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Microfluidic ratchets: from bacterial separation to sperm guidance[1] CARLOS CONDAT, IVAN BERDAKIN, VERONICA MARCONI, IFEG-CONICET and FaMAF-Universidad Nacional de Cordoba, Cordoba, Argentina, ALEJANDRO GUIDOBALDI, LAURA GIOJALAS, CEBICEM - CONICET and FCEFyN -Universidad Nacional de Cordoba, Cordoba, Argentina, ALEJANDRO SILHANEK, Department of Physics, University of Liege, Liege, Belgium, YOGESH JEYARAM, VICTOR MOSHCHALKOV, Institute of Nanoscale Physics and Chemistry, Katholieke Universiteit Leuven, Leuven, Belgium, LYN VENKEN, JOZEF VANDERLEYDEN, Faculty of Bioscience Engineering, Katholieke Universiteit Leuven, Leuven, Belgium — It has been shown that a suitably built asymmetric microdevice can be used to separate and select self-propelled microorganisms. The efficiency of this rectification effect depends on the detailed dynamics of the individual microorganism. In the case of run-and-tumble bacteria we show that the distribution of run lengths and the partial preservation of run orientation memory through a tumble are important factors when computing the rectification efficiency. In addition, we show that this ratchet effect can be used to separate or concentrate sperm cells. Using a simple phenomenological model we optimize the geometry of the confining habitat in order to accumulate the cells. Both swimming strategy and swimmer size should be taken into account to optimize the design of a micropatterned architecture for a device that can be used for effective physical bacterial separation or sperm guidance.

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