. Swarming bacteria move two-dimensionally in close proximity and may be tracked using a non-labeled cell tracking technique which follows local interrogation windows rather than individual cells. This swarming appears random at first, but average velocity and spatial correlation studies reveal temperature-dependent rotational vortices and translational steams. As temperature falls from 25°C to 18°C, the average velocity is shown to decrease. The arrow (→) denotes a speed of 35 μm/s.